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RESEARCH ARTICLE

CALCULATION AND ANALYSIS OF THE COSTS OF BIOCHEMISTRY EXAMINATIONS BY THE ACTIVITY-BASED COSTING METHOD -ABC-CASE OF THE LABORATORY AT THE PREFECTURAL HOSPITAL OF SALE- MOROCCO

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Abstract

Objectives: The implementation of Universal Health Coverage, as a necessary step towards achieving the Sustainable Development Target, in particular MDT3, brings into play the question of good management, the efficiency of hospitals with a view to reduce costs, which seems to be an international issue. It is in this context that the present study fits. It aims to analyze and calculate the cost of biochemistry examinations.

Methods: This is a retrospective accounting study in the year 2019 which focuses on the calculation of the average cost by the accounting method based on the activity of 32 biochemical examinations at the Prefectural Hospital of SALE. Data analysis was performed by SPSS 20.0.

Results: The costs of biochemistry examinations are around 15,335,689.58MAD, which is three times higher than the income envisaged by the application of the national pricing system, which is of the order of 5,081,280.00 MAD. The most significant expenses are attributed to laboratory consumables and personnel; they represent respectively 45.20% and 40.05% of the overall expenses. The activities that consume the largest share of resources with 74.03% and 9.12% are respectively the processing of examinations and the management of the laboratory. Among the costs examinations, we quote Uric acid (114.78MAD)-Albuminemia (117.12MAD)- Ferritin (250.96MAD)-PSA (253.22MAD).

Conclusions: The results could be essential for both efficient resource allocation, hospital reimbursement and health policy decision-making. Also, the introduction of ABC in our Moroccan hospitals could help the transition from a flat-rate pricing system to fee-for-service (T2A).

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Introduction:-

Globally, healthcare systems are suffering from a hemorrhage of expenditure, an estimated waste of between 20 and 40% of all healthcare expenditures, thus impacting the efficiency of the system, following the total and correct non-

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use of available resources, either through poor supply management, irrational use of medications, improper distribution and management of human and technical resources, or fragmentation of funding and administration (WHO, 2010).

According to the WHO, low-income countries could save up to 24% per year on their total health expenditure by improving the efficiency of hospitals and their workforce.

To achieve these objectives, many countries have attempted to adopt the concept of hospital autonomy and the implementation of management control tools such as hospital cost accounting, which will allow for the improvement, as well as the amortization, of the costs of the various health care services. (WHO, 2010; Perrot, 2004).

In Morocco, total health spending has risen sharply in recent decades. They amounted to 60.90 Billion MAD in 2018 against 52 Billion MAD in 2013 and 47.8 Billion MAD in 2010. This upsurge has its origin in a series of reforms that the national health system has undergone, starting with the establishment of Basic Medical Coverage in 2002, then the introduction of the ¹RAMED regime in 2012 and finally, the current project of the implementation of the Universal Health Coverage, this transition is necessary towards the achievement of the Sustainable Development Objectives, in particular the SDO3. And one of the highest priorities for strengthening the financial protection of the population and further reducing direct household payments (National Accounts, 2018).

The expenditure of public health establishments (hospitals under the Ministry of Health, CHU and ESSP) represents 22% of the expenditure incurred, 61.7% of this share is for the benefit of hospitals. For this reason, governments have taken a particular interest in the management of hospitals by adopting efficient hospital strategies.

For this, the Ministry of Health has initiated a hospital reform, one of the major projects of which is the reconstruction of hospitals' financial and accounting management, focusing on cost control and the rationalization of hospital resources. However, the absence of an efficient information system and the non-existence of an analytical accounting system and a good knowledge of the cost of services confront the managers and directors of Moroccan public hospitals with the difficulties of rationalizing resources.

The hospital medical biology laboratory occupies an important place in the health care system. The results of the analyses and the information that they provide are essential for patient care.

Laboratory services at the CHP of Sale absorb a significant part of the hospital's budget and only cover 7% of the overall revenue generated by the hospital.

It is estimated that almost 80% of the patients are either Ramedists or exempt pregnant women, hence the interest in having convincing data on the costs of these services to serve as arguments when negotiating subsidies, as well as rationalizing resources and negotiating reimbursements from third-party health insurance companies.

This study is the first of its kind, which focuses on laboratory examinations and biochemical examinations, if we exclude, of course, the study of the structure and cost analysis of public hospitals in Morocco carried out by the ²DHSA in 2002-2003 (DHSA, 2005), it will increase the number of such studies still very rare at the national level, while a lot of cost calculation work at the hospital level (Tewfik and all, 2021; Pumalainen and all, 2020; Niasti and all, 2019; Bensaleh, 2019; Almeida, Cunha, 2017) that at the laboratory level have been developed (Mouseli and all, 2017).

The main objective of the present work is to calculate and analyze the cost of biochemistry examinations at the MY ABDELLAH Hospital laboratory in SALE using the activity-based costing (ABC) method.

The results of this work can be used to guide resource allocation based on an objective approach at the hospital level and serve as solid and proven arguments during subsidy negotiations.

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Through this study, and in order to ensure continuity of care, the director will have to deal with deficit situations by studying

The differences between the amounts invoiced and the estimated real costs

The possibility of reducing production costs to bring them into line with the national reference tariff.

Methods:-

Design of the study:

This is a retrospective accounting study covering the year 2019, based on an analysis of the laboratory services process. It is devoted to the analysis and calculation of the cost of biochemistry examinations provided by the laboratory of the My ABDELLAH Hospital in SALE, using the ABC method.

Context of the study:

The present work took place at the laboratory unit which is part of the medico-technical department of the CHP of SALE. The CHP is a new prefectural hospital center built in 2018 and managed in SEGMA mode. It comprises five structures: a day clinic, a day clinic annex, a dental care center, a hemodialysis center and the My ABDELLAH Hospital in SALE with a bed capacity of 250 beds. It is organized into 6 departments and 3 services and includes 26 disciplines. The CHP deserves a population of over 1,061,463 inhabitants in 2019.

Choice of services to be analyzed

The hospital medical biology laboratory occupies an important place in the health care system since the results of the analyses and the information they provide are essential for patient care.

On the other hand, the My ABDELLAH Hospital laboratory is the service that generates the lowest proportion of receipts, even though it is one of the major consumers of resources and technical means at the hospital. It also provides a very interesting and diversified range of services, including parasitology, serology, hormonology, hematology and biochemistry examinations.

In this work, we will focus on the range of biochemistry examinations which present the most important demand of the population served by the CHP with a proportion of 40% of all examinations realized in 2019.

Based on the circular n°10/INH/2019 of 13/12/2019 of the Ministry of Health, having for object the Application of the standards of the guidelines the minimum package of medical biology analyzes at the level of public health laboratories and which determines the examinations which must be provided at each level: prefectural, regional or interregional, and by the intervention of the biological physician, we have defined the package of 32 biochemistry examinations which are the subject of our study.

Sampling

The sample in our study is restricted to the staff of the laboratory at My ABDELLAH Hospital in SALE (Gaspard, 2019) and administrative and technical managers.

Definition of variables

The dependent variable is: Cost of biochemistry examinations.

The independent variables are: Resources used and activities defined.

The independent mediating variables are: Resource inductors and activity inductors.

Data collection methods

In the present work, data collection was based on three main tools (Kohn and Christiaens, 2014; Gaspard, 2019) used concomitantly to collect all the necessary information relating to the resources used and the activities defined in the process of carrying out biochemistry examinations: discovery observation armed with an observation grid (Roux, 1982), and the semi-structured interview and the collection of documents such as activity reports, budget documents.

Conceptuel Framework for data analysis

In this work, we have applied the activity-based accounting model adopted by most authors, who can be summarized as follows: "Activities consume resources and products consume activities". (Evraen and Mévellec, 1990, 1991). Alcouffe et al (2003), Bescos et al (2002), De la Villarmois and Tondeur (1996), Godowski (2003), Gosselin (2000), Gosselin and Ouellet (1999), Gosselin and Pinet (2002).

This is a new accounting method that appeared and was used in the 1980s in the United States in the industrial sector, and its success lead to its introduction and use in hospital management from the 1990s (Baker, 1998, King et al. 1994).

The implementation of this model is essentially based on the identification and mapping of activities, the identification of resources used in these activities, the allocation and distribution of resources to these activities using resource drivers and finally the allocation of activity costs to products or cost objects using activity drivers (Alcouffe and Malleret, 2004).

Depreciation calculation

The locals of the CHP and the majority if not all of the furniture, equipment and biomedical equipment are new and date from 2018. The life span of the premises is estimated at 25 years and that of the equipment between 5 and 10years. To calculate the Equivalent Annual Cost, and considering a discount rate of 5%, we used the following mathematical equation:

$$K = E \times \frac{1 - (1 - r)^{-n}}{r} = E A(n, r)$$

A: the present value of an annuity

K: The initial acquisition price of the property

E: Equivalent annual cost

n: lifetime (in years)

r: Annual interest rate

Results:-

Identification of activities:

Based on the observation carried out in the laboratory unit, and the semi-directive interviews conducted with all the stakeholders inside and outside this unit, we tried to map all the activities of the process of carrying out biochemistry examinations, from the admission of the patient to his discharge, and we identified three processes. In each process, there are multiple activities that have been grouped into nine macro activities as shown in table.

Identification of resources consumed

In a second step we identified all the resources and expenses used by the predefined activities concerning human resources, office supplies, laboratory consumables such as fungibles and laboratory reagents, expenses related to the depreciation of premises, furniture, technical and computer equipment, and biomedical equipment, overheads for water, electricity and telecommunication consumption, and expenses for subcontracted services such as security, cleaning of premises and catering for the staff on duty. The expenses corresponding to these resources are summarized in Table.

Of all the above-mentioned expenses, allocated to biochemistry services at the My Abdellah Hospital laboratory, the most important expenses are allocated to laboratory consumables with 45.20% and to personnel expenses with 40.05%, followed by furniture/material/equipment CAE expenses with 8.17%, as shown in the graph.

Identification and choice of resource inductors:

The resource inductors selected in this study to allocate the identified resources to the different defined activities are summarized as follows.

Allocation of resources to activities:

After determining the resources and resource inductors, in this fourth step we proceeded to allocate the above-mentioned resources to the different defined activities of the biochemistry examination process using the resource inductors that determines their consumption volume. It should be noted that some activities consume more resources

than others and sometimes some resources are consumed only by some activities and not by the whole process. The result is summarized in Table 4.

Thus, the activity that consumes the largest and most important share of resources is the examination processing activity with 74.03%, followed by the laboratory management activity and the sample collection and identification activity, which represent respectively 9.12% and 7.42% of the total expenses consumed by activities, as shown in graph.2

Identification of activity inductors

The activity inductors retained according to the available data to allocate and distribute the activity costs between the cost objects defined by the biochemical examinations carried out in the laboratory of the My ABDELLAH Hospital in SALE, are summarized in the table.

Distribution of activity costs between cost objects:

The volume and cost of activity inductors are similar for seven activities, whereas they differ for each examination in the two activities of sampling/identification and examination processing, as each examination requires specific fungibles and reagents. We found that the costs of inducing reception-registration activities, biological validation, laboratory management, general administrative management, human resources management, financial and accounting management, management of logistics and the maintenance and management of the SAA are respectively 1,97MAD, 0.20MAD, 1.88MAD, 0.28MAD, 0.07MAD, 0,19MAD, 0,50MAD and 4.24MAD

After determining the volume of the activity inductor. We calculated their costs by dividing the activity cost by the corresponding inductor volume. And at the end, we defined the cost of the cost objects, by summing the costs of inductors. The results obtained are presented in Table.

Discussion:-

The results obtained show that 88.91% of the expenditure corresponds to operating expenditure and 11.09% to depreciation or amortization of investments. The latter is high given the recency of the building and equipment/furniture, which was commissioned in 2018.

We also found that fixed and variable costs represent 53.95% and 46.05% respectively. And direct and indirect costs represent 31.26% and 68.74% respectively. The latter result is similar to the study of Rajabi in 2012 in Iran, who explained the high amount of indirect costs in Shahid Faghi Hospital by the incorrect use of resources (Rajabi, 2012). This seems to be contradictory with the results of Mousli (Mousli, 2017).

The analysis of the results relating to the expenses related to the resources consumed by the Biochemistry examinations shows that the most important expenses are charged to the consumables of the laboratory see fungibles and reagents, followed by the expenses of human resources then the expenses of depreciation of the premises and equipment which represented respectively 45.04%, 39.76% and 8.22% of the global expenses of the Biochemistry examinations, the minimal expenses correspond to the general expenses of water, electricity and telecommunications.

This result is proved by several studies, notably the one carried out at the private laboratories of the city of Kerman in IRAN (Mousli, 2017), with 37% of the laboratory consumables and 36.3% of the personnel costs, which represent the most important burdens.

In the laboratory of the VALIASR hospital in TAHRAN, the results showed that the maximum and minimum costs are related to the cost of human resources and the energy cost, which consume 44% and 0.5% of resources respectively.

In the same context, another study carried out in the hospital sector to calculate the cost of radiology services at the Beheshti hospital in Hamadan, showed that the highest costs concern human resources (65.2%) and the weakest are the power lines (0.4%) (Niasti, 2019).

These studies also confirm our results in terms of the minimum cost of water, electricity and telecommunications overhead with 0.45% (Naciri, 2009).

Analysis of resources consumed by activities

The activity of processing and carrying out examinations alone consumes 74.03% of the resources allocated to the hospital, this is justified by the fact that this activity, which uses laboratory consumables and most of the laboratory staff who work full-time, this activity alone monopolizes 56.41% of resources, in the form of laboratory consumables and 29.86% in the form of personnel costs. Followed by the laboratory management activity with 9.12% of the resources consumed, of which 81.80% are personnel costs. And the activity of taking and identifying samples with 7.42% of the resources consumed, consisting mainly of 43.52% of personnel and 46.32% of laboratory consumables.

According to the results, all activities consume mainly more than 60% in the form of Human resources costs, with the exception of the activity of sampling and processing of examinations, which are mainly made up of the costs of laboratory reagents and fungibles, followed by Human resources costs. This is due to the fact that these two activities are the main consumers of laboratory fungibles and reagents.

Analysis of the cost of biochemistry examinations

The analysis of the costs of the examinations showed that they were similar in seven activities and different in the other two activities of specimen collection and examination processing. This is explained by the quantity and types of fungibles and reagents consumed by each examination.

In fact, it was noted that some examinations consume more loads to perform a higher number of examinations such as blood glucose, creatinine and urea. On the other hand, other examinations such as TSH, T4, Troponin and Ferritin consume more charges while the number of examinations carried out is in the minority, which is quite logical due to the high prices of the reagents necessary for the performance of these examinations. This also explains their prices, which are higher than for other tests in both the public and private sectors, as shown in graph.

The impact of costs on the revenue and budget of the CHP of Sale

After estimating the costs of the 32 biochemistry examinations carried out by the laboratory of the My ABDELLAH Hospital in SALE, using the ABC method, we calculated the difference between the overall cost and the revenue expected from the application of the current national tariffs in the public and private sectors.

We found that the cost of the biochemistry examinations covered by this study is three times higher than the tariffs for services rendered by the laboratories of public health care institutions, approved by the Ministry of Health and Social Protection. And only 1.67 times higher than the rates of private laboratories. And this is obvious, since the tariffs of private laboratories are 1.78 times higher than the tariffs of public laboratories.

On the other hand, this proves that it is imperative to seek efficiency in services in order to reduce the cost price.

Certainly, the high cost of biochemistry examinations has a negative impact on the center's budget and obviously on the revenue charged to the laboratory. Especially since all the examinations carried out for hospitalized patients with a quotation of B less than 120 are not invoiced and do not enter into the laboratory's revenues, they are integrated into the hospitalization packages. 15% of the envisaged revenues. In addition, they are included in the laboratory's expenses.

On the other hand, according to the activity reports for 2019, 78.90% of the patients admitted to the laboratory are Ramedists. And we are well aware that hospitals, except for the CHU, do not receive direct reimbursement of the amounts invoiced to Ramedist patients, which further reduces the center's revenue and therefore its budget.

0.84% of the revenue is reimbursed by the compulsory health insurance organizations (³CNOPS, ⁴CNSS, ⁵MAFAR) and 14.42% corresponds to direct payments, which means that the centre only receives 15.26% of the amounts invoiced as its revenue and consequently this share only covers 4.30% of the costs of the biochemistry examinations.

³National Fund of Social Welfare Organizations

⁴The National Social Security Fund

⁵Royal Armed Forces Mutual Fund

Now, by removing the human resource costs which are covered by the budget of the Minister of Health and Social Welfare and not by the center's budget, the envisaged own revenues from the CHP's Biochemistry examinations can cover 7.16% of the costs.

The estimated cost per examination is different from the current tariff. About 93.80% of the tests were underestimated which is close to the Adane study in 2015 for which 90% of the tests were underestimated (Adane, 2015). This information could alert the competent authorities to reconsider resetting the prices of these tests

The difference between costs and tariffs has been pointed out by many international studies in the hospital sector, notably the study by Mousli in 2017 which demonstrated a difference between costs and tariffs in private laboratories (Mousli, 2017). Naciri's study in 2009 which showed that this difference is the result of unrealistic tariffs compared to the cost of services (Naciri, 2009). Rohollah's study in 2016 which showed that the cost of radiology services was significantly higher than the tariffs approved by the Ministry of Health (Rohollah, 2016). And the study by Tewfik in 2021 which proved that the Italian National Health System tariff for flap surgery for head and neck reconstructions seems insufficient to cover the real cost of this type of surgery (Tewfik, 2021).

To remedy the situation, and to reduce the costs of laboratory services, it is imperative to introduce management control tools, such as the implementation of activity-based cost accounting. This approach has proven its effectiveness in hospital management and cost analysis through several studies. Milkoff has shown that ABC models can provide a double reading, that of cost information and that of the activity architecture of a service (Milkoff, 1996).

This is also the case for Sarka who has proven in practice in his Cost Analysis study in a dermatology department that activity-based costing is an accurate and relevant approach that provides a wealth of additional information for managers in terms of activity standardization, cost analysis, hospital budgeting and decision making (Sarka, 2015).

Limitations of the study

Among the limitations of this study are:

- The self-reporting nature of the data collected through interviews,
- Lack of an integrated information system,
- The absence of standardized protocols, which prompted us to work with the data collected after the interview with the persons concerned and based on the literature, especially for the organization and activities of the laboratory;
- The absence of cost accounting at the CHP level;
- Costs outside the hospital, related to administration at the level of the delegation, the region and at the central level of the Minister of Health and Social Protection, other external stakeholders of the CHP as well as costs borne by the patient such as transport are not taken into account.

Ethical consideration

To respect the ethical considerations when analyzing the economic efficiency of the My ABDELLAH Hospital in SALE, especially in its laboratory unit, we started our research study by submitting the research protocol for approval to the Ethics Committee of the Faculty of Medicine and Pharmacy in Rabat.

The Ethics Committee for Biomedical Research of Rabat issued a FAVOURABLE OPINION to our research project entitled "Calculation of the costs of biochemistry examinations by the ABC cost accounting method - case of the laboratory at the CHP of Sale" under reference CERB 77-2.

Conclusions:-

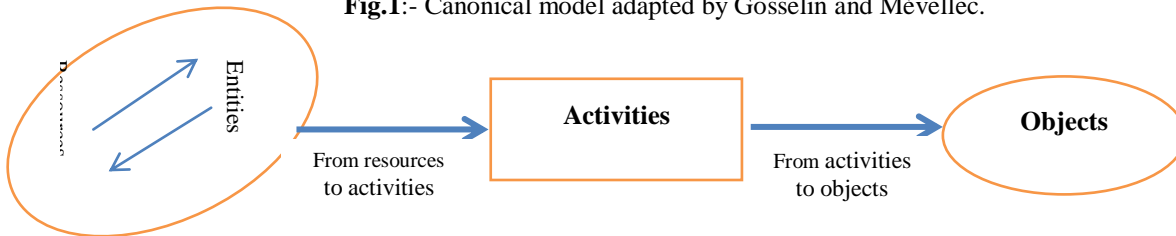
Our study devoted to the calculation of the costs of biochemistry examinations in the laboratory of the My ABDELLAH Hospital -CHP of SALE- is the first in a public laboratory in the Moroccan context. Through it, we were able to estimate and verify the costs of the examinations that are the object of our work. We were able to elaborate data on the charges and activities that can be acted upon to reduce the costs, these activities constitute the core of the Biochemistry services, namely the processing of the examinations and the management of the laboratory unit. And to resources related to personnel and laboratory reagents and fungibles.

Thus, we have concluded that 93.80% of the examinations are underpriced concerning the national tariffs in force.

Overall, regarding the results of the present study, we have tried to make available to policymakers and hospital managers evidence on the feasibility and necessity of applying cost accounting to different hospital services. This evidence can be used to rationalize resource allocation and provide a strong argument for budgetary negotiations.

On the other hand, the economic constraints linked to the control of health expenditure, in particular the reduction in staff numbers; impose on hospital or private biological analysis laboratories the search for increased productivity by limiting costs. Among the solutions also proposed for cost optimization, is that of billing for reagents based on the laboratory's actual activity in terms of the number of "patient" results rendered, instead of billing "per box".

Fig.1:- Canonical model adapted by Gosselin and Mévellec.



(Conceptual model of the ABC accounting method illustrating how to calculate the cost of objects through the identification and calculation of the costs of the activities and the resources used by these activities necessary for the production of the objects)

Table 1:- Processes/Activities/Macro-activities of Biochemistry examinations.

Processes	Activities	Macro activities
MedicaltechnicalProcess	Installation of patients-sample collection	Sampling-Identification-Transmission
	Sample identification	
	Transmission of samples to the palliasses	
	Sample processing (centrifugation, aliquoting)	Processing and conducting exams
	Storage of samples	
	Calibration and control of devices	
	Preparation of reagents	
	Preparation of distilled water	
	Realization of biological exams	
	Technical validation of results	Validation of results
	Biological validation of results	
Internal administrative process (inside laboratory)	Reception and Identity vigilance	Registration of patients and transmission of results
	Recording of results	
	Transmission of results	
	Archiving of result registers	Management of the laboratory
	Archiving of stock cards	
	Management and coordination of staff and establishment of on-call lists	
	Stock management (Reagents/fungibles/consumables)	
	Cleaning the locals	Management of subcontracting services
	Surveillance and security of the locals	
	Waste management	
Catering for guard staff		
External administrative process (outside laboratory)	Management of the RDV	Management of SAA
	Reception, admission and billing	
	Recovery and management of AMO files	
	Hospital information management (GIH)	General administrative management
	Preparing diet vouchers	
	Validation of IDE guard lists	
	Validation of IDE time off	

Validation of Doctors' time off	Management of HR
Validation and approval of public orders	
Complaint handling	
HR administrative management	
Stock management of supplies and materials	Gestion de logistique et maintenance
Ordering and stock management of consumables from the pharmacy nomenclature of MDM	
Biomedical equipment maintenance	
Electrical maintenance	
Management and monitoring of hospital waste	
Preparation and development of public orders	Financial and Accounting Management
Commitment and payment of public orders	
Filing and archiving of order files	
Collection for paying patients	
Verification and transmission of receipts to the TG	
Treatment and settlement of care allowances	

(After identifying the three processes for carrying out laboratory examinations, we identified through maintenance and observation the different activities of each process and we grouped them into Macroactivities)

Table 2:- Resources used by activities.

Resources identified	Corresponding amounts
Human resources	1 251 245,77 MAD
Fungibles and laboratory reagents	1 173 657,39 MAD
Office supplies	26 009,26 MAD
Water consumption	3 193,04 MAD
Electricity consumption	7 777,06 MAD
Consumption in Telecommunications	765,56 MAD
Depreciation of locals	75 827,26 MAD
Depreciation of furniture, technical equipment computer equipment and biomedical equipment	212 125,32 MAD
Cleaning of locals	18 858,44 MAD
Guarding and security	38 588,06 MAD
Custody staff restoration	11 279,16 MAD
Waste management	4 992,00 MAD

(The table has illustrated the costs of resource used by each activity of performing laboratory examinations)

Table 3:- Identification of resource inductors.

Resources	Inductors Retained of Resource
Workforce	Number of workinghours
Depreciation of premises	Surface (M ²)
Depreciation of equipment/ furniture/equipment	Equipment type
Water - Electricity	Surface (M ²)
Telecommunication	Number of the fleets
Waste management	Quantity generated(KG)
Cleaning services	Number of agents
Guarding and security	Number of pieces
Restoration of the guard staff	Number of food days
Office supply	Quantities consumed
Fungibles and reagents of laboratory	Quantities consumed
pharmacyexpenses	Quantities consumed od MMD
maintenance expenses	Number of interventions
Electrical maintenance	Number of services

Management of materials and supplies	Number of services
Preparing Diet Vouchers	Number of working hours
Admission-Billing	Number of admissions
AMO Admission	Number of admissions of Medicare
Hospital information management	Number of services
Appointment Management	Number of appointments
HR management	Number of staff
The box	Number of paying people
Compensation management	Number of staff
Expense management	Number of services
General administrative expenditure	Number of services

(The table summarized the inductors used to allocate the resources used to the different activities)

Table 4:- Summary of expenses allocated to biochemistry services activities.

Activities	Resources							Total
	HR	CAE Locals	CAE FME	General expenses	Services sub-contracting	Office supply	Consumable laboratory	
Home-Registration	19 200,00	4 766,11	1 016,52	715,97	5 273,33	302,42	-	31 274,57
Sample-Identification	83 830,00	4 766,11	4 216,31	715,97	7 769,33	2 103,42	89 218,22	192 619,36
Processing of examinations	574 094,58	29 966,40	191 813,84	4 501,62	23 609,17	13 968,54	1 084 439,17	1 922 393,32
Biological validation	23 634,62	522,68	425,94	78,52	674,56	27,90	-	25 364,22
Laboratory management	193 766,69	13 084,26	9 038,48	1 495,06	15 179,45	4 305,34	-	236 869,28
General administrative management	31 244,76	2 171,56	1 617,76	455,89	31,35	204,92	-	35 726,24
Human resources management	8 456,77	533,01	266,92	95,91	13,82	75,52	-	9 441,94
Financial and accounting management	22 133,08	995,49	460,50	210,15	153,11	663,36	-	24 615,69
Logistic management and maintenance	44 635,41	12 792,84	1071,29	2 141,55	2 188,69	313,29	-	63 143,08
SAA management	38 861,20	6 228,80	2 197,75	1 316,24	2 593,57	4 044,34	-	55 241,90
Total	1 039 857,11	75 827,26	212 125,32	11 726,88	57 486,38	26 009,26	1 172 304,73	2 596 689,60

(The table summarized the costs of the resources used as well as the costs of the different activities)

Table 5:- Identification of activity's inductor.

Activities	Activity's inductor
Home- Registration	Number of admitted patients
Sample-Identification	Number of examinations / patients
Processing of examinations	Number of examinations

Biological validation	Number of examinations
Laboratory management	Number of examinations
General administrative management	Number of examinations
Humanresources management	Number of examinations
Financial and accounting management	Number of examinations
Logistic management and maintenance	Number of examinations
SAA management	Number of admitted patients

(The table summarized the inductors used to allocate the costs of activities used to the laboratory examinations)

Table 6:- Summary and comparison of costs with public and private tariffs.

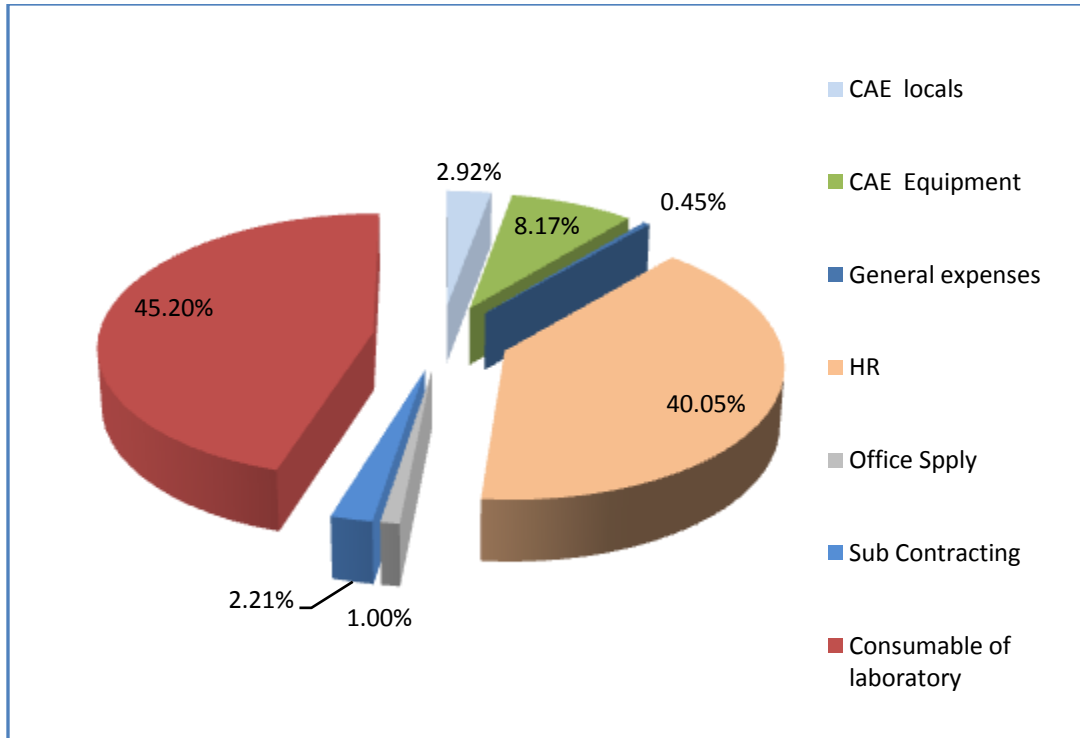
Examination (Clé B) (B=0,75MAD)	Unit Cost	Unit Tariff P.S	Unit Tariff S.PV	Number examination	Total Cost (MAD)	Total Price (MAD) P.S	Total Price (MAD) PV.S
Uri Acid (30)	114,78	22,50	40,20	2 690	308 758,20	60 525,00	108 138,00
Albuminemia (60)	117,12	45,00	80,40	309	36 190,08	13 905,00	24 843,60
Direct Bilirubin (70)	123,10	52,50	93,80	1 676	206 315,60	87 990,00	157 208,80
Total Bilirubin (70)	123,21	52,50	93,80	1 682	207 239,22	88 305,00	157 771,60
LDL cholesterol (50)	113,99	37,50	67,00	6 572	749 142,28	246 450,00	440 324,00
H D L Cholesterol (50)	129,34	37,50	67,00	6 486	838 899,24	243 225,00	434 562,00
Total cholesterol (30)	114,60	22,50	40,20	8 443	967 567,80	189 967,50	339 408,60
Creatinine (30)	114,04	22,50	40,20	13 486	1 537 943,44	303 435,00	542 137,20
Glycemia (30)	113,96	22,50	40,20	18 754	2 137 205,84	421 965,00	753 910,80
Total protein (30)	118,01	22,50	40,20	756	89 215,56	17 010,00	30 391,20
Triglycerides (50)	114,74	37,50	80,40	8 160	936 278,40	306 000,00	656 064,00
Urea (30)	114,21	22,50	40,20	14 633	1 671 234,93	329 242,50	588 246,60
Transaminases (TGO)(50)	114,24	37,50	67,00	7 923	905 123,52	297 112,50	530 841,00
Transaminases P (TGP) (50)	114,34	37,50	67,00	7 933	907 059,22	297 487,50	531 511,00
Gamma glutamyltransferase (G G T) (50)	114,92	37,50	67,00	2 458	282 473,36	92 175,00	164 686,00
Lipase (100)	169,32	75,00	134,00	200	33 864,00	15 000,00	26 800,00
Alkaline Phosphatases (50)	114,91	37,50	67,00	1 898	218 099,18	71 175,00	127 166,00
Alkaline Réserve (40)	152,59	30,00	53,60	297	45 319,23	8 910,00	15 919,20
SerumIron (60)	136,26	45,00	80,40	220	29 977,20	9 900,00	17 688,00
Phosphorus (40)	118,10	30,00	53,60	775	91 527,50	23 250,00	41 540,00
Potassium (30)	115,58	22,50	40,20	1 366	157 882,28	30 735,00	54 913,20
Sodium (30)	115,58	22,50	40,20	1 366	157 882,28	30 735,00	54 913,20
Calcium(30)	120,27	22,50	40,20	934	112 332,18	21 015,00	37 546,80
Chlorine (30)	115,53	22,50	40,20	1 364	157 582,92	30 690,00	54 832,80
CRP(100)	129,25	75,00	134,00	6 517	842 322,25	488 775,00	873 278,00
Ferritin (250)	250,96	187,50	335,00	435	109 167,60	81 562,50	145 725,00
PSA(300)	253,22	225,00	402,00	416	105 339,52	93 600,00	167 232,00
QUANTITATIVE and QUALITATIVE BHCG (250)	154,60	187,50	335,00	85	13 141,00	15 937,50	28 475,00
Troponin (250)	271,77	187,50	335,00	454	123 383,58	85 125,00	152 090,00
T4 FREE (200)	242,58	150,00	268,00	605	146 760,90	90 750,00	162 140,00
TSH (250)	169,72	187,50	335,00	3 836	651 045,92	719 250,00	1 285 060,00

Glycosylatedhemoglobin (100)	155,35	75,00	134,00	3 601	559 415,35	270 075,00	482 534,00
Total	-	-		126 330	15 689,58	335 5 280,00	9 187 897,60

PS: Public Sector PV S: Private Sector

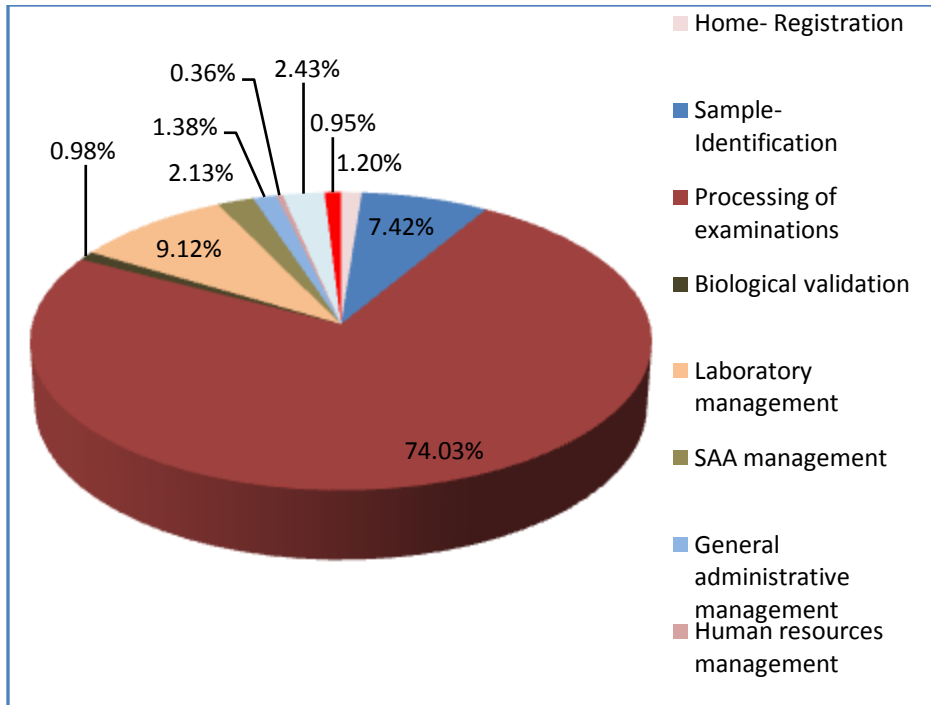
(The table summarized the unit cost of each examination as well as the overall cost of each examination in the year 2019

It shows that the costs are clearly higher than hospital tariffs as well as private laboratory tariffs)



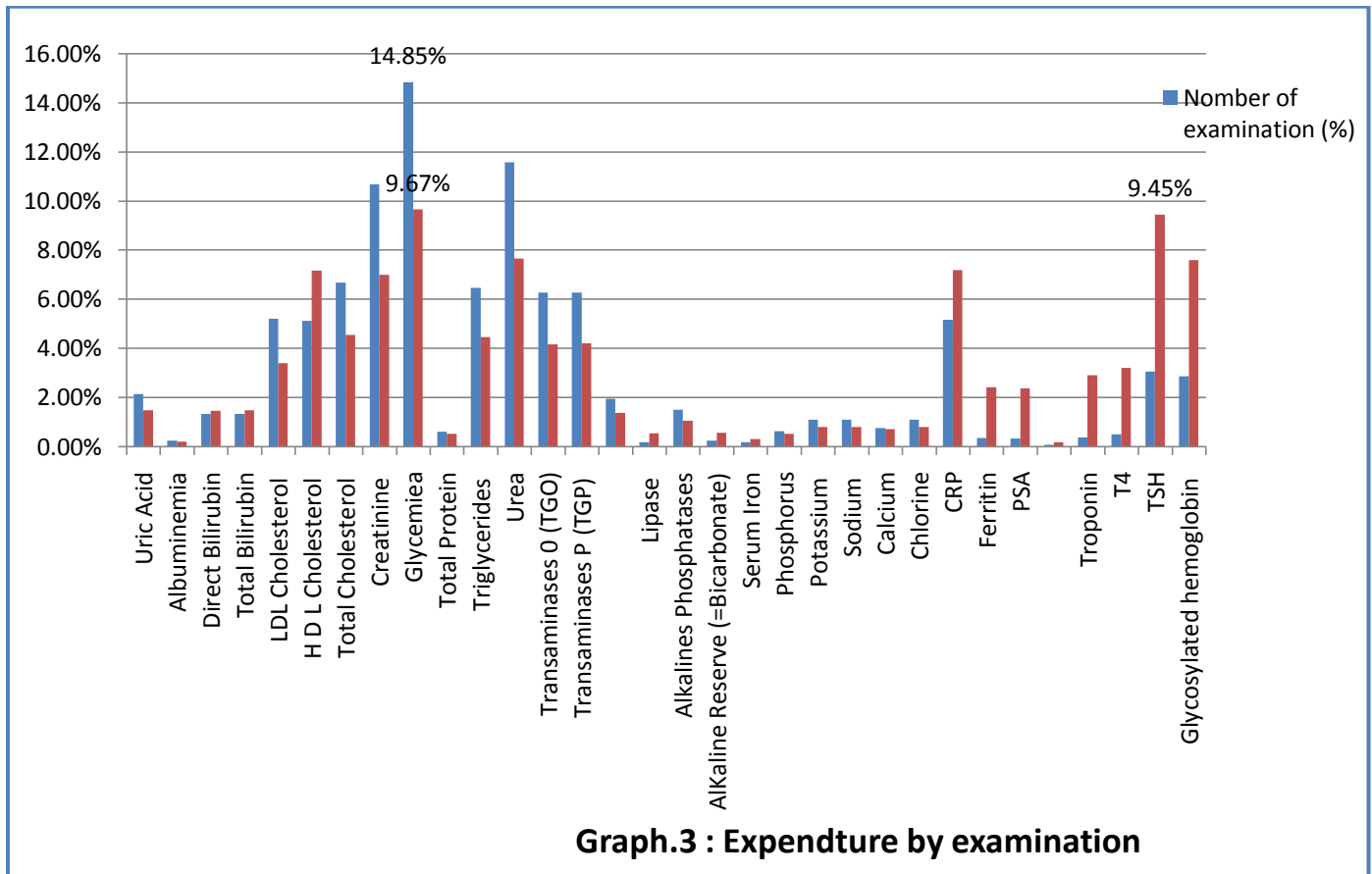
Graph 1:- Distribution of costs by type of resource.

(The graph shows that the most important expenses for carrying laboratory examinations correspond to human resources and laboratory consumables such as fungibles and reagents)



Graph 2:- Distribution of charges by activity.

(The graph shows that the most important expenses for carrying laboratory examinations correspond to processing of examinations and laboratory management)



Graph.3 : Expendure by examination

(The graph shows that some examinations require little expenditure to produce a large number of examinations such as glycemia and creatinine. Whereas other examinations such as the TSH and Ferritin and PSA, consume more charges to produce few examinations, this is due to the high price of the reagents and fungible used)

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