



# Cost analysis of a nephrology department by means of analytical accounting

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## SUMMARY

**Background:** The analytical accounting is a countable technique directed to the evaluation, by means of pre-established criteria of distribution, of the internal economy of the hospital, in order to know the effectiveness and efficiency of Clinical Units.

The aim of this study was to analyze the activity and costs of the Nephrology Department of General Hospital of Castellón.

**Methods:** Activity of Hospitalization and Ambulatory Care, during 2003 was analysed. Hospitalization discharges were grouped in DGR and the costs per DGR were determined.

**Results:** Total costs Hospitalisation and Ambulatory Care were 560.434,9 and 146.317,8 Euros, respectively. And the costs of one stay, one first outpatient visit and maintenance visit were 200, 63, and 31,6 Euros, respectively. Eighty per cent of the discharges were grouped in 9 DGR and DRG number 316 (Renal Failure) represented 30% of the total productivity. Costs of DGR 316 were 3.178,2 Euros and 16% represented laboratory cost and costs of diagnostic or therapeutic procedures.

**Conclusion:** With introduction of analytical accounting and DGR system, the Nephrology Departments can acquire more full information on the results and costs of treatment. These techniques permits to improve the financial and economic performance.

Key words: **Costs analysis. Diagnosis related group. Analytical accounting.**

## EVALUACIÓN DE COSTES EN UN SERVICIO DE NEFROLOGÍA MEDIANTE LA CONTABILIDAD ANALÍTICA

## RESUMEN

La contabilidad analítica es una técnica contable dirigida a la evaluación directa, mediante criterios de reparto preestablecidos, de los hechos económicos internos del hospital, con objeto de conocer los costes y productos de cada uno de los Servicios.

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*El objetivo de este estudio es analizar el coste de los principales productos intermedios y finales elaborados por el Servicio de Nefrología del Hospital General de Castellón, utilizando esta herramienta contable.*

*Se ha analizado la estructura de costes de los Centros de Actividad de Hospitalización (CAH) y Consulta Externa (CACEX). Para ello se han definido tres productos intermedios: Estancia, Primera Visita y Visita Sucesiva, y los productos finales (GRDs) elaborados por el Servicio. La metodología aplicada en los productos finales es la asignación de costes en función del peso relativo de cada GRD (método «top-down») y posteriormente se añadieron los costes de las distintas exploraciones diagnósticas o terapéuticas realizadas.*

*El coste total del CAH fue de 560.434,9 € y del CACEX de 176.317,8 €. El coste de los productos intermedios Estancia, Primera Visita y Visita Sucesiva fueron de 200,01, 63,26 y 31,63 €, respectivamente. El 80% de los 232 de episodios de hospitalización se agrupó en 9 GRDs. El GRD más frecuente fue el 316 (Insuficiencia Renal), que representó el 30% de la casuística del Servicio. Su coste ascendió a 3.178,2 € y el 16% de este correspondió a las exploraciones diagnósticas y terapéuticas. Podemos concluir que la implantación y desarrollo de la contabilidad analítica es una necesidad en los Servicios de Nefrología. Esto nos permitirá conocer la estructura de costes de los Servicios, la complejidad de la casuística y por tanto la adecuada planificación de los recursos necesarios para atenderla.*

**Palabras clave: Análisis de costes. Grupos relacionados con el diagnóstico. Contabilidad analítica.**

## INTRODUCTION

As a services enterprise, the hospital elaborates a series of intangible products that are identified as the service itself provided to each patient. Since there do not exist diseases but diseased people, we may say that Hospital Departments, including the Nephrology Department, elaborate as many final products as diagnosed and treated patients.

All this has prone the elaboration of different measurement systems of the patient diversity or «case-mix» that try to create homogenous groups with regards to one or several relevant characteristics<sup>1</sup>. The most used one in our area is the Diagnosis-Related Groups (DRG), which needs the conjunction of three elements:

- A minimal basic set of data (MBSD): basically, administrative, particulars, length of hospital admission, etc.
- A Disease Classifying System, usually IDC-9CM (International Disease Classification, 9<sup>th</sup> revision-Clinical Modification)
- A system of Analytical Accounting that allows the creation of Activity Centers for the imputation of the different costs generated during the process of patient care<sup>2,3</sup>.

Through this System, intermediate products are being elaborated that generate an added value and

allow resolving the final processes that each treated and hospital-discharged patient represents<sup>4,5</sup>.

The aim of this study is the costs analysis of the different intermediate products elaborated by the Activity Centers that comprise the Nephrology Department and of the final products that the Hospitalization Activity Center elaborates, the only one in which we are able to quantify at this time the final products.

## MATERIAL AND METHODS

### Activity Centers and Costs Structure

Costs from the Hospitalization (HAC) and Out-Patient Clinic (OPCAC) Activity Centers from the Nephrology Department of Hospital General of Castellón during 2003 have been analyzed. These costs comprise:

- Costs of Faculty Staff: percentage of time spent in each one of the Activity Centers.
- Structural costs: both primary and secondary
- Intermediate logistic costs: they are grouped in those corresponding to the non-faculty health care staff, non-health care personnel, pharmacy, and disposable material. Due to patient dispersion within the several Hospitalization Units of the hospital, these costs are imputed according to percentage of occupation of patients assigned to the Nephrology Department in each unit.

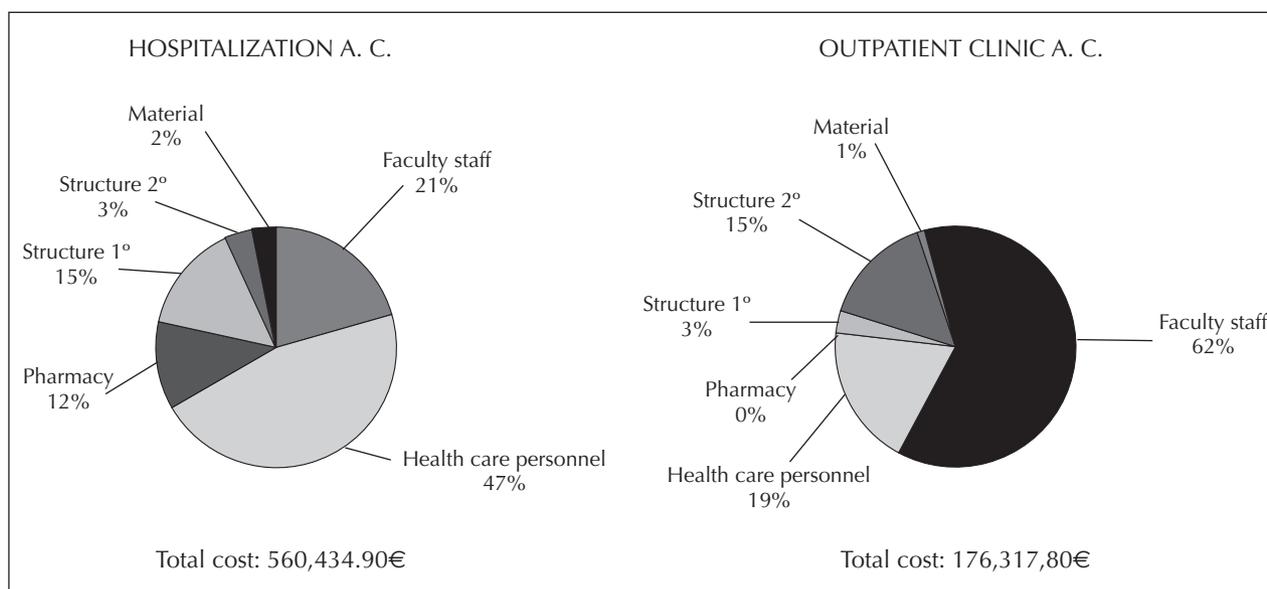


fig. 1.—Total cost and costs structure of the Hospitalization and Outpatient Clinic Activity Centers

### Intermediate products analyzed

- Stay: intermediate product elaborated by the HAC.
- First visit and follow-up visit: intermediate products elaborated by the OPCAC.

The cost per hospital stay was calculated by the equation:

$$\text{HAC total Cost} / \text{Num. of hospital stays.}$$

The cost of the OPCAC visit was analyzed by assigning Relative Value Units (RVU) to each visit. Thus, the first visit equals one RVU and the follow-up visit 0.5 RVU.

$$\text{Cost per RVU: OPCAC total cost} / \text{Num. of RVUs}$$

$$\text{First visit cost: RVU Cost} \times 1$$

$$\text{Follow-up visit cost: RVU cost} \times 0.5$$

### Final products analyzed

The final products analyzed are the different hospitalization episodes codified and assigned to their correspondent DRG by the Documentation Unit of the Hospital. Each DRG was assigned the Medicare/New York Relative Value for 2003. The hospital clinical charts of 30% of the hospitalization episodes assigned to each DRG were also analyzed in order to quantify the costs by diagnostic and therapeutic procedures (DTPC). The procedures were categorized as:

- Laboratory procedures: hematology, biochemistry, and microbiology.
- Imaging procedures: interventional and non-interventional procedures.
- Cardiology procedures: basically EKG and echocardiogram.
- Endoscopic and pathology procedures.
- Ophthalmology procedures: basically, fundus examination
- Applied depurative techniques: basically, hemodialysis.

Costs of each one of the procedures were obtained from the catalogues of Cost Management indicators from the different central departments of the Hospital. The cost of each one of the procedures has been obtained through the elaboration of Relative Value Units of each one of the departments catalogues. The cost per hemodialysis session was obtained from the methodology applied to our Unit and notified in previous studies<sup>6</sup>.

Costs by DRG were distributed according to the Relative Weight of the DRG and was performed in four steps:

1. Determination of the Relative Weight of the DRG (RWDRG):  

$$\text{Num. of hospital discharges with that DRG} \times \text{relative Weight} / \text{Num. of total hospital discharges from the Department.}$$
2. Determination of the DRG total Cost (DRGTC):  

$$\text{HAC total cost} \times \text{RWDRG} / \text{Mean weight of the Department.}$$

**Table I.** Description of costs and activity of the main intermediate products

Intermediate Product (cost/activity)	Year		
	2001	2002	2003
Stay	174.55€/2,411	183.53€/2,482	200.01€/2,802
1. <sup>st</sup> Visit	51.63€/491	57.08€/637	65.07€/616
F-U visit	25.82€/4,068	28.54€/4,442	32.54€/4,187

3. Determination of the DRG Unitary Cost (DRGUC):  
DRGGC/Num. of hospital discharges with that DRG
4. Determination of the Total DRG Unitary Cost (TDRGUC):  
DRGUC + DTPC

## RESULTS

The total number of hospitalization episodes during 2003 was 232 and 2802 stays were generated. At the OPCAC, 622 first visits and 4330 follow-up visits were assisted. The activity of this center produced 2787 RVUs, which were divided into 2165 by follow-up visits and 622 by first visits. Total costs from the HAC and OPCAC are shown in Figure 1, which were 560,434.98 and 176,317.8 €, respectively. Also shown is the cost structure of the activity centers. As it can be seen, the greater amount corresponds to health care personnel, both faculty and non-faculty. Costs and activity of each one of the intermediate products throughout 2001-2003 are shown in table I. In 2003, the cost per hospital stay was 200.01 €, and costs per first and follow-up visit were 63.26 and

31.63 €, respectively. A progressive increase is observed throughout these years.

Of the 232 hospitalization episodes, 186 were grouped in 9 DRGs. Therefore, 80% of the Department casuistic is analyzed by studying these 9 DRGs. Most of them corresponded to the Main Diagnostic Categories 11 and 5; that is to say, categories of «Diseases and Disorders of the Kidney and Urinary Tract», and «Circulatory System».

The characteristics of the 9 DRGs analyzed are shown in table II, with their corresponding relative weights. The Mean Relative Weight of the Department was 1216.

Costs of the different steps analyzed are shown in Table III. The Unitary Cost per DRG, as a result of the distribution of Hospitalization Costs according to the Relative Weight and number of episodes, varies from 1,174 € for the least complex DRG 134, to 4,042.66 € for the most complex DRG 120.

The contribution of each one of the diagnostic or therapeutic procedures to the procedures costs in the different analyzed DRGs is shown in Figure 2. Most of the costs correspond to costs for radiological procedures (interventional or diagnostic) and for replacement therapies.

The lowest Total Unitary Cost corresponded to DRG132, which is «Other diagnoses Kidney/Urinary Tract without co-morbidity,» and the highest to DRG 120, which is «Other interventions on the Circulatory System.»

## DISCUSSION

The production of health care services is based upon the application of a series of resources (human, equipment, infrastructure, organization) with the aim of achieving a series of products that are desirable

**Table II.** Description of the main DRGs

DRG	MDC	Description	N	Stay	DMS	RW
316	11	Renal failure	69	781	9.06	1.342
331	11	Other diagnoses kidney/urinary tract > 17 with CC	25	364	10.45	1.022
144	05	Other circulatory diagnoses with CC	23	131	5.7	1.166
332	11	Other diagnoses kidney/urinary tract > 17 without CC	19	155	6.41	0.599
134	05	Hypertension	16	118	6.4	0.591
120	05	Other interventions circulatory system	15	94	6.27	2.035
315	11	Other interventions kidney/urinary tract	10	66	6.6	2.047
240	08	Connective tissue disorders with CC	5	137	9	1.271
294	10	Diabetes > 35	4	48	12	0.758

DMS: Depurated mean stay. RW: Relative weight.

**Table III.** Costs per DRG

DRG	RWDRG	TCDRG (€)	UCDRG (€)	CPP (€)	UGRDTC (€)
316	0.399	183,952.31	2,665.97	512.26	3,178.23
331	0.110	50,756.27	2,030.27	713.05	2,743.32
144	0.115	53,275.79	2,316.33	597.38	2,913.71
332	0.049	22,609.12	1,189.95	299.44	1,489.4
134	0.040	18,784.98	1,174.06	493.85	1,667.91
120	0.131	60,639.98	4,042.66	3,682.13	7,724.79
315	0.088	40,665.04	4,066.5	1,553.78	5,620.26
240	0.027	12,624.62	2,524.92	400.96	2,925.88
294	0.013	6,023.24	1,505.81	1,116.56	2,622.37

RWDRG: Relative weight. TCDRG: Total cost. UCDRG: Unitary cost. CPP: Cost per procedure. UGRDTC: Total unitary cost.

from a health care point of view and with greater value than resources invested. As the Department productive process goes further a greater added value of the resulting product is obtained<sup>7</sup>.

The costs imputation model in this services production implies the creation of a distribution system among the different Activity Centers, defined as Structural, Logistic Intermediate, and Final. The first two ones perform an activity service for the Final Centers. Therefore, when distributing total costs of a particular Department, the Structural and Logistic Activity Services will affect their costs through a «cascade distribution method» until all of them will be definitively assigned to a Final Center<sup>8</sup>.

In our study, structural and logistic costs have been imputed to two Final Centers: Outpatient Clinic and Hospitalization. As shown in Figure 1, most of the Hospitalization costs correspond to those imputed to the Logistic Centers, which comprise the costs of

non-faculty health care personnel, non-health care consumption, disposable material, and pharmacy consumption. By contrast, in the Outpatient Clinic, most of the costs correspond to faculty staff.

Once the resources have been defined, we must define the hospital product. At this point, we face the difficulty of measuring intangible products, poorly homogenous and which consumption is identified by the service itself provided to each patient. For this reason, in the first phase, we used measurements oriented to intermediate products that more easily identifiable and measurable. That is the case for Hospital stays and first and follow-up visits in the Outpatient Clinic<sup>9</sup>.

In our study, the costs of these intermediate products were 200 €, 63 € and 31 € for hospital stay, the first visit and the follow-up visit, respectively. These costs are sharply lower than those published by the National Institute of Health (Insalud) for the year 2000 and for the Group 3 hospitals, which mean was 381, 379 y 227 €, respectively. If we compare ourselves with the most efficient Insalud hospital for each Activity Center, its costs are lower for the first and follow-up visits, and similar for hospital stay as compared to those obtained by our Department<sup>10</sup>. We have not included in these intermediate products the costs of diagnostic and therapeutic procedures since these would be also considered, themselves, intermediate products<sup>11</sup>.

Moving forward in the measurement of the hospital product, measurements aimed at quantifying final products are used. However, the diagnostic and therapeutic process for each patient is highly heterogeneous, and variably complex. From this point of view, we might say that each Nephrology Department elaborates as many final products as patients are diagnosed and treated<sup>12</sup>.

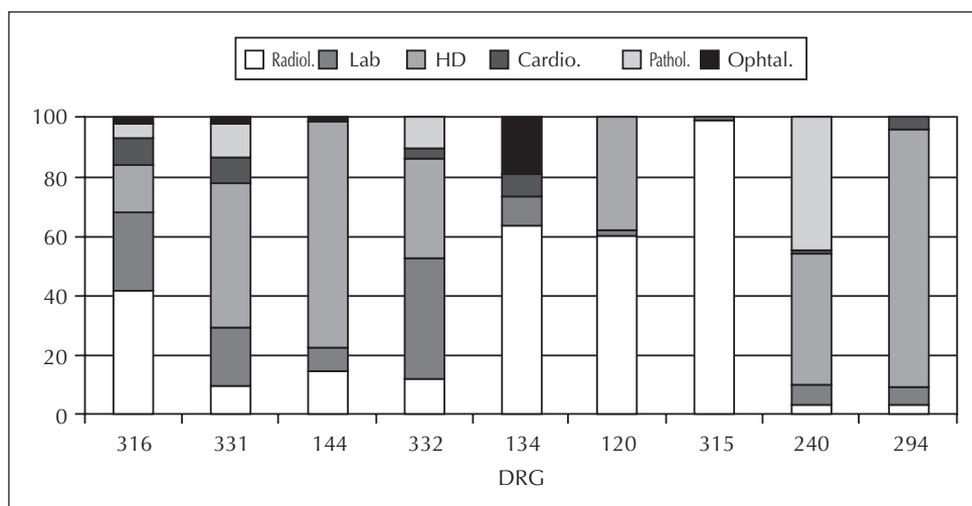


Fig. 2.—Contribution of the different diagnostic and therapeutic procedures to the total cost for procedures in each analyzed DRG. Rx: imaging examinations. Lab: laboratory examinations. HD: applied de-purative techniques. Cardio: cardiologic examinations. AP: endoscopic and pathology examinations. Ophtal: ophthalmological examinations.

To solve these difficulties in the quantification of the final product, several Patient Classification Systems (PCS) have emerged so that patients may be recognized as similar with regards to type of necessary care and, therefore, resource consumption<sup>13</sup>.

The PCS used in our Hospital, as in many other hospitals in our area, is the Diagnosis-Related Groups (DRG) System. This system elaborates a classification of Main Diagnostic Categories (MDC). Further, medical and surgical subgroups are established to which subclasses are added according to age or presence of complications and comorbidities. Each one of these DRGs elaborated by a particular Department represents a Relative Weight (RW) according to complexity and resources consumed<sup>14</sup>. MDC 11 corresponds to diseases and disorders of the kidney and urinary tract, and it comprises the main DRGs of the Nephrology Department<sup>15</sup>.

In our Department, 132 DRGs of the 232 elaborated ones corresponded to this MDC, and 64 DRGs corresponded to MDC 5. Hospital admissions due to arterial hypertension and processes related to complications of the vascular access justify this high number.

In analytical accounting, two methods are used to obtain the costs of the DRGs<sup>16</sup>:

- The «Top-Down» method of distribution of costs according to the assigned relative weight of each DRG, either using the american weights or those particular to each Health Service.
- The «Bottom-Up» method by reconstructing the cost by procedure as the sum of costs for each assisted patient and assigned to a particular DRG.

In our study, we have used the «Top-Down» method that has the advantages of lesser need of information and a simpler calculation. However, it has the limitation of using the american mean weights system (Medicare/New York) for the year 2003, which is the one used by the Documentation Department of our Hospital.

The highest costs corresponded to DRG 120 «Other interventions of the circulatory system» that comprises pharmaco-mechanic resolution of obstructions and further angioplasty and stent placement within the humeral-axillary grafts used as a vascular access for hemodialysis.

Most of the costs of the DRGs elaborated in our Department were higher than those published for the Insalud hospitals<sup>10</sup>. However, several differences make the comparison difficult. In the first place, the Insalud costs correspond to the year 2000, and they use the advanced AP-DRG (all patients) version. Besides, important differences are

noted in the assignment of the relative weight of each DRG<sup>17</sup>.

We can conclude that analytical accounting represents a powerful tool that allows the Nephrology Department managers knowing the costs in each Activity Center that comprise the Unit.

Although it poses some difficulties when making comparisons with the departments of other hospitals, it may bring us important information for year-to-year comparison of our Department and contribute to improving the efficacy.

The better development of this tool by using the «Bottom-Up» method will allow us knowing the real cost per patient and to measure the efficacy of the different departments. In addition, it will be helpful as an auto-evaluation tool for faculty staff that assists these processes<sup>18</sup>.

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