



## Original Article

# Example of cost calculations for an operating room and a post-anaesthesia care unit



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## ABSTRACT

**Objective:** The aim of this study was to evaluate the cost of an operating room using data from our hospital. Using an accounting-based method helped us.

**Methods:** Over the year 2012, the sum of direct and indirect expenses with cost sharing expenses allowed us to calculate the cost of the operating room (OR) and of the post-anaesthesia care unit (PACU).

**Results:** The cost of the OR and PACU was €10.8 per minute of time offered. Two thirds of the direct expenses were allocated to surgery and one third to anaesthesia. Indirect expenses were 25% of the direct expenses. The cost of medications and single use medical devices was €111.45 per anaesthesia. The total cost of anaesthesia (taking into account wages and indirect expenses) was €753.14 per anaesthesia as compared to the total cost of the anaesthesia. The part of medications and single use devices for anaesthesia was 14.8% of the total cost.

**Conclusion:** Despite the difficulties facing cost evaluation, this model of calculation, assisted by the cost accounting controller, helped us to have a concrete financial vision. It also shows that a global reflexion is necessary during financial decision-making.

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## 1. Introduction

To support health costs, institutions must manage their human and financial resources. The evaluation of costs is an essential part of medico-economic analysis. The cost is an amount that has to be paid in order to get something. It is a monetary valuation of the resources and material used in the production and delivery of a good or a service. The calculation of a cost depends on the methodology used. Costs are usually expressed as a price or monetary value [1]. These economic concerns have already been published [2]. However different costs have been compared according to type of surgery [1,3–5], the anaesthetic technique used (regional anaesthesia or general anaesthesia) [5,6], the medications and the devices used [7–10], and the type of hospitalization (outpatient surgery or not) [4,11], but rarely according to the overall cost of an operating room (OR).

The comparison of the cost from different hospitals is sometimes difficult because of different organizations. The realization of a model of cost calculation, based on accounting, is therefore necessary. It helps the institution to make financial evaluations and internal development with its own methodology. It also helps contribute to the establishment of national cost studies with a common methodology [12]. The objective of this study was to answer the question about the cost of the OR. We present a model of calculation assisted by cost accounting management controllers. [13] As an example, we provide the results of our hospital.

## 2. Methods

The cost evaluation of the use of an OR is comparable to the cost of a business company. This cost represents the sum of spending required to produce goods or services. The service is represented here by a surgical procedure under anaesthesia. The total cost contains all the costs incurred by the company. Some expenses are fixed (not related to activity) whereas other expenses are variable

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(related to activity). Shared costs are composed of direct and indirect expenses.

Direct expenses are related to the production cost of the company (Table 1). Their sharing is recommended by the hospital cost accounting manual [13]. We selected the following as direct expenses: wages (medical doctors, nurses and non-medical staff), medications, implantable medical devices (implants, prostheses), other single use devices, depreciation, lease, maintenance and servicing of medical devices, and finally the use of an external laboratory. Indirect expenses are not directly related with the cost of production but are necessary for its realization. They are often common to other departments in the same hospital (e.g. administrative services). The evaluation of indirect expenses requires a fair sharing for the part induced in the OR. This requires creation of fair cost sharing (e.g. surface of the OR area compared to the entire hospital at the real estate cost). Indirect expenses consisted of: maintenance of medical equipment, pharmacy, administrative services, hotel service, maintenance, stretcher-bearer, financial structure (or expenses relating to borrowings) and finally the building structure (or construction cost) [12] (Table 2).

The production unit selected is the OR and the post-anaesthesia care unit (PACU). The OR and the PACU were assembled into one entity because many elements are held in common: for example, staff and medications (common orders). Preoperative visits by the anaesthesiologist and hospitalization were not evaluated. Although these elements are essential to the arrival or departure from the OR, they can be identified as an independent production. The sum of all expenses, divided by the number of products allows us to calculate the unit production cost. In a hospital, the unit cost of production can be represented by several models: the time, the number of patients or the number of surgical procedures. We chose the time offered for surgical procedures as the unit cost of production [14]. The duration of inclusion was the year 2012.

Data analyses were descriptive. The results are presented in euros or percentages for quantitative variables and percentages for categorical variables.

### 3. Results

#### 3.1. Demographic data

In our hospital (the Cancer Institute of Lorraine, Nancy, France), there are 4 ORs (open from 8 am until 4:30 pm, 5 days a week) and

6 PACU sites (open until 6:30 pm). The calculation of the cost does not include emergency surgeries outside these hours.

In 2012, there were no ambulatory procedures. Procedures included: 50% breast surgery (mastectomy ± axillary dissection, breast reconstruction), 10% gastrointestinal surgery (bowel resection, liver resection, para-aortic lymphadenectomy, hyperthermic intraperitoneal chemotherapy), 10% gynaecologic surgery (colpohysterectomy with annexectomy and/or lymphadenectomy, oophorectomy, hyperthermic intraperitoneal chemotherapy), 10% head and neck surgery (thyroidectomy, laryngectomy, glossectomy), 10% skin tumours surgery, 2% urological surgery (nephrectomy, cystectomy, prostatectomy by laparotomy), 2% sarcoma surgery and 6% other type of surgeries. For 2012, 2392 surgical procedures were included during one year: 2150 under anaesthesia and 242 without anaesthesia.

The number of staff members was calculated as per full job time. Sharing was implemented according to the part of time spent in the operating room for each staff member. Activities outside the operating room are excluded (e.g. consultations, critical care unit, university activities...). The repartition of the anaesthesiologists and the surgeons was based on a survey of their activities between their clinical time, research and teaching. The survey is updated every 2 years. One anaesthesiologist always works in 2 ORs with a nurse anaesthetist in each OR. The full time work period of an anaesthesiologist represents 205 days per year. The 4 ORs were open 255 days during the year 2012. Therefore 2.5 anaesthesiologists are needed to cover the entire year (Table 3). A surgeon works in the majority of cases with two nurses in the OR. Residents in anaesthesia or surgery and the student nurses were not included in the staff. The cost of cleaning staff was calculated as an indirect expense (Table 2). The stretcher-bearer cost is calculated according to the number of transports (Table 2).

#### 3.2. Results

The cost of the OR and PACU was € 10.80 per minute of time offered (€ 623 per hour) for the year 2012. These costs are the sum of direct and indirect expenses. The time offered for surgery and PACU was 7,578 hours. The real occupancy was 6110 hours. The real occupancy with emergency surgeries was 6,285 hours (+ 175 hours more than real occupancy).

Direct expenses are described in Table 1. They accounted for € 8.63 per minute of offered time (€ 517.69 per hour) for 2012. Two thirds of direct expenses were allocated to surgery

**Table 1**  
Direct expenses for one year.

Title of expense items	Direct expenses				
	Surgery		Anaesthesia		Total
	€	%	€	%	€
Personnel					
Medical personnel	659,766	64	379,216	36	1,038,982
Management personnel	153,103	84	29,852	16	182,955
Others paramedical personnel	750,068	57	563,404	43	1,313,472
Total Personnel	1,562,937	62	972,472	38	2,535,409
Medications and material					
Medications	54,270	32	115,299	68	169,569
Implantable medical devices outside the unassigned to patient list	38,516	99	174	1	38,690
Medical consumables	656,416	84	124,327	16	780,743
Medical equipment rentals	280,593	84	55,263	16	335,856
Maintenance for medical devices	38,476	61	24,294	39	62,770
Total medications and material	1,068,271	77	319,357	23	1,387,628
Total residual net expenses for sections	2,631,208	67	1,291,829	33	3,923,037
Total opening of the OR + PACU block in hours (4 rooms) = session time available					7578
Cost of block opening per minute					8.63

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