



## Editorial

# What does one minute of operating room time cost?

“How much does one minute of OR time cost?” is a question often asked in the operating room (OR) suite. We hear this question during cases that seem to be taking longer than they should, or when a missing piece of equipment delays the next step of the surgery. This question also arises if there is a last-minute cancellation that leaves the OR unexpectedly idle until another case can be assigned. The latter issue is specifically addressed in the nice article by Lau et al. in this issue of the *Journal of Clinical Anesthesia*. In it, the authors analyze the reasons that cases are cancelled after the patient has arrived in the OR [1].

The short answer to “How much does one minute of OR time cost?” is, “It depends.” It depends on many factors including: which country you are in, as resource costs vary from country to country; which surgical procedure is being performed, as, for example, OR time for a coronary artery bypass graft costs more than for an inguinal hernia repair; whether the answer refers to hospital charges as appearing on the hospital bill sent to the insurance company or to hospital costs related to the actual amount of money that the hospital spends in providing the surgery; whether the OR cost includes fixed overhead costs that are constant regardless of the number of surgeries performed, or if it only accounts for the variable costs, which vary according to the number of cases performed; or whether professional fees of the physician work in the OR are included. The objective of this article is to review these concepts in more detail.

## 1. Reasons to measure costs

A cost is defined as a resource (eg, an ampoule of propofol) sacrificed to achieve an objective (ie, patient well-being during surgery) [2]. All organizations, including hospitals, have 4 basic reasons to measure costs: 1) to make economic decisions for resource allocation, for example, whether to replace existing anesthesia machines; 2) as justification for reimbursement or as a basis for establishing a fair price, eg, what to charge the patient who undergoes a kidney transplant; 3) to encourage or discourage use of services, eg, knowing the cost of a medication helps the hospital system to determine whether to make it readily

available, or whether specific pharmacy approval is required; or 4) for income and asset measurement for external parties, eg, pharmaceuticals as line-item expense in the end-of-fiscal-year financial reports.

The adage, “If something cannot be measured effectively it cannot be managed effectively” is true. As a result, improved cost accounting allows for improved management planning and control of resources. Importantly, an estimate of what a resource costs depends on whose viewpoint (eg, society, payor, hospital, physician, patient) is taken when a cost estimate is made.

## 2. Cost versus charge

Incentives to reduce costs in the United States result from the fee-for-service system. Two important terms, often confused when discussing the business of health care, are:

**Cost** = the amount of hospital expenditures for resources (ie, buying supplies) to deliver medical care. However, it is very difficult for hospitals to know the true cost attributable to delivering care. There are no published formal data on true OR costs. Excluding physician costs, OR administrators may use a ballpark number such as \$15 to \$20 per OR minute for a basic surgical procedure, with at least half of that figure being fixed overhead costs [3]. The variable cost depends in large part on how OR staff is paid (eg, hourly or salaried).

**Charge** = the amount of money the doctor or the hospital bills for medical care. Hospitals do know exactly what the charges on the patient’s hospital bill are, but charge data rarely reflect the true cost to the hospital of providing care. The hospital “charge master” contains thousands of individual items across departments providing patient services. Every chargeable item in the hospital must be part of the charge master for a hospital to bill for it.

A Google search identifies some online postings of OR charges. For example, at one facility a two-hour case of low complexity is billed at \$3,520 (\$29/min), a figure that increases to \$9,647 (\$80/min) for a high-complexity case [4]. This figure does not include the anesthesia charge ranging from \$185 for the low complexity case to \$957 for the most

complex case. A 2005 study of 100 U.S. hospitals found that OR charges averaged \$62/min (range: \$22 to \$133/min) [5]. These figures did not include extra resources specific to the procedure (eg, clip for an intracranial aneurysm) and did not include surgeon and anesthesia provider fees. Depending on how the facility sets its charges, some hospitals may halve the per-minute OR charge after the first hour of surgery. Such a calculation is made because the bulk of supplies (custom pack opened, implants identified) and bulk of support labor (room set-up, choosing of instruments) occur in the first part of the case.

It is important to remember that hospital charges are set over years. Updates to the charge master may not occur frequently. In fact, with inflationary increases applied to thousands of revenue codes, hospitals may be unable to explain the rationale for some of their charges. This situation is made apparent in the lay press when patients are shocked at the hospital bill, in particular items such as an aspirin, charged at \$10!

### 3. “Top-down” costing

Hospitals traditionally have used a “top-down” costing approach to determine the cost of a surgical procedure, or the cost of OR time. The most prevalent top-down costing method is the cost-to-charge ratio (Table 1). This top-down method estimates costs by computing an overall ratio of facility costs to facility charges as they appear on patients’ hospital bills. In the example shown in Table 1, if the sum of all charges for all patients cared for in the OR suite equals \$1,000, and the total expenses incurred to actually provide the care to those patients equal \$500, then the cost-to-charge ratio =  $\$500/\$1000 = 0.50$ . This ratio is applied to the charges for other items to determine their “actual” costs.

In a hospital using a top-down costing approach, if the OR administrator is asked, “What is the cost of having a patient in the OR for an additional 15 minutes?”, the administrator will likely examine the patient charge (as it appears on the patient’s hospital bill) for those 15 minutes in the OR and multiply that number by 0.50. Similarly, if the administrator is asked, “What is the cost of the using a

microscope during surgery?” he or she would find the corresponding charge on the hospital bill and multiply by 0.50. This example illustrates the disadvantages of the top-down costing method. An “averaging” effect renders cost estimates for any particular item imprecise. Charges often reflect what the market forces of supply and demand will bear and therefore do not necessarily maintain a constant relationship with costs.

Of note, large variation in cost-to-charge ratios exists among hospital departments. For example, cost-to-charge ratios can be as high as 0.92 for the surgery admission unit, ranging to 0.52 for the patient ward, and 0.37 for the intensive care unit [6].

### 4. “Bottom-up” costing – a more precise way to measure costs

An alternative costing approach, which is increasingly being adopted by organizations that require accurate cost data for contracting, is “bottom-up” costing, sometimes referred to as “micro-costing.” This method is more precise, but it is more difficult to do as each step of care is analyzed and costed individually. There is an incremental cost (people and software) to proper accounting of hospital costs. It was unnecessary when hospital reimbursement was based mainly on discounted fees, independent of internal costs. Once hospitals began negotiating with payors for a single payment for a type of surgery, then hospitals needed to know exactly what their incremental costs are so as to not lose money.

With bottom-up costing, individual elements of patient care are added to determine total cost from the bottom up. With bottom-up costing, more precise economic measurements of the perioperative period are possible [7,8]. When this is done, it becomes clear that the most expensive day for a surgical patient in the hospital is the first one, when the procedure takes place. In fact, because of technological advances, the supplies budget (eg, robotic supplies, prosthetic devices, invasive surgical supplies, endomechanicals, equipment, and instruments) may be greater than the salaries and benefits of nonphysician OR staff.

After the first day when the surgery occurs, the hospital cost per day decreases each day the patient remains in the hospital. One study documented that the variable costs incurred by patients on their last full hospital day may be less than 5% of the total cost of the stay [9]. This finding is important because reducing the number of days that the patient is in the hospital (via a clinical pathway, for example) may not save the hospital as much money as expected. This can have negative financial consequences if the hospital contract calls for a per diem payment for each day the patient is hospitalized, and the per diem is lost on the least costly (last) day. This type of economic revelation would be absent with a top-down cost-accounting approach.

**Table 1** Hypothetical example of computing a cost-to-charge ratio

Annual Operating Room Suite Budget Expenses	
Salaries	\$200
Benefits	\$ 62
Equipment	\$212
Depreciation	\$ 26
Total	\$500
<b>Total Patient Charges as on the Hospital Bill = \$1,000</b>	

## 5. Fixed costs versus variable costs

One advantage of bottom-up costing is that total costs can be separated into fixed and variable components. Fixed costs (eg, rental of a building that houses the surgery suite, acquisition cost of an anesthesia machine) do not change in proportion to volume of surgical cases. Hospital administration (eg, contracts office, billing, security, human resources), depreciation, hospital computer system, medical records department, insurance, and housekeeping/dietary are components of overhead costs. Different methodologies are available to determine how to allocate such fixed costs to individual revenue centers like the OR [10].

The majority of the cost of providing hospital service is related to buildings, equipment, and salaried labor, which are fixed overhead over the short-term [11]. As a result, fixed costs must be emphasized if any cost reduction strategy is going to succeed in the OR or elsewhere. The high fixed costs also mean that reduction in Postanesthesia Care Unit (PACU) stay, due to more efficient recovery protocols, for example, may not actually reduce costs if the majority of PACU costs are fixed. Freestanding surgery centers have thrived because they have the economic advantage of much lower overhead than the traditional hospital.

On the other hand, variable costs (ie, disposable supplies such as a Laryngeal Mask Airway) do change as volume of activity changes. Other examples of variable costs are unit doses of medication, packets of suture, disposable surgical drapes, and medical waste disposal costs. The variable cost/total cost ratio can be high and equal 0.70 for the pharmacy, or be low such as 0.32 for the radiology suite where most of the imaging equipment is a fixed cost. It is crucial to remember that changes in physician practice patterns (eg, choice of volatile anesthetic, ordering fewer blood tests) typically only affect variable costs. Superhuman effort, for example, to rush around on the day of surgery trying to reduce turnover times, may be dangerous, stressful, and have little financial justification.

Operating room labor can be a variable cost or a fixed cost depending on how staff is paid. If staff is paid per hour and they are sent home when the work is done, then that labor cost is variable. In contrast, if OR staff are paid a salary regardless of when the cases finish, then that is a fixed labor cost. Time horizon, or how long in the future one is determining whether a cost is fixed or variable, is also important.

One limitation in considering total costs only is that they do not indicate the financial impact of reducing surgical volume. Total costs contain fixed costs, which are incurred under any circumstance. Thus, the decision to eliminate a surgical service line that is losing \$5,000 per case (when revenues are subtracted from full costs) does not result in a saving of \$5,000 per case. The reason is that the fixed costs continue regardless of the number of cases.

Every hospital manager understands that as patient volume decreases, average cost per patient increases. This is because fixed costs need to be distributed among fewer

patients. It also explains why hospitals aim to maintain a high hospital census. When making decisions about which medical or surgical services to eliminate, a separate cash flow analysis is required. Such analyses would carefully consider which costs are eliminated, which revenue is forgone, and which costs and revenues are likely to replace the eliminated line of service.

## 6. Contribution margin

The contribution margin is the hospital revenue generated by a surgical case, less all the hospitalization variable labor and supply costs. Theoretically, any case with a contribution margin greater than zero, which can be done safely, is financially worth doing to a facility. Even a service that loses money may be worthwhile to a hospital if other non-financial benefits are derived, such as providing community service.

In the U.S., fee-for-service hospitals have a positive contribution margin for almost all elective cases, mostly due to a large percentage of fixed OR costs. As much as tenfold variability in contribution margin exists among surgeons in different specialties [12]. For U.S. hospitals not on a fixed annual budget, contribution margin per OR hour averages one to two thousand U.S. dollars per OR hour [13].

## 7. Conclusion

Most hospitals perform all cases scheduled by its surgeons, provided a case can be done safely. This reflects the desire to retain and grow surgeons' practices, to enhance market share and reputation, and to fulfill community service missions. Evaluating the effectiveness of OR management often depends on who you ask, but often includes the most "throughput" of cases, with the least cost including a low cancellation rate [14]. Each surgical facility needs a clear understanding of its economic structure to ensure the groundwork for an efficient and well-functioning OR suite.

At the heart of the question, "How much does OR time cost?" is another question, "How much money is being lost?" when a case is suddenly cancelled, for example. However, many people often confuse the terms "cost" and "charge", using them interchangeably even when they should know better. It can be dangerous financially since costs and charges are not related linearly. Charges are list prices, and payors with clout can negotiate large discounts. In contrast, self-pay patients, for example, are expected to pay full list price. Management science tells us that the incentive is for charges to be set high enough to extract the most reimbursement from the portfolio of payers that an organization has.

The cost of OR time depends on the resources consumed and the unit costs of those resources. Ultimately, hospital managers must decide whether the benefits of more accurate

and detailed cost information justify the additional costs of obtaining that information.

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## References

- [1] Lau HK, Chen TH, Liou CM, Chou MC, Hung WT. Retrospective analysis of surgery postponed or cancelled inside the operating room. *J Clin Anesth* 2010;22:237-40.
- [2] Horngren CT, Foster G. *Cost Accounting: A managerial Emphasis*. 6<sup>th</sup> ed. Englewood Cliffs, NJ: Prentice Hall Inc.; 1991.
- [3] Park KW, Dickerson C. Can efficient supply management in the operating room save millions? *Curr Opin Anaesthesiol* 2009;22:242-8.
- [4] Available at: [http://www.akrongeneral.org/portal/page?\\_pageid=153,10351153&\\_dad=portal&\\_schema=PORTAL](http://www.akrongeneral.org/portal/page?_pageid=153,10351153&_dad=portal&_schema=PORTAL). Accessed January 14, 2010.
- [5] Available at: <http://www.shippertmedical.com/UserFiles/File/Time-saving.pdf>. Accessed January 14, 2010.
- [6] Macario A, Vitez T, Dunn B, McDonald T. What are the costs in perioperative care? Analysis of hospital costs and charges for inpatient surgical care. *Anesthesiology* 1995;83:1138-44.
- [7] Macario A, Schilling P, Rubio R, Goodman S. Economics of one-stage versus two-stage bilateral total knee arthroplasties. *Clin Orthop Relat Res* 2003(414):149-56.
- [8] Macario A, McCoy M. The pharmacy cost of delivering postoperative analgesia to patients undergoing joint replacement surgery. *J Pain* 2003;4:22-8.
- [9] Smith A, Kurpad R, Lal A, Nielsen M, Wallen EM, Pruthi RS. Cost analysis of robotic versus open radical cystectomy for bladder cancer. *J Urol* 2010;183:505-9.
- [10] Finkler SA, Ward DM. *Cost Accounting for Health Care Organizations: Concepts and Applications*. 2nd ed. New York: Aspen Publishers; 1999.
- [11] Propp DA. Fixed vs variable costs of hospital care. *JAMA* 1999;282:630.
- [12] Macario A, Dexter F, Traub RD. Hospital profitability per hour of operating room time can vary among surgeons. *Anesth Analg* 2001;93:669-75.
- [13] Macario A. Are your hospital operating rooms "efficient"? A scoring system with eight performance indicators. *Anesthesiology* 2006;105:237-40.
- [14] Vitez TS, Macario A. Setting performance standards for an anesthesia department. *J Clin Anesth* 1998;10:166-75.