

Managerial Accounting Applications in Radiology

Frank James Lexa, MD, MBA^a, Tushar Mehta, MPPM, PhD^b,
Abraham Seidmann, PhD^b

We review the core issues in managerial accounting for radiologists. We introduce the topic and then explore its application to diagnostic imaging. We define key terms such as *fixed cost*, *variable cost*, *marginal cost*, and *marginal revenue* and discuss their role in understanding the operational and financial implications for a radiology facility by using a cost-volume-profit model. Our work places particular emphasis on the role of managerial accounting in understanding service costs, as well as how it assists executive decision making.

Key Words: Fixed cost, variable cost, managerial accounting, revenue, service activity costing, management

J Am Coll Radiol 2005;2:262-270. Copyright © 2005 American College of Radiology

Managerial accounting is one of the most powerful tools in the modern armamentarium of scientific business analysis. In this article, we introduce the basic concepts used in managerial accounting and discuss the core terms used in the field, including *fixed cost*, *variable cost*, *marginal revenue*, and *break-even point*. We also introduce a new approach that we have developed—service activity costing—that is particularly useful for understanding the cost basis of services in industries such as diagnostic imaging that have a relatively high ratio of fixed costs to marginal costs [1].

We address how managerial accounting can provide a clear, concise picture of the true costs of various services. We discuss what fixed costs and marginal costs are, why they are important in the short and medium term, and why all costs are marginal in the long term. We show how to model cost structures and discuss why doing so is so important.

Most important, we explore how these concepts and modeling systems help improve decision making and maximize the effectiveness and efficiency of the clinical practice [2-4]. Managerial decisions affect the quality of the work, the effectiveness of the workplace, and the profitability of the practice. In addition, managerial accounting provides the tools to model the effect of novel or even revolutionary designs for new services.

One misconception about cost accounting and mana-

gerial accounting in general is that it is applicable only to for-profit entities or only to outpatient global billing practices. In fact, these principles can be applied (albeit with some differences) to any type of medical (or non-medical) firm. Even public entities that are not in the business of making a profit (such as the government and the Army) use these tools to better manage, plan, and understand their costs. Although space limitations force us to focus on only one type of practice, keep in mind that these principles are highly adaptable and are used by a wide range of entities to analyze costs.

MANAGERIAL ACCOUNTING: ITS ROLE IN A MEDICAL PRACTICE

All of us are familiar, at least superficially, with the roles of financial accounting and financial accountants in our practices. These are the people who keep our books, prepare our taxes, and often perform a host of related services, such as payroll and cash management. Most physicians, however, are far less familiar with managerial accounting and the role that this discipline can play in building and running a successful practice. That is a shame, because managerial accounting is much closer to what radiologists need to do when they run their practices and make key choices in planning, purchasing, hiring, and so on. Indeed, most practice managers are probably already making “managerial accounting” decisions intuitively. The tools in this chapter will help them to analyze their practices and understand how costs are driven and how to make better decisions. Accounting systems can help radiology executives meet a host of challenges, including better command and control of the business, improved pricing of services, better cost con-

^aUniversity of Pennsylvania, the Wharton School, Philadelphia, Pennsylvania.

^bUniversity of Rochester, Rochester, New York.

Corresponding author and reprints: Frank J. Lexa, MD, MBA, University of Pennsylvania, the Wharton School, GCP, 302 Steinberg-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA 19104; E-mail: lexa@wharton.upenn.edu.

tracting with external agencies, improved purchasing and planning, and developing performance incentives for employees.

CHALLENGES TO ACCURATE COSTING IN RADIOLOGY

A radiology practice has some characteristics that can make accurate costing difficult, particularly for the uninitiated. First, it is a high-fixed cost business, and although the variable costs are nontrivial, they are small when compared with the large fixed costs. Furthermore, there has been a downward trend in variable costs as sites convert to digital archiving. A second source of difficulty is that most practices provide a wide array of services across multiple modalities. This diversity has the potential to create a great deal of cost confusion. There are often many shared elements, such as front office services, billing, and collection. This can make accurate cost analysis difficult, and empirical studies have shown that actual costs can be quite different from what is commonly assumed [5,6]. Although business decisions are made for a variety of financial and nonfinancial purposes, the techniques of managerial accounting can give the radiology executive a much better grasp of how costs are generated, how they can be appropriately allocated, and how to better manage the business.

TYPES OF COSTS AND COST ALLOCATION

The radiology manager faces a difficult task in distinguishing the types of costs a practice incurs. Some traditional ledger and capital costing approaches can be misleading and result in distorted or even destructive decision making [7,8]. In particular, failure to allocate costs accurately can produce inaccurate profitability analyses that penalize higher-margin services and underestimate the costs of less profitable services. It can also distort incentives for employees and allocation of resources. Activity-based costing systems, conversely, use techniques to avoid or at least minimize these distortions [9-11]. Activity-based costing systems can get to the root costs of the business processes that are used in providing health care services [12]. The ultimate goal of activity-based costing systems and other forms of managerial decision making is to improve decision making and improve the business [13,14].

As part of the costing process, costs are usually divided into two categories: Fixed costs and variable costs. Fixed costs are constant and do not depend on the number of service procedures that the practice provides. Examples include the costs of purchased or leased equipment, office space, and the base salaries of critical personnel. In contrast, variable costs do depend on the amount of ser-

vice(s) provided. They vary directly with the number of revenue-producing service procedures performed at the facility. Examples of variable costs are the costs of contrast, film, and overtime. It is important to note that the terms *fixed* and *variable* refer to their effects relative to the product or service and not to their inherent payment flexibility or illiquidity. Hence, the lease of a magnetic resonance imaging (MRI) system is a fixed cost, although the lease may be subject to cancellation, because the cost is incurred even if no procedures are performed.

The reader may have already realized an extremely important aspect of this particular partitioning of costs. The definition of *fixed* depends on the length of time associated with the analysis. A lease, for example, constitutes a fixed cost only after it is signed and then only for the duration of the lease. It is a variable cost before it is signed or for purposes of negotiating renewal.

Another frequently used dichotomy is that of direct vs. indirect costs. These refer to costs that can be attributed to the delivery of service. Direct costs are attributable to the resources that are directly used or consumed by the service; for an MRI, these would include the machine and equipment maintenance cost, the costs of the technologist and the radiologist, and consumables such as film, contrast, and linen. Direct costs can be traced to a service easily—i.e., directly. Indirect costs refer to what is more commonly known as *overhead*—things that support the service but may also be applied to other services or just to general support, i.e., costs that can not be directly tied to the service. Indirect costs include items such as the costs of administrators, the telephone, office and stockroom space, insurance, marketing, office supplies, janitorial help, and snow removal. Sometimes a single supplier bill contains both direct and indirect components; the practice's electricity bill, for example, includes general office costs, which are probably impossible to allocate to a single service, and a substantial component from the imaging system, which should be allocated as a direct cost because that can be directly tied to the service.

Note, too, that both direct and indirect costs can be either fixed or variable. For example, a technologist paid strictly on a salary basis constitutes a fixed cost. If there is an incentive plan that includes a volume-driven monetary reward, then the technologist is both a fixed cost and a variable cost; finally, if the technologist is paid strictly on a per-procedure basis, then that constitutes a pure variable cost for the practice. Irrespective of the salary structure, the technologist represents a direct cost associated with the MRI facility. On the indirect side, the janitor's work is a fixed cost (unless additional work with overtime costs is generated by a busy day, in which case there would also be a variable component) that is spread over all types of studies performed. As a general rule, the

more sophisticated the analysis, the more costs are allocated to business processes. The more accurate that allocation, the better the model and the lower the amount that ends up in the wastebasket term of *overhead* [15].

TOOLS FOR MANAGERIAL ANALYSIS

The types of costs described in the previous section lay the foundation for the key elements associated with managerial analysis. We now look at the concepts of marginal revenue and marginal cost. At their core, these represent the revenue and the cost, respectively, of providing one more procedure. The marginal revenue would be the revenue earned from the additional procedure. The marginal cost would be the cost associated with the same procedure. In many cases, the marginal cost is the same as the variable cost described in the previous section, but not always. Understanding the difference may make all the difference between a profitable new program and one destined to lose money.

The easiest way to illustrate marginal analysis may be through an example. You are the director at Merion Imaging Associates (MIA), a well-known regional facility in a large metropolitan area. Part of your business is through a radiology contract with a large self-insured regional employer. The company's employee benefit department wants the center to stay open an extra 2 hours each Saturday and reserve that time for its employees. In exchange, MIA will receive a Saturday services surcharge—a flat fee paid over and above the existing per-procedure reimbursement. Before you decide about this, you have to answer a basic question: what is the marginal revenue for this incremental Saturday work? The marginal revenue will be the regular reimbursement for the scans performed plus an allocated portion of the Saturday-service fee you negotiated.

The same concept applies to marginal cost. Consider a scenario in which MIA implements a productivity improvement program that results in the practice's being able to perform one more procedure each day. What is the marginal cost of this incremental procedure? It is just the variable cost: the consumables, the electricity, and so on. Therefore, the marginal cost is the same as the variable cost. Now, consider your competitor that decides to stay open an extra half hour each day so that it too can perform one more daily procedure. What is its cost for this procedure? In addition to incurring the variable costs of the procedure, it will have to pay its staff for the overtime work. Therefore, its marginal cost of the extra procedure is the variable cost of one more MRI plus any other additional costs incurred as part of the change in the competitor's schedule. Assuming that both centers get the same reimbursement for their services, your competitor will earn less for the additional procedure it pro-

vides because it has higher costs. In fact, it may discover that at some levels of service it even lose money by performing an additional procedure. If that were to happen, we would say that it has a *negative contribution margin*, also called *contribution*, which is the net income of providing a service, i.e.,

Contribution margin = marginal revenue – marginal cost.

We can now calculate the *break-even point*, which is the number of procedures that must be performed to cover the fixed costs:

$$\text{Break-even point} = \frac{\text{Fixed cost per period}}{\text{contribution margin.}}$$

This leads us to a metric used by some to measure the financial feasibility of a project: the payback period. Although a complete review of its few pros and many cons is beyond the scope of this article, it is the time required for the practice to achieve the break-even volume, i.e., to go into the black. It is related to break-even point and procedures performed by

$$\text{Payback period} = \frac{\text{break-even point}}{\text{procedures performed per period.}}$$

COST-VOLUME-PROFIT ANALYSIS

Cost-volume-profit analysis combines fixed costs, marginal costs, and marginal revenues. The amount of revenue received per service—e.g. reimbursement per brain MRI performed (using actual revenue rather than charge) into a single model that provides a strong, visual depiction of the current state of a business and allows a manager to examine what would happen if those variables were modified in various scenarios. Fig. 1 shows the basic form of a cost-volume-profit diagram. The diagram combines the fixed costs and variable costs with marginal revenue over a wide range of outputs. A manager can ask

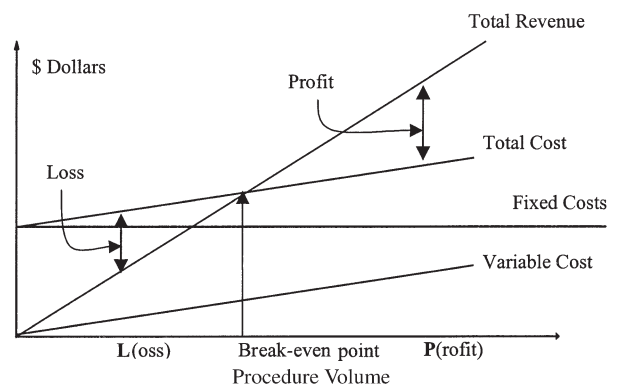


Fig. 1. Cost-volume-profit diagram. Arrows indicate loss territory, break-even point and profit.

how each of these contributes to the risk and performance of a business and how various interventions will improve or worsen the business.

The line marked fixed cost represents the cost that the practice will incur for the duration represented on the diagram irrespective of how many procedures it performs. Because this cost is independent of volume, it is a horizontal line. The variable cost line represents the total variable costs incurred at a particular procedure volume. The total cost line is the sum of the fixed cost and the variable cost lines. The total revenue line is the total gross revenue earned at a particular procedure volume. Therefore, the practice's profit (or loss) is the difference between the total revenue line and the total cost line. If the practice volume is at the point labeled L (for loss) on the diagram, its total revenue is less than the total cost, and it is still in the red, generating a loss. By the time it gets to a procedure volume shown by P (for profit) on the diagram, the total revenue exceeds the total cost, and the

practice earns a profit. The break-even point discussed in the previous section is the procedure volume at which the total revenue and total cost lines intersect. This is represented by break-even in the diagram.

Let us examine two businesses (Fig. 2) and analyze which one is more likely to be successful. Everything else being equal, the business with the lower break-even point is more likely to succeed. At the break-even point, the revenue line intercepts the total cost line. If the practice performs fewer procedures than required to break even, it shows a loss; if more, it turns a profit. Hence, knowing the break-even point is important for effectively managing a practice. In Fig. 2, Business A needs to perform far fewer procedures to succeed. Even when both are successful, as long as they perform the same number of procedures, Business A produces greater profits. Thus, cost volume profit analysis lets the radiology manager answer "what if" questions with regard to changes in cost and revenue, which investments have higher or lower risk levels, and which variables can be changed to improve the organization's risk profile.

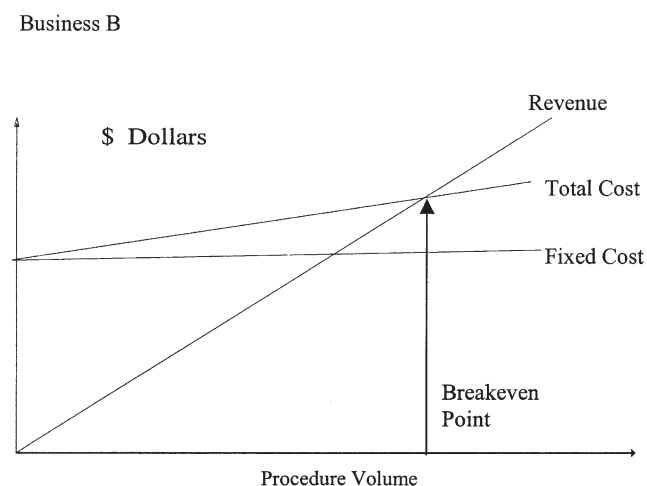
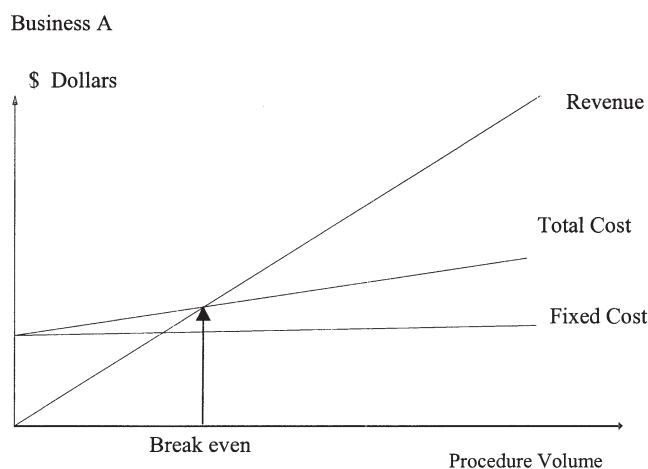


Fig. 2. Comparison of two businesses with different break-even points (the variable cost line has been left off to keep the figures simpler).

ACTIVITY-BASED COSTING APPROACHES TO UNDERSTANDING COSTS

In this section, we introduce activity-based costing. The process of activity-based costing assigns costs to services on the basis of their actual consumption of resources. We will review the traditional basis for finding the cost of magnetic resonance services. This analysis has relied on compiling historical data and computing the following: (1) take the total number of studies from the previous year; (2) sum the total fixed costs; (3) divide total costs by total studies to obtain the fixed cost per study; and (4) add any appropriate variable costs to get (5) the total cost for the activity. This provides a basis for getting a preliminary understanding of how activities in a business consume costs. These techniques are often used in the corporate world and can certainly help with making business decisions more intelligently.

There are, however, some serious problems with this approach to costing. The first serious problem is that costs are calculated *ex post facto*. This is a severe limitation if costs are likely to change over time. It will be a particularly troublesome issue if there will be substantial cost changes during your planning period. Managers can use cost projection adjustments, multiple scenarios, and frequently updated data to reduce distortions and their effects. The second, and more important, fault for those in the radiology field is that the method does not address costs that are used and those that go unused. The latter concept, which is called the *cost of unused capacity*, needs to be differentiated from costs that are used. The cost of unused capacity is a serious problem for industries such

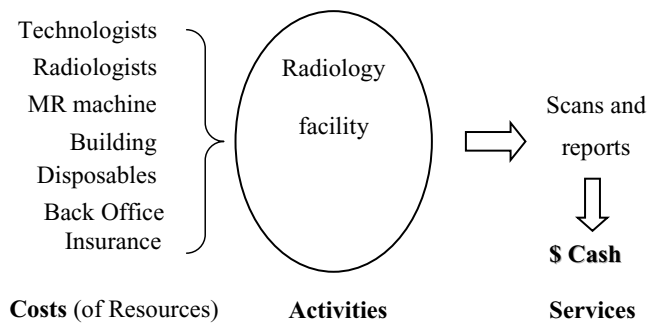


Fig. 3. Activity based costing view of MR services at a radiology facility.

as the hotel or airline industries, in which unused inventory (a room last February in the Palmer House) is lost forever if it goes unsold.

ADDRESSING UNUSED CAPACITY THROUGH SERVICE ACTIVITY COSTING

The problem of unused capacity raises issues that can be addressed through an enhancement of activity-based costing that we have called service activity costing [1]. This approach allows the radiology manager to identify profit-maximizing actions, intelligently price medical services and negotiate contracts, and better understand resource consumption. The key idea is to assign costs to each service provided to provide a clear picture of how your business uses costs. All costs incurred by a facility are allocated to the service(s) provided.

In radiology, the service consists of the scans and reports, the activity is the process of providing the service (everything from scheduling to scanning to reading to charging and reimbursement), and the cost consists of what the facility pays for all its resources—physical equipment, the building, costs, consumables, and so on. Fig. 3 illustrates the major resources of a typical radiology facility and the service it provides.

The basis by which the cost of a particular resource is allocated depends on how the resource is consumed in providing the service. For each type of resource in the center, a *cost driver* is identified. A driver is the basis by which a resource is consumed. For example, a simple driver would be the number of MRI examinations performed. When the service is performed, costs are incurred; i.e., performing an MRI scan drives costs. Clearly, however, not all magnetic resonance examinations are created equal. There are large differences between performing an outpatient shoulder examination and an inpatient abdominal magnetic resonance with contrast, magnetic resonance angiography, and additional sequences on a comatose patient. In general, the

more detailed the cost drivers, the more helpful your analysis will be for making decisions.

For example, a more sophisticated analysis involves understanding how different activities consume the resources in the enterprise. This might lead to using subtypes of magnetic resonance studies as cost drivers or perhaps to using minutes in the scanner as a cost driver. Compared with a combined brain/orbits/magnetic resonance angiography examination, a simple knee study uses fewer scan-related resources: less technologist time and less machine time.

Once you have identified the drivers of costs, you can then consider which costs they consume. Once we differentiate among the types of scans as cost drivers, we can then calculate the cost of the technologist and the machine by the type of scan on the basis of the time required for each type of study. We can then analyze how front office costs (the receptionist, secretary, and so on) are affected by each type of study and whether they vary with the type of scan. By the same token, we can examine whether the structure of back office costs (e.g., billing) is similar to that of front office costs (i.e., independent of or dependent on the type of study). If the type of study really does not matter with those costs, then scan volume may be the appropriate driver to allocate the costs of that resource. In the rest of this article, we will treat the number of magnetic resonance scans as the primary driver for simplicity's sake, but, as discussed previously, other drivers are also possible when you decide to look at a deeper level. In fact, when you perform a sophisticated analysis, you usually find that cost drivers act differently across almost all types of costs and that overhead is only very rarely spread equally across all activities.

AN EXAMPLE OF THE POWER OF SERVICE ACTIVITY COSTING

To illustrate the various concepts, we will expand on the MIA case discussed earlier in this volume. This lets us examine the real costs of producing magnetic resonance scans. The magnetic resonance center owned and operated by the MIA group has a total annual cost of \$1.2 million dollars and a capacity of performing 4500 scans each year. As it happened—and quite unfortunately—it could not fill its capacity and performed only 3600 studies last year. As the manager, you have to calculate what it costs to provide a magnetic resonance scan. With the historical approach, the total cost divided by the number of studies performed yields a per-study (per-driver) cost of \$333.33 (\$1,200,000/3600). However, given the installed capacity and the performance of the site, the cost per possible study (i.e., based on capacity) is \$1,200,000/4500, or just \$266.67 per case. What is going on here? Is

the cost per study \$333.33 or \$266.67? Where is the money really going?

The answer is that the **figure** of \$333.33 per study includes the cost of studies not done, i.e., the cost of the unused imaging capacity. The **figure** of \$266.67 is an accurate accounting **figure** of how much it costs to perform a study according to the potential capacity of the facility and not on how well—or poorly—MIA actually filled the available slots. We can then distinguish between the cost of studies performed and slots that were available but remained unfilled, i.e., unused capacity. The 3600 studies actually performed cost the facility $\$266.67 \times 3600$, i.e., \$960,000. The remainder (\$240,000) is the cost of unused capacity ($\$266.67 \times 900$ studies). In other words, MIA wasted approximately a quarter of a million dollars on slots that it paid for but that remained unfilled. There is a direct analogy with unsold hotel rooms and empty airline seats on a departed flight. There is no way for a hotel to sell a room for last Thursday or, at least, no reason for a rational person to buy it. Similarly, no rational person will pay for a seat on a flight that departed 3 days ago. The same holds for a radiology group: the empty slot at 3:00 pm last Wednesday on Magnetic Resonance Scanner 2 is gone forever. Consequently, a smart costing model needs to take into account what the facility paid for that slot, filled or unfilled. This is much more illuminating than more naive models and avoids some serious pitfalls that threaten the unwary. To summarize,

Service activity costing = used capacity cost
+ unused capacity cost.

In the rest of this article, we illustrate the applicability of service activity costing to executive decision making and to avoiding some common traps and pitfalls in accounting decisions. These include:

1. finding a substitute for a recently defaulted contract,
2. avoiding the death spiral,
3. using productivity improvements to increase capacity,
4. confusing allocated fixed costs (from service activity costing) with marginal costs,
5. using a cost reduction initiative to stake out a position of price leadership, and
6. investing to increase capacity.

FINDING A SUBSTITUTE FOR A RECENTLY DEFAULTED CONTRACT

As the MIA practice manager, you face a new challenge. The Wal-ron contract defaulted, and there are empty slots on the firm's new scanner [16]. Should you accept a new low-ball contract from McHealth Corp. to fill the

empty slots? Is the \$295 per study it is offering an acceptable rate?

You ask your junior partner to estimate the cost of the studies this year. He estimates that at the current rate of business, MIA will perform 4000 studies by the end of the year. On that basis, he calculates your costs as \$1.2 million/4000 studies, or \$300 per study, and tells you that that should be your cost basis in negotiating with McHealth. Is he right or wrong? Remember that, according to your capacity of 4500 annual studies, you had estimated your per-study cost as \$266.67. Does that mean that your costs increased by \$33.33 per patient ($\$300.00 - \266.67) during the course of the year because of the shortfall? Not really. The real phenomenon here is that you will use $4000 \times \$266.67 = \$1,066,640$ of actual resources and will waste $500 \times \$266.67$, or \$133,330, in unused capacity. To summarize, because service activity cost = used capacity cost + unused capacity cost,

$$\begin{aligned} \$1,200,000 &= 4000 \times 266.67 \\ &+ 500 \times 266.67 (\text{within rounding errors}). \end{aligned}$$

Another way to think about this is that poor marketing or poor contracting resulted in a waste of \$133,330. Of course, as you realize, this includes only the loss in expenses to which you are already committed. It does not include the revenue you lost by not performing all those scans.

We still have not resolved the McHealth contract question. Because your cost per study is \$266.67 and McHealth is offering \$295, you should take the contract—as long as you do not think there is an alternative customer who will offer you higher price and there are no compelling reasons beyond the cost basis for the decision.

PITFALLS IN MANAGERIAL ACCOUNTING: THE DEATH SPIRAL

The direct application of the historical method of cost allocation as shown previously leads to one of the worst outcomes of faulty managerial accounting—the death spiral. Imagine that you accepted your junior colleague's analysis instead of the analysis from the service activity costing model. After rejecting the McHealth contract, the practice performs only 4000 scans that year. In pricing future Managed Care Organizational (MCO) contracts, you use the \$300 **figure** and increase your price to cover your costs. Because demand is price sensitive, some of your clients turn to the competition, leaving you with another loss in volume—say, an additional 500 cases per year. Your junior partner analyzes the new data and says that MIA's costs have increased to \$1.2 million/3500 cases, or almost \$350 per slot. If you follow this logic (or lack thereof), you will increase your price yet again and see yet another reduction in volume. Repeat this cycle enough times and you will have

killed your business, even though you were making a profit before you took your junior partner's advice. This death spiral (business is off, so we will just increase prices to cover our costs) is a fairly common reaction, especially among untrained managers. Using service activity costing, conversely, to evaluate costs correctly identifies that there is capacity that the practice is wasting. This lets the manager—you—see what is really going on and helps avoid traps such as the death spiral.

USING PRODUCTIVITY IMPROVEMENTS TO INCREASE CAPACITY

Service activity costing can also help managers evaluate costs as they consider expansion scenarios. On the basis of the death spiral that you barely avoided, you ban your junior partner, now nicknamed Dr. D.S. (for Dr. Death Spiral), from the office and hire a new radiologist who graduated with an MBA from Wharton last year. She suggests that you look at the practical limits of the facility and examine your cost structure when you are going full steam. After comparing your facility with others across the country, it becomes apparent that with minimal modification of your processes, the practical annual capacity achievable—without increasing the stress on the staff, scheduling, and so on—is 5000 scans, while still keeping costs at \$1.2 million. This yields a new cost of \$240 per study slot ($\$1,200,000/5000$). Using the numbers you calculated with the help of your new radiologist, you project your work for the coming year and hire a marketing agency, OutSource Associates, to help fill the additional slots.

Fast-forwarding to the end of the year, the two of you review what happened and determine that the new marketing agency, OutSource Associates, missed the mark, only getting you 4000 filled slots. You ask your new MD/MBA to tell you the cost of performing the scans. She responds that the cost of each scan did not change from the estimate at the start of the year. Instead, there is a cost of unused capacity: $\$240 \times 1000$, the number of slots that remained unfilled. To put that another way, it cost the practice a quarter of a million dollars to not scan those patients. She also reminds you that in addition to the cost of unused capacity, there is the revenue lost because of the unfilled scans. Finally, she points out that this is a marketing problem and that you are also out the not-so-small amount of OutSource's fees.

AVOIDING ANOTHER TRAP: CONFUSING ALLOCATED FIXED COSTS (FROM SERVICE ACTIVITY COSTING) WITH MARGINAL COSTS

Your former junior partner happened to stop by during the last discussion. He later calls you up and says, "Now

I understand. If you perform one more case tomorrow, it will cost you an additional \$240." Is he right? Should you lift the banishment? The answer to the first question is an emphatic no. On the second question, you can probably do better. This \$240 number is not the marginal cost of one more study; it is the appropriate share of the money already spent or at least allocated. If you think of it as buying slots in advance and then either using or wasting them, you are closer to the truth. How would you calculate the marginal cost of an extra procedure? We reviewed the correct method in the "Tools for Managerial Analysis" section. If you do not need to pay people overtime, it is just the cost of electricity, film, contrast (if appropriate), and other consumables. This is probably a rather small number compared with the allocated fixed costs calculated with the help of service activity costing. Technically, what we need to use is the sum of direct variable costs associated with the production of a scan.

USING A COST-REDUCTION INITIATIVE TO STAKE OUT A POSITION OF PRICE LEADERSHIP

Your protégé is on a roll and undertakes on a new initiative, presenting you with a quality-improvement plan that can reduce your costs by 10% and suggesting that MIA pass the savings on to its clients in the form of lower prices. One danger of decreasing prices is that the competition may respond in kind and trigger a price war. Such battles are usually not great ideas and generally end badly. Service activity costing can help you calculate the rational level to which you can decrease your price without adversely affecting your financial health. Alternatively, you could leverage your competitive advantage and let your competitors know that you are better positioned to withstand any price war they might be contemplating.

Getting back to your new pet project, you and the MD/MBA project revised costs of \$1,080,000 ($\$1.2 \text{ million} \times 0.9$) for next year, with a new cost of \$216 per slot. It is important to understand your real costs for both used and unused capacity and to know your lower price limit before you get into this kind of a price war. Although one is rarely a smart idea, thanks to service activity costing, at least you have an accurate base to work from and can understand where your profitability starts (and stops).

USING SERVICE ACTIVITY COSTING TO EVALUATE DECISIONS ABOUT INVESTING TO INCREASE CAPACITY

Returning from the annual Radiological Society of North America meeting, your new radiologist excitedly informs you that for a one-time investment of \$120,000 in software

and reconfiguring the center, MIA can increase capacity to 6000 slots without increasing other fixed costs (coincidentally, this is the amount she saved you with her last initiative). Of course, this brings your cost back to what it before she joined the practice, i.e., \$1.2 million. However, now the center has a capacity of 6000 procedures—an increase of 1500 scans each year. Now your unit cost is \$200 per slot (\$1.2 million/6000). Should you invest the \$120,000? That depends on how effectively you can use the extra capacity. Given the MIA contribution margin (remember the term we introduced the section on “Tools for Managerial Analysis”?), you must use enough of the new capacity to earn sufficient additional net income to recoup the investment, i.e., break even on this project to increase capacity. To recap, if MIA performs 6000 cases, it uses \$1.2 million for used capacity, and wastes none as unused if it performs 5000 cases, it uses \$1,000,000 for used capacity, losing \$200,000 as unused if it performs 4000 cases, it uses \$800,000 for used capacity, losing \$400,000 for unused.

Service activity costing is also a control tool. The costs associated with unused capacity bear on calculating your marginal contribution, which, in turn, affects a host of other issues, such as how much to pay a marketing group to fill unused slots or how to price off-hours scanning. This leads to a final and more general exploration of how service activity costing can help radiology managers make smarter business decisions.

By the end of the next partnership review, your protégé is the youngest partner in your practice’s history. Under your tutelage, she has applied the principles of service activity costing at your center to increase capacity by 33% (from 4500 to 6000 scans a year) and demand (resulting from cost reductions passed on to your customers in the form of lower prices) to the point that you have a significant waiting list for most of your services and are planning substantial expansions on the way to dominating your market: congratulations!

CONCLUSIONS

Managerial accounting uses a variety of tools to make business decisions more rational and more scientific. It is important for radiology managers to know the structure of the costs of a radiology practice: Which are fixed? Which are marginal? How will events, both internal to the organization and external, change them? How can they be controlled?

The service activity costing model helps managers understand the costs of services. It supersedes traditional costing by explicitly considering the costs of both used and unused service capacity. Managers use service activity costing to develop better models of their cost structures, and this in turn will allow more nuanced contract negotiation and evaluation of proposed changes.

GLOSSARY

Break-even point. The point at which a company’s revenues equal its total cost, where there is no short-term profit or loss [17].

Contribution margin,

contribution margin = marginal revenue – marginal cost.

Direct cost. A cost directly attributable to the manufacturing of a product. Opposite of indirect cost [18]. This is particularly important when a firm produces multiple goods or services and is trying to understand which costs go directly to which services.

Fixed cost. A cost that remains constant, regardless of any change in a company’s activity [19], at least in the short term, for a given business design, or over a defined planning horizon.

Indirect cost. A cost that is necessary for the functioning of the organization as a whole but that cannot be directly assigned to one service or product [20].

Marginal cost. The cost associated with one additional unit of production. Also called *incremental cost* [21].

Marginal revenue. The additional revenue added by an additional unit of output, or, in terms of a formula [22],

marginal revenue

$$= (\text{change in total revenue})/(\text{change in sales}).$$

Payback period. This is the time to reach break even:

payback period

$$= \text{break-even point}/\text{procedures performed per period}.$$

Total cost. The sum of all fixed and variable costs for a business at a given level of output.

Variable cost. In general, cost that changes with changes in the quantity of output produced [23].

REFERENCES

1. Seidmann A, Lexa FJ, Mehta T. Measuring the capacity, productivity and costs of service of an MRI center—the service activity costing approach. In: Edelman R, editor. Clinical magnetic resonance imaging. In press.
2. Needles BE, Powers M, Crosson SV. Financial and managerial accounting. 6th ed. Boston, Houghton Mifflin; 2002.
3. Zimmerman J. Accounting for decision making and control. 4th ed. Chicago, Irwin/McGraw Hill; 2003.
4. Kaplan RS. Research opportunities in management accounting. J Manage Accounting Res 1993 Volume 5:1-14.
5. Nisenbaum HL, Birnbaum BA, Myers MM, Grossman TI, Gefter WB, Langlotz CP. The costs of CT procedures in an academic radiology department determined by an activity-based costing (ABC) method. J Comput Assist Tomogr 2000;24:813-23.

6. Enzmann DR, Anglada PM, Haviley C, Venta LA. Providing professional mammography services: financial analysis. *Radiology* 2001;219:467-73.
7. Cooper R, Kaplan RS. Measure costs right: make the right decision. *Harvard Business Rev* 1988;Sept-Oct:96-103.
8. Cooper R, Kaplan RS. Profit priorities from activity-based costing. *Harvard Business Rev* 1991;May-Jun:130-5.
9. Capettini R, Chow CW, McNamee AH. On the need and opportunities for improving costing and cost management in healthcare organizations. *Managerial Finance* 1998;24:46-59.
10. Ruhl JM, Hartman BP. Activity-based costing in the service sector. *Adv Manage Accounting* 1998;6:147-61.
11. Holt T. Developing activity-based management system for the Army Medical Department. *J Health Care Finance* 2001;27:41-9.
12. West TD, West DA. Applying ABC to healthcare. *Strategic Finance* 1997;78:22-33.
13. Player S. Activity based analyses lead to better decision making. *Healthcare Financial Manage* 1998;52:66-78.
14. Kaplan RS, Norton DP. The balanced scorecard: translating strategy into action. *Harvard College*; 1996.
15. Laurila J, Suramo I, Brommels M, et al. Activity-based costing in radiology: application in a pediatric radiological unit. *Acta Radiol* 2000;41:189-95.
16. Lexa FJ, Berlin JW. First Principles for Financial Modeling in Medicine. *JACR* 2005;2:220-224.
17. Available at: http://www.ism-knowledgecenter.ws/kc/glossary/g_def.asp?ident=ngl00055. Accessed August 9, 2004.
18. Available at: http://www.investorwords.com/1443/direct_cost.html. Accessed August 9, 2004.
19. Available at: <http://www.investopedia.com/terms/f/fixedcost.asp>. Accessed August 9, 2004.
20. Web definition from Google August 9, 2004; original source, <http://scd.das.state.or.us/oam/scdpolicy/definitions.htm>.
21. Available at: http://www.investorwords.com/2948/marginal_cost.html. Accessed August 9, 2004.
22. Available at: <http://ingrimayne.saintjoe.edu/econ/elasticity/RevEtDemand.html>. August 9, 2004.
23. Available at: <http://www.amosweb.com/cgi-bin/gls.pl?fcd=dsp&key=variable+cost> Accessed August 9, 2004.