David W. Young

what does an MRI scan cost?

AT A GLANCE

- Historically, hospital departments have computed the costs of individual tests or procedures using the ratio of cost to charges (RCC) method, which can produce inaccurate results.
- To determine a more accurate cost of a test or procedure, the activity-based costing (ABC) method must be used.
- Accurate cost calculations will ensure reliable information about the profitability of a hospital's DRGs.

As the U.S. healthcare system evolves under the Affordable Care Act, providers can be expected to assume increasing amounts of risk in the delivery of care. The formation of accountable care organizations (ACOs), the use of bundled prices, penalties for avoidable hospital readmissions, and the movement toward sub-capitation will change the risk profiles of both hospitals and their attending physicians. Laboratories and departments of radiology, which historically have been able to operate somewhat independently, will need to become more fully integrated into a hospital's overall operations. Rather than bill separately for distinct tests and procedures, hospitals must incorporate the cost of these services into the total costs they incur for a discharged patient under either a DRG-based or other risk-based payment system. If it does not compute these costs accurately, the hospital will have misleading information about the profitability of its DRGs.

One question that is bound to emerge as this transformation takes place is how hospitals should compute the cost of the tests and procedures administered by laboratories and radiology departments. Hospitals historically have computed the cost of these services by using a ratio of cost to charges (RCC), but such an approach provides reasonably accurate information only when patients are grouped into service lines or DRGs.[a] The process does not approximate the cost of an individual test or procedure (e.g., a blood test, a chest X-ray, a magnetic resonance imaging [MRI] scan).[b] As a result, services provided by laboratories and departments of radiology are particularly susceptible to the misleading cost information that emerges from use of an RCC approach. For example, in a laboratory, an RCC approach does not address the fact that continuous quality control testing, which can eat up consumables, makes the cost per test fluctuate greatly based on volume. Thus, these departments require more accurate information if they are to play an active role in their hospital's cost containment strategy.

To determine the full cost of each of its tests or procedures, a laboratory or radiology department needs to employ a technique known as activity-based costing (ABC).[c] An ABC methodology is necessary if the department is to attach its non-direct costs,

a. Shwartz, M., Young, D.W., and Seigrist, R., "The Ratio of Costs to Charges: How Good a Basis for Estimating Costs," *Inquiry*, Fall, 1995.
b. Young, D.W., "On the Folly of Using RCCs and RVUs for Intermediate Product Costing," *hfm*, April, 2007.
c. Kaplan, R.S., and Anderson, S.R., *Time-Driven Activity-Based Costing: A Simpler and More Powerful Push to Higher Profits*, Boston: Harvard Business School Press, 2007.

including departmental and allocated overhead, to each of its procedures. To understand why this is so, let's use the example of an MRI scan.

A radiology department incurs three categories of costs in providing an MRI scan: *direct costs*, such as the time of the technician who conducts the procedure and any disposables used by the patient; *departmental overhead*, such as the department's administrative salaries; and *allocated overhead*, or the department's share of hospital-wide expenses (e.g., housekeeping and maintenance), calculated on the basis of certain predetermined metrics (such as square feet). The ABC process takes all three categories into account.

To illustrate the distinction between an RCC and an ABC methodology, consider the hypothetical example of Owen Hospital for which a simplified full-cost report for one year is shown in the exhibit below. As the exhibit indicates, the radiology department had $1.75 million in direct costs. These costs include those that are easily traceable to the department, such as technician and administrative salaries, machine depreciation, the cost of medical and administrative supplies, and expenditures for purchased services. Some of these costs, such as technician salaries and medical supplies, can be traced easily to an individual procedure, but others, such as administrative salaries, cannot.

The exhibit also shows that $688,321 was allocated to the radiology department, representing the department's share of the hospital's service center expenses—for example, hospital building's depreciation totaled $1.2 million, of which radiology's share, based on its square feet of space, was $140,000; building maintenance totaled $1.055 million, of which radiology's share, based on maintenance hours, was $147,700; housekeeping totaled $454,555, of which radiology's share was $64,300; and administration

OWEN HOSPITAL: ABBREVIATED HOSPITAL COST REPORT

	1 Direct Costs	2 Allocated Costs*	3 Costs to Be Allocated†	4 Depreciation (Sq. Ft.)	5 Main-tenance (Hours)	6 House-keeping (Sq. Ft.)	7 Administrative and General (Salary)	8 Full Cost‡
Support Centers								
Building Depreciation	$1,200,000	–	$1,200,000	–	–	–	–	–
Building Maintenance	$950,000	$105,000	$1,055,000	$105,000	–	–	–	–
Housekeeping Services	$300,000	$154,555	$454,555	$95,000	$59,555	–	–	–
Admin & General	$1,300,000	$381,605	$1,681,605	$156,000	$158,250	$67,355	–	–
Mission Center								
Radiology	$1,750,000	$688,321	–	$140,000	$147,700	$64,300	$336,321	$2,438,321
Laboratory	$2,000,000	$788,814	–	$160,000	$172,545	$69,500	$386,769	$2,788,814
Dialysis Unit	$1,250,000	$423,930	–	$50,000	$116,050	$22,455	$235,425	$1,673,930
Inpatient Care	$7,000,000	$959,723	–	$350,000	$158,250	$165,600	$285,873	$7,959,723
Outpatient Department	$2,250,000	$889,212	–	$144,000	$242,650	$65,345	$437,217	$3,139,212
Total Cost	$18,000,000	–	–	$1,200,000	$1,055,000	$454,555	$1,681,605	$18,000,000

* Allocated Costs = Sum of Columns 4, 5, 6, and 7.
† Costs to Be Allocated = Sum of Columns 1 and 2.
‡ Full Cost = Sum of Columns 1 and 2.

FIRST STEP IN THE ABC ANALYSIS

Radiology	Labor and Material Cost/Unit	Number of Units	Percentage of Space Occupied	Percentage of Maintenance Hours	Percentage of Salary Dollars	Department Administrative Costs
Chest X-Ray	$40.00	25,000	40%	20%	80%	
MRI Scan	$70.00	5,000	60%	80%	20%	
Total		30,000				$400,000

and general totaled $1,681,605, of which radiology's share was $336,321.

To receive Medicare payments, all hospitals must prepare a similar report each year. The actual report for any given hospital is much more extensive and complex than this, but the basic structure is the same for all hospitals.

There are many debatable elements in the report, such as the bases of allocation and the stepdown sequence, but a department of radiology (or any other hospital mission center) will not be able to exert much, if any, influence over these elements. The department most likely must accept the costs that are allocated to it. In the case of Owen Hospital, this means the total cost to maintain and run the radiology department is $2,438,321 ($1.75 million of direct costs plus $688,321 of allocated costs). The more important challenge is to find a way to attach a portion of this total to each of the procedures that took place in the department during the time period in question. This is where ABC can be helpful.

Assume that the radiology department conducted only two types of procedures during this time period: simple chest X-rays and MRI scans. In practice, of course, the mix of procedures in a radiology department would be more extensive. Nevertheless, this information can be used to illustrate how ABC can affect a department's knowledge of its costs, as shown in the exhibit above. For this example, the labor and material costs per procedure were $40 for a chest X-ray and $70 for an MRI scan. (Actual labor and material costs would be relatively easy to determine with time and motion studies.)

In the example, the department conducted 25,000 chest x-rays and 5,000 MRIs during the time period studied. The chest x-ray unit and the MRI unit occupied 40 percent and 60 percent of the department's space, respectively. The chest x-ray equipment required 20 percent of the department's maintenance hours, and the MRI equipment required 80 percent. Analysts further determined that 80 percent of the department's total administrative costs of $400,000 was associated with chest x-rays and 20 percent with MRIs.

Assume now that the hospital is using an RCC approach to determine its per unit costs, the charge for a chest x-ray is $300, and the charge for an MRI scan is $2,000. As the exhibit on the below indicates, the RCC-based cost would be $41.80 for the chest x-ray and $278.67 for the MRI. Given that total charges were $17.5 million and total costs (from the exhibit on page 47) were $2,438,321, the ratio of costs to charges is 0.139.

COMPUTING COST PER PROCEDURE USING THE RATIO OF COST TO CHARGES (RCC) METHOD

Radiology	Charge per Unit	Number of Units	Total Charges	Total Costs (from Cost Report)	RCC	RCC-Based Cost
Chest X-Ray	$300	25,000	$7,500,000			$41.80
MRI Scan	$2,000	5,000	10,000,000			$278.67
Total		30,000	$17,500,000	$2,438,321	0.139	

OWEN HOSPITAL: COMPUTING FULL COST PER UNIT USING AN ABC APPROACH

Radiology	1 Labor and Material Cost/Unit*	2 Number of Units*	3 Directly Attachable Direct Cost†	4 Department Administrative Cost‡	5 Percentage of Space*	6 Depreciation Cost§	7 Housekeeping Cost#
Chest X-Ray	$40.00	25,000	$1,000,000	$333,333	40%	$56,000	$25,720
MRI Scan	$70.00	5,000	350,000	66,667	60%	84,000	38,580
Total		30,000	$1,350,000	$400,000		$140,000	$64,300

Radiology	8 Percentage of Maintenance Hours*	9 Maintenance Cost¶	10 Percentage of Salary Dollars*	11 Administrative and General Cost**	12 Total Cost††	13 Cost per Unit‡‡
Chest X-Ray	20%	$29,540	80%	$269,057	$1,713,650	$68.55
MRI Scan	80%	118,160	20%	67,264	724,671	$144.93
Total		$147,700		$336,321	$2,438,321	

* Numbers in Columns 1, 2, 5, 8, and 10 are based on the first step in the ABC analysis, as shown in the exhibit at the top of page 48.
† Directly Attachable Direct Cost = Column 1 × Column 2
‡Total Department Administrative Cost, as shown in the exhibit at the top of page 48, is divided between the two types of procedures based on the proportion of units. Because MRI scans represented only 16.7 percent of total procedures, 16.7 percent of the $400,000 was allocated to this type of procedure—i.e., $66,667.
§Allocated Depreciation Cost of $140,000 (as shown in the sample cost report) is distributed between the two types of procedures based on percentage of space.
#Allocated Housekeeping Cost of $64,300 is also distributed based on percentage of space.
¶Allocated Maintenace Cost of $147,700 is distributed based on percentage of maintenance hours.
**Allocated Administrative and General Cost of $336,321 is distributed based on percentage of salary dollars.
††Total Cost = sum of Columns 3, 4, 6, 7, 9, and 11.
‡‡The Cost per Unit (i.e., full cost per procedure) = Column 12 ÷ Column 2.

Now, let's apply an ABC approach to the cost computations. The approach is shown in the exhibit above. We now can compare the cost per procedure based on the RCC approach with that of an ABC approach. Compared with the RCC-based cost, the ABC-based cost was 64 percent higher for chest X-rays and 48 percent lower for MRI scans.

Of course, there is no guarantee that the numbers will always move in the same direction or by the same magnitude as those shown above. Rather, this simplified example shows that an RCC-based approach to costing of individual procedures in a radiology department can produce misleading results.

In other industries, ABC has led to a complete rethinking of an organization's pricing structure.[d] In an era in health care where cost control has become strategically important, an organization must fully understand its costs, either because those costs will affect pricing decisions or because they will reveal profitability conclusions that differ from traditional assumptions.

Clearly, ABC is more complex to implement than shown here, but it can be and has been successfully used in other industries and in some healthcare organizations.[e] The effort to establish an ABC system can be lengthy and expensive, but once established, the system can be maintained with little effort. Most important, it is a key consideration for hospitals that wish to succeed in an era of increasing buyer sensitivity to costs. It allows a hospital to either price a service more accurately or understand more clearly where it is making or losing money on its service that receive DRG-based payments. ■

d. Cooper, R., and Kaplan, R.S., *Cost and Effect: Using Integrated Cost Systems to Drive Profitability and Performance*, Boston: Harvard Business School Press, 1998. (See especially the chapter titled "ABC in Service Industries.")

e. Pandey, S., "Applying the ABCs in a Provider Organization," *hfm*, November 2012.

David W. Young, DBA, is professor emeritus, Boston University; president and CEO, The Crimson Group, Inc., Cambridge, Mass.; and a member of HFMA's Massachusetts/Rhode Island Chapter (David@DavidYoung.org).