On the need and opportunities for improving Costing and cost Management in Healthcare Organizations

by Robert Capettini, Price Waterhouse Alumni Professor, San Diego State University, Chee W. Chow, Vern Odmark Professor, San Diego State University and Alan H. McNamee, Associate Professor, Lyon College

I. Introduction

One of the key challenges to the continued viability of hospitals is the development of relevant and accurate cost information on which to base strategic, pricing, and management decisions. Recently, with the inception of prospective payment plans (such as Medicare DRG based payments) hospitals have focused more on the different levels of costs required to service different categories of diagnoses. Better cost systems are particularly important for hospitals because of the nature of their cost structures. The rapid advances in medical technology over the past twenty-five years have led to organizations with an extremely high percentage of fixed costs and little flexibility to decrease costs when output volume decreases. In addition, prospective payment systems and capitation agreements have placed greater emphasis on reducing throughput time (length of stay) across categories of diagnoses. Thus, the strategic acquisition of patients within the capacity and mix parameters of the facility are of extreme importance, and planning and management of utilization have become key success factors.

Accurate cost information on individual lines of service is needed if a hospital is to know what mix of services to emphasize, where costs may be better managed, and how to successfully bid on business from insurers, managed care programs and employer groups. Activity-Based Costing, or ABC is a method which can help hospitals more accurately understand their costs and help avoid suboptimal and often disastrous decisions about prices, product mix and planning and control. In this paper, we will first briefly discuss the activity based costing approach. Then, we will present the results of a survey of hospital administrators on hospitals' cost hierarchy, and use the survey findings to illustrate the potential benefit of activity based costing. We also will present findings on the symptoms of cost systems not giving hospital managers useful information with which to make sound strategic decisions. Finally, we point out how activity based costing information can be used to make better strategic decisions in hospitals.

II. What is Activity-based Costing

Several articles (e.g., Chan, 1993; Chaffman, and Talbot, 1990; Harr, 1990; Helmi and Tanju, 1991; Rotch, 1990) have recently advocated the use of activity based costing by service organizations in general and healthcare organizations in particular. The core idea behind ABC is that the production of a product or service generates ACTIVITIES which consume RESOURCES. So, the way to better understand the

cost of a unit of service output is to focus on the ACTIVITIES.necessary to produce the service and then to identify the costs incurred by these activities.

For example, the cost of one unit of nursing service can be misallocated to various services provided if different types of nursing activities are not considered and if total patient-days (a volume driven output measure) is used as an allocation base without adjusting for patient acuity levels. Helmi and Tanju (1991) compare traditional costing, which typically uses volume-related bases (e.g., patient-days, number of tests) to allocate costs, with an activity based approach for a nursing unit. They illustrate the impact of considering three types of activities (Supervision, Delivering nursing care and Changing linens & garments) when allocating the cost of a nursing station to three categories of patients (determined by the frequency of care required). Their example demonstrates that unless types of activities and their relative consumption of resources are considered, the less acute patients with *average service demands* on the nursing station are subsidizing the higher acuity patients with *high service demands* on the nursing station. Thus, the patients which require more nursing care appear less costly to service than is really so. This cross-subsidization among service lines is often hidden in a traditional, volume based costing system and can impact cost finding, rate setting and reimbursement. The potential for such biased costing in healthcare organizations is high, as traditionally, such organizations have not traced their costs to activities. Rather, healthcare providers generally classify costs based on a functional or departmental view of the organization. Costs are generally accumulated by Nursing service units, ICU, CCU, Obstetrics, OR, ER, Pharmacy, Laboratory, Radiology, Laundry, Housekeeping, Patient accounting, General Administration etc.

III. Alternative Approaches to Classification of Activities

Cooper's (1990) recent field research in the manufacturing industry identifies conditions which favor ABC systems. Companies which face (1) intensive competition, (2) sell a highly diverse mix of products, and (3) have high levels of non-unit-level activities (i.e., activities used by more than one type of service) find that the benefits of these more complex cost systems outweigh the additional costs caused by their increased complexity. We believe that hospitals face the same type of business environment and are good candidates for activity based costing. Cooper reports that managers associate three major benefits with the categorizing of activities in an ABC system:

1. Improved decision making due to more accurate product costs.

2. Improved insights into managing the activities which lead to fixed costs.

3. Easier access to relevant costs for a wider range of decisions.

In considering the potential categories of activities on which to base an ABC system, Cooper proposes the following cost hierarchy. We have added examples of these activities in a hospital setting.

1. ***Unit-Level Activities.*** These are activities which are performed *each time a unit of service is provided* (i.e., the activities increase as the num-

ber of units of service increases). An example of this type of activity would be variable utility costs, or the inspection of every (or every 10th) lab test. Unit-level costs are consumed in direct proportion to the number of units of service produced.

2. ***Batch-Level Activities.*** These are activities which are performed *each time a batch of services is provided* (i.e., the activities increase as the number of batches of services increases). The activity is the same whether we run a batch of 10 units, or 100 units, or 1,000 units. An example of this type of activity would be the set up required for a run (or a batch) of a particular type of lab test, or the set up required for a surgical procedure, or preparing a work order for a number of lab tests. Batch-level costs vary according to the number of batches made, but are common (or fixed) for all the units in a batch.

3. ***Service-Sustaining Activities.*** These are activities which are performed as needed to support the production of *each different type of service*. Inputs are consumed to sustain the ability to produce individual services, regardless of whether such services are provided in a given period. An example of this type of activity would be the administrative effort needed to design and maintain the required steps necessary to perform a particular lab test at a certain level of quality, or developing special testing routines, or keeping current the list of suppliers. Service-sustaining costs can be assigned to individual services, but their total amounts are independent (i.e., fixed) regardless of the number of batches or the number of units of each service produced.

4. ***Facility-Sustaining Activities.*** These are activities which *support a facility's general service providing process* (i.e., its infrastructure). The level of use of these activities is unrelated to the number of individual services provided, the number of batches run, or the number of different services which can be provided. Examples of this type of activity would be general management, landscaping, insurance, security, facilities maintenance, accounting, and personnel.

Activity based costing systems classify costs more precisely than traditional costing systems. The first three categories (unit-level, batch-level, and service-sustaining) contain costs which can be directly assigned to individual services by means of activity drivers. By identifying the appropriate activity drivers for these three types of costs, the resulting cost figures can better capture the underlying economics of a contemporary service process. The last category, facility-sustaining activities, contains costs which are common to a variety of services (i.e., general overhead). Therefore, facility-sustaining activities can be treated by either NOT allocating their costs to the services or by allocating their costs to the services in some arbitrary manner. Some think that the allocation of such general overhead adds no information about the economics of the service process. But, others (see Zimmerman, 1979) feel that the allocations can benefit the organization by reminding managers that each service needs to cover some of these general overhead costs.

IV. While ABC Can Make a Difference, Does It?

Although Helmi and Tanju (1991) and others (e.g., Chan, 1993; Chaffman, and Talbot, 1990; Harr, 1990; Rotch, 1990) have discussed the general concept of Activity Based Costing and illustrated how it can make a difference in healthcare organizations, previous articles have not shown that the size of non-volume based costs are big enough in healthcare organizations for traditional costing methods to yield biased information. Nor have prior studies investigated how the non-volume based costs are distributed over the various categories (i.e., batch-level costs, service-sustaining costs, and facility-sustaining costs). One objective of our study is to provide such an investigation. We then use the findings of our investigation to demonstrate how activity based allocations can yield less biased (i.e., more accurate) cost estimates compared to traditional volume based allocations. In addition, we demonstrate how activity based cost allocations can improve cost management.

We distributed a short questionnaire to department managers who have a wide range of decision making authority at three large metropolitan hospitals. The questionnaire asked department managers of both clinical and ancillary departments to focus on their departmental costs. First, we asked them to distribute 100 points between two categories of cost; 1) both Direct Materials and Labor, and 2) all other General Operating Costs of the department (including overhead allocated to their department).

Next, we asked them to consider only the department's General Operating Costs (category 2 above; i.e., operating expenses directly incurred by the department plus organizational overhead allocated to their department, but *not* direct materials or labor). Managers were asked to distribute 100 points to reflect their best estimate of how their department's General Operating Costs are distributed among the following four types of activities:

A. **Activities to support the production of a unit of output of a particular service** (i.e., Unit-Level Activities).

B. **Activities to support the production of a batch of a particular service** (i.e., Batch-Level Activities).

C. **Activities to sustain the department's ability to perform a particular service.** (i.e., Service-Sustaining Activities).

D. **Department sustaining activities.** (i.e., Facility-Sustaining Activities).

Fifty-two responses were received from a total of 90 questionnaires which were distributed (a response rate of 57.8%). Five returned questionnaires were eliminated from the sample due to incomplete responses and/or points not summing to 100. Thus, there were forty-seven usable responses. These were distributed quite evenly across the three hospitals (36%, 34% and 30%). The survey results are summarized in Exhibit 1.

EXHIBIT 1
Summary of Questionnaire Findings

	Mean	*Median*	*Mode*	*Std. Dev.*	*Range*
Considering total dept. costs, number of points out of 100, which were distributed to each of two categories:					
Direct materials and labor	80.1	80	80	13.95	10-99
All other general operating costs	19.9	20	20	13.95	1-90
Considering only general operating costs, number of points out of 100, distributed among four types of activities:					
Department sustaining activities	34.3	30	20	21.4	0-80
Activities to sustain department's ability to perform a **particular service**	23.2	20	10	13.5	5-60
Activities to support the production of a **batch** of a particular service	20.9	20	30	14.4	0-80
Activities to support the production of a **unit** of output of a particular service	21.6	20	10	14.3	0-70

In answering our first question, respondents estimated that, on average, 80% of total departmental operating costs were direct materials and labor, and 20% were other operating costs. Of the latter, perceptions are that, on average: 1) thirty-four percent are related to department sustaining activities, 2) twenty-three percent are related to activities to sustain the department's ability to perform a particular service, 3) twenty-one percent are related to activities to support the production of a **batch** of a particular service, and 4) twenty-two percent are related to activities to support the production of a **unit** of output of a particular service. As can be seen from Exhibit 1, there was a wide range of responses, and the variance of the responses was large.

V. Example

The example below uses the mean cost distributions from our survey (see Exhibit 1) and some example data (see Exhibits 2-4) to demonstrate how the use of unit-level, batch-level, service-sustaining, and facility-sustaining activities can improve costing accuracy. We assume a Radiology Department with two lines of service: (1) X-rays and (2) MRI scans. We assume that the total amount invested in equipment in the Radiology Department is equally split between X-rays and MRI. Exhibit 2 supplies information on two types of overhead costs: (a) directly assignable overhead costs: these are equipment costs which can be traced directly to each line of service based upon machine hours (MH) used, and (b) overhead costs which are allocated to each

procedure based upon the hospital's selection of a cost driver or a set of cost drivers: setup costs, maintenance costs, supply processing and distribution costs, department clerical support costs, and general administrative overhead costs.

EXHIBIT 2
Total Overhead To Be Assigned To Each Radiology Procedure

Directly Assignable Overhead		
Equipment Costs (5,147.5 machine hours @ $100/machine hour)		$541,750
Allocated Overhead		
Setup	$28,600	
Maintenance	20,000	
Supply Processing & Distribution	50,000	
Department Clerical Support	25,000	
General Administrative Overhead	10,000	133,600
TOTAL OVERHEAD		$675,350

EXHIBIT 3
Basic Service Information

	X-Ray	*MRI Scan*
Volume in units per year	25,000	5,000
Number of runs or setups per year	360	5,000
Material cost per unit: 1 film @ $10 2 components @ $25	$10/unit	$50/unit
Labor cost at $20 per hour:		
Setup labor	.5 labor hour/run	.25 labor hour/run
Direct labor	.1 labor hour/unit	1.0 labor hour/unit
Machine usage at $100 per hour	.0167 machine hour/unit	1.0 machine hour/unit

Exhibit 3 lists some basic information for each service, such as volume of service per year in units, number of runs or setups per year, material cost per unit of service, labor cost for setting up the equipment for a run, labor cost for delivering a unit of service, and machine hour usage per unit of service. Finally, Exhibit 4 details the overhead transactions workload relationships, such as that each component is processed once per run, that maintenance is a function of machine hour usage, that clerical support is a function of its labor hours worked, and that general overhead is a function of total units of service.

Our example assigns the same total costs to the two services using (a) a traditional costing approach and (b) an activity based costing approach based on Cooper's cost hierarchies. Both approaches use the same allocations of material and direct labor

EXHIBIT 4 Overhead Transactions Workload		
	X-Ray	*MRI Scan*
Supply Processing and Distribution: Process each component once per run	360	10,000
Maintenance: $100 per machine hour	.0167 machine hour/unit	1.0 machine hour/unit
Department Clerical Support	2,858.3 labor hours	1,141.7 labor hours
General Overhead:	25,000 units	5,000 units

costs to X-Rays and MRI scans. Both charge each of the two services with the standard cost of materials. In our example, this means that each X-Ray is costed at $10 for the film while each MRI scan is charged at $25 for each of the two component materials for a total of $50 per scan (see Exhibit 3). Also, both costing approaches charge each of the two services with the standard cost of direct labor. In our example, this means that each X-Ray takes a standard of six minutes (.1 of an hour) at a labor rate (which includes benefits) of $20 per hour for a total standard cost of $2.00 per X-Ray. Each MRI scan takes a standard of one hour at a labor rate (which includes benefits) of $20 per hour for a total standard cost of $20.00 per MRI scan (see Exhibit 3).

EXHIBIT 5 Allocation Based on a Traditional Costing Approach		
	X-Ray	*MRI Scan*
Raw Material 1 film @ $10 2 Components @ $25	$10.00	$ 50.00
Direct Labor: ($20)(.1 hour/unit) ($20)(1 hour/unit)	2.00	20.00
Overhead (based on Direct labor cost)	9.00	90.05
Total cost per unit	$21.00	160.05
Overhead Rate = Total Overhead Cost/Total Direct Labor Cost Total Overhead Cost = $675,350 (see Exhibit 2) Total Direct Labor Cost = $150,000 (from Exhibit 3): for X-Ray: ($20)(.1 hr./unit)(25,000 units) = for MRI Scan: ($20)(1 hr./unit)(5,000 units) = Total		$ 50,000 100,000 $150,000
Overhead Rate = $675,350/$150,000 = $4.5023 per Direct Labor dollar		

Exhibit 5 shows the details of the costs assigned to the X-Rays and MRI scans using a traditional costing approach, with all of the $675,350 of overhead assigned to the two services based upon direct labor costs. Figure 1 illustrates how the traditional costing approach makes the allocation of costs to each X-Ray and MRI scan. The figure shows, in the middle of the diagram, the cost per unit of service (an X-Ray or an MRI scan) as the object to which the hospital assigns the costs. As Exhibit 5 shows, this traditional allocation of overhead assigns all overhead costs to the services based on their use of one volume based measure — direct labor dollars. The total cost per X-Ray is $21.00 and the total cost per MRI scan is $160.05.

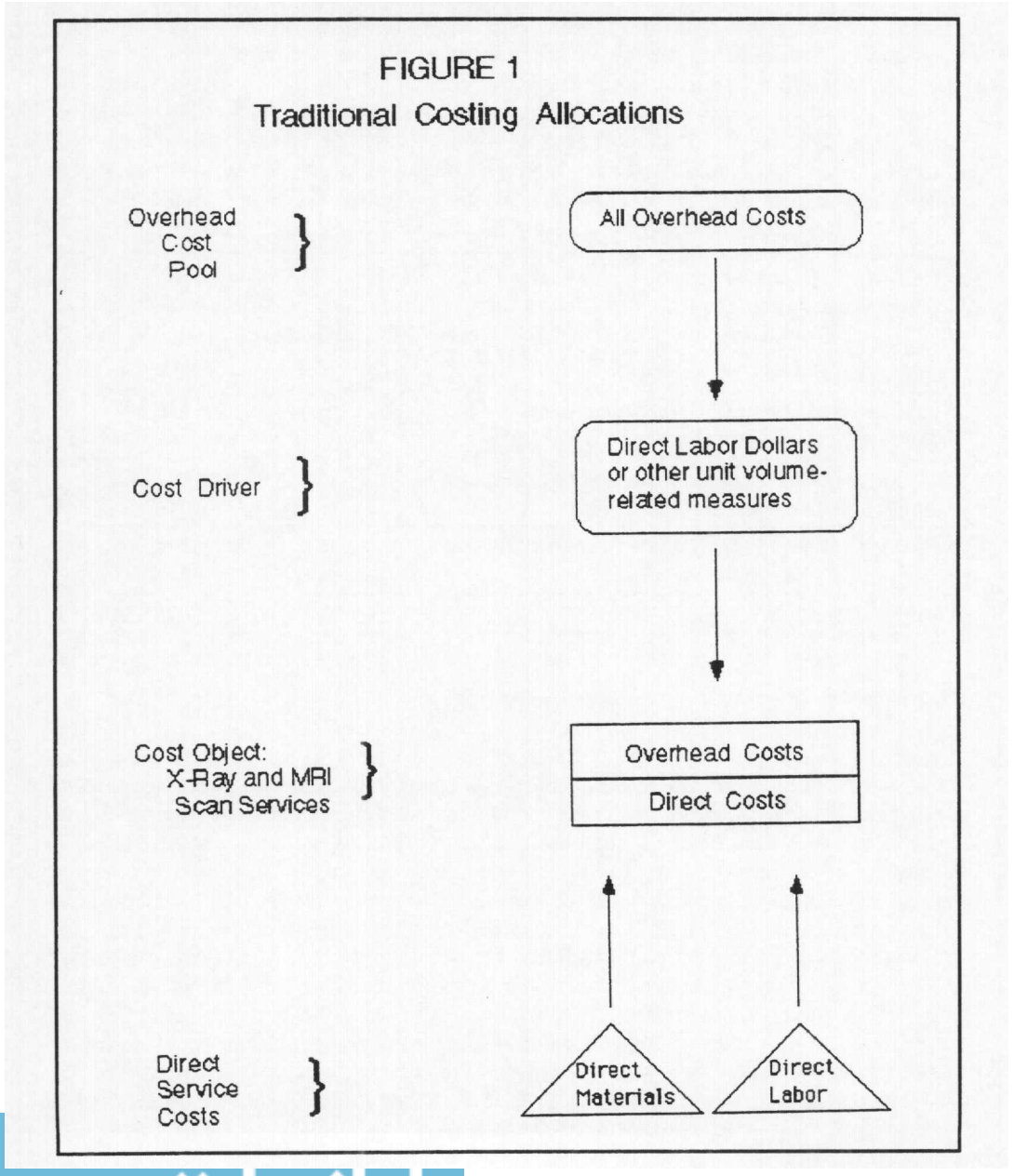

Exhibit 6 shows how the same $675,350 of overhead costs are assigned to the four different levels of cost hierarchy using the percentages obtained from our survey. The details of the costs assigned to the X-Rays and MRI scans using the cost hierarchy approach, with separate allocations of costs for department sustaining activities, activities to sustain the department's ability to perform a particular service, activities to support the production of a batch of a particular service, and activities to support the production of a unit of output of a particular service, are shown in Exhibit 7. Figure 2 illustrates how the ABC hierarchy costing approach makes the allocation of costs to each X-Ray and MRI scan. The figure shows, in the middle of the diagram, the cost per unit of service (an X-Ray or an MRI scan) as the object to which the hospital assigns the costs. As Exhibit 7 shows, the hierarchy approach allocates the total overhead costs as follows: the cost of facility-sustaining activities is allocated based upon the relative cost of the equipment, the cost of service-sustaining activities is allocated based upon the relative hours of clerical support required, the cost of batch-level activities is allocated based upon the relative setup time, and the cost of unit-level activities is allocated based upon direct labor hours. When these costs are added, they result in unit costs of $23.76 per X-Ray and $146.23 per MRI scan.

EXHIBIT 6
Percentages Obtained from our Survey for Cooper's Cost Hierarchies which are Applied to the $675,350 Total Overhead for the Department

Department Sustaining Activities	@ 34.3% = $231,645
Activities to Sustain the Department's Ability to Perform a Particular Service	@ 23.2% = 156,681
Activities to Support the Production of a Batch of a Particular Service	@ 20.9% = 141,148
Activities to Support the Production of a Unit of Output of a Particular Service	@ 21.6% = 145,876
Total Overhead	$675,350

VI. Is This Real or Just Academic Imaginings?

While our example above has shown that ABC can substantially change a healthcare organization's understanding of its costs, the question still may remain whether there really is a major deficiency in current hospital accounting systems. Cooper (1989) suggested a number of symptoms which are manifestations of an outdated costing system. In our survey, we also asked department managers how frequently in the past three years they or their staff had experienced nine different possible symptoms of outdated costing systems. The distribution of their responses is displayed in Exhibit 8. The results show that across the nine symptoms, about 23% to 90% of the respondents thought this occurred from occasionally to constantly. Further, from about 3% to 55% of the respondents thought that particular symptoms occurred from frequently to constantly. These findings strongly suggest that there are limitations to the hospital costing systems currently used and that there is a need to seriously consider installing ABC systems in hospitals.

EXHIBIT 7 ABC Allocations Based on Cooper's Cost Hierarchies		
	X-Ray	*MRI Scan*
Facility-Sustaining Activities: Based on relative equipment cost: (50%)($231,645)/25,000 (50%)($231,645)/5,000	$4.62	$23.16
Service-Sustaining Activities: Based on hours of clerical support required:	4.48	8.94
Batch-Level Activities: Based on setup time:	.71	24.68
Unit-level Activities: Based on direct labor hours:	1.95	19.45
Total Overhead per unit	$11.76	$76.23
Raw Material:	10.00	50.00
Direct Labor:	2.00	20.00
Total Cost per unit	$23.76	**$146.23**
Department's Ability to Perform a Service: for X-Rays [($156,681)(2,858.3 hours)/(4,000)]/25,000 units = $4.48 for MRI Scans: [($156,681)(1,141.7 hours)/(4,000)]/5,000 units = $8.94		
Production of a Batch of Service: for X-Rays [($141,148)(180 hours)/(1,430)]/25,000 units = $.71 for MRI Scans: [($141,148)(1,250 hours)/(1,430)]/5,000 units = $24.68		
Production of a Unit of Service: for X-Rays [($145,876)(2,500 hours)/(7,500)]/25,000 units = $1.95 for MRI Scans: [($145,876)(5,000 hours)/(7,500)]/5,000 units = $19.45		

VII. Toward Activity Based Management

Once an activity based cost system is in place, it can provide the basis for benefits beyond just the costing of services and related pricing and product mix decisions. Healthcare organizations also can use the information provided by an activity based costing system to improve organizational profitability. Turney (1992) points out that the "real key to success is putting ABC information to work is to identify appropriate strategies, improve product design and remove waste from operating activities".

Healthcare organizations often have little control over the pricing and mix decisions mentioned above. Hospitals tend to be price takers in providing Medicare services. In addition, many providers are required (for various reasons) to accept a wide variety of patients. In these situations an approach to becoming more efficient and effective is to use the activity focus of the ABC system to *manage ACTIVITIES* (instead of costs) which vary for different levels of service. Thus, the key is to use the information produced from Activity Based Costing to identify the activities (the cost drivers) which cause the overhead costs at the various levels of the cost hierarchy

FIGURE 2

Activity Based Costing Allocations

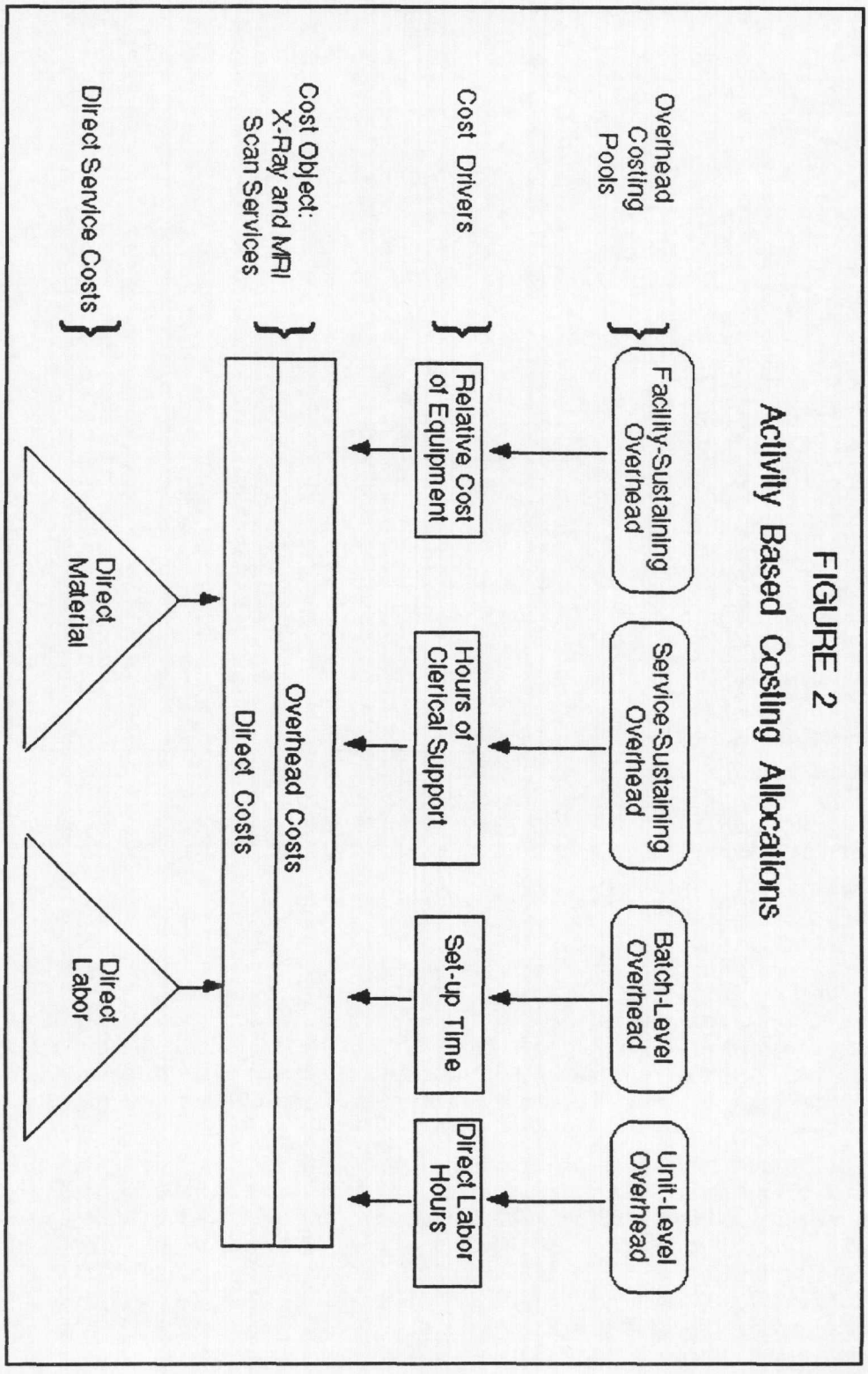

Exhibit 8*
Frequencies of Occurrence for Symptoms of
Outdated Product Costing Systems**

	Never	Occasionally	Periodically	Frequently	Constantly	Mean Response***
Wanting to drop products or services which the accounting system identifies as having a favorable revenue to cost ratio	77%	18%	2%	3%	0%	1.31
Finding it hard to understand or explain some services' reported costs	10%	30%	21%	31%	8%	2.96
Finding that the accounting system shows hard-to-perform functions to be less costly than you believe they are	23%	17%	28%	19%	13%	2.81
Finding that few other healthcare organizations in your area are offering services which your hospital's accounting system shows to have a favorable revenue to cost ratio	52%	35%	10%	3%	0%	1.65
Finding the charges of other healthcare organizations in your area for high volume services or procedures to appear unrealistically low	29%	44%	15%	6%	6%	2.15
Finding that suppliers are submitting bids to perform services at considerably lower prices than expected	28%	40%	16%	16%	0%	2.21
Requesting the accounting department to conduct special studies	8%	49%	19%	20%	4%	2.63
Using your own cost accounting system (separate from your hospital's official system) for decision making purposes	19%	23%	16%	19%	23%	3.04
Finding that, holding demographic factors constant, the volume of patients for particular services or procedures is not affected when charges are increased	12%	17%	17%	39%	15%	3.27

* Symptoms are taken from R. Cooper, "You Need a New Cost System When ..." Harvard Business Review (January-February 1989), pp. 77-82.

** Number of observations vary across symptoms due to "not applicable" responses.

(Facility-Sustaining, Service-Sustaining, Batch-Level, and Unit-Level) to be incurred.

The management of the hospital then needs to implement a *strategy of continuous improvement in the processes* (i.e., an ongoing search for waste in operating **activities** and the elimination of this waste), *at all levels of the cost hierarchy, for delivering these services.* Changing a process to reduce costs involves modifying or eliminating it so that fewer resources are consumed. Turney (1991) proposed four ways in which continuous improvement efforts can reduce costs:

1. Activity reduction: reducing the time or effort required to perform the activity.

2. Activity elimination: eliminating the activity entirely.

3. Activity selection: selecting the low-cost alternative from a set of alternatives.

4. Activity sharing: making changes which permit the sharing of activities with other services to yield economies of scale.

In contrast, conventional approaches to cost cutting, which are based on traditional costing systems, do not identify the costs drivers (i.e., the activities) which cause the costs. Thus, these approaches do not direct the healthcare manager's attention to where the activity and cost savings may be found. Instead, they tend to favor across-the-board solutions which may work in the short run but usually fail in the long run because resources (often staff) are eliminated without regard to the underlying work which still needs to be performed.

In order to effectively pursue continuous improvement programs and manage activities and the related resources (and their related costs) consumed by these activities, management must have better cost information than has been provided in the past by conventional cost systems. This points to the use of Activity Based Costing as an important tool in helping to identify which activities (and their related costs) to reduce.

VIII. Summary

A number of writers have suggested that activity based costing may be beneficial to hospitals. We have collected survey data on hospitals' costs hierarchies, and used these findings to illustrate the extent to which ABC information may be used to more appropriately cost various hospital services as the basis for better product mix, pricing, and cost control, as well as strategic decisions. Our survey also has found considerable evidence of the symptoms of outdated costs systems. This suggests that benefits from installing better cost systems are real, and not the artifact of academic imaginings or artificial numerical examples.

References

Capettini, R., C. Chow, and A. Wong-Boren, "Enhancing Student Awareness of the Need for Managerial Thinking in Accounting: Some Survey Results for the Classroom," *Accounting Educators' Journal,* 1994, 6 (1), pp. 128-143.

Chan, Y-C.L., "Improving hospital cost accounting with activity-based costing," *Health Care Management Review,* 1993, 18 (1), pp. 71-77.

Chaffman, B.M. and J. Talbot, "Activity-Based Costing in a Service Organization," *CMA* 64, no. 10 (1990): 15-18.

Cooper, R. "Cost Classification in Unit-Based and Activity-Based Manufacturing Cost Systems," *Journal of Cost Management,* Fall 1990, pp. 4-14.

Cooper, R. "You Need A New Cost System When ...," *Harvard Business Review,* January-February 1989, pp. 77-82.

Harr, D.J., "How Activity Accounting Works in Government," *Management Accounting,* September 1990, pp. 36-40.

Helmi, M.A. and M.N. Tanju, "Activity-based costing may reduce costs, aid planning," *Healthcare Financial Management,* November 1991, pp. 95-96.

Lewis, R.J. "Activity-Based Costing for Marketing," *Management Accounting,* November 1991, pp. 33-35, 38.

McLaughlin, C.P. and A.D. Kaluzny, "Total quality management in health. Making it work," *Healthcare Management Review,* 15(3): pp. 2-14, 1990.

Rotch, W., "Activity-Based Costing in Service Industries," *Journal of Cost Management,* Summer 1990, pp. 4-14.

Suver, J.D., B.R. Newman and K.E. Boles, "Accounting for the cost of quality," *Healthcare Financial Management,* September 1992, pp. 29-37.

Turney, P.B.B., "Activity-Based Management: ABM puts ABC information to work," *Management Accounting,* January 1992, pp. 20-25.

Turney, P.B.B., "How Activity-Based Costing Helps Reduce Cost," *Journal of Cost Management,* Winter 1991, pp. 29-35.

Zimmerman, J., "The Costs and Benefits of cost Allocations," *Accounting Review,* July 1979, pp. 504-521.