USING INDUSTRIAL ENGINEERING TECHNIQUES IN THE DEVELOPMENT OF EFFECTIVE COST ACCOUNTING SYSTEMS FOR HOSPITALS

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1. INTRODUCTION

Today's hospital industry is facing a crisis. In 1987, a record 79 of the nation's 5,680 community hospitals closed and it is estimated that a total of 700 hospitals will have to close by 1995 [1,14]. The Andersen report noted that the following actions are necessary for survival in the 1990s:

1. To compete effectively, each hospital must analyze its market, customers and competitors, as well as its competitive strengths and weaknesses, in order to develop and deliver competitive services and products.

2. Providers must segment their markets, introduce product line management into their delivery system, and develop those services which they can deliver most cost-effectively and profitably.

3. New products must be introduced based upon market need, benefits to the institution, and business strengths of the institution as compared to its competitors.

4. The success of health care providers will be dependent upon strategic and financial planning, risk identification and analysis, predictive market analysis and computerized decision support systems [19].

These new demands on hospitals have come largely as a result of governmental action. Motivated by an ever-increasing federal deficit, budgetary concerns have become the primary driving force behind federal health policy [1]. From 1965 to 1982, health care costs rose dramatically, increasing from 6% of the gross national product (GNP) to 10.5% [21]. Health care's share of the GNP increased to 10.7% in 1985 and is predicted to become 11.5% by 1990 and 12.2% by 1995 [1]. This trend is attributed to spiraling health care costs and an aging population. According to the American Association of Retired Persons, the number of people age 65 and over will increase by 18% from 1987 to 1992, while the number of people age 85 and over will increase by 30% over the same period [30]. As a result, the number of people who are eligible for Medicare is growing rapidly. Today, Medicare payments to hospitals account for more than 40% of

hospital income in the United States [30]. In an effort to bring health care costs under control, in 1983 the government introduced a prospective payment system (PPS) for Medicare reimbursement. Instead of reimbursement based on the reported costs of treating patients (as was done in the past), hospitals now are paid based on Diagnostic Related Groupings (DRGs). For each group of diagnoses, a hospital receives a predetermined fee independent of the actual cost. This new PPS is intended to eliminate the direct pass-through of hospital costs that existed with previous cost-based reimbursement policies [5].

Before PPS, nothing about Medicare's reimbursement system supported a cost minimizing mentality. In fact, just the opposite was true. Cost maximization was the achievement most rewarded by the system. The higher the reported costs, the higher the amount of reimbursement a hospital would receive. As a result, operating inefficiencies were masked and even encouraged. The goal of hospital information systems was to assign costs so as to maximize reimbursement, rather than focus on the true cost of resources consumed when providing a specific patient's care [7].

Under PPS, incurring costs no longer generates revenue. Revenue amounts are fixed for each patient based on a diagnosis. Since it will be up to the hospital to provide services at a cost that is equal to or less than

the amount of reimbursement specified for each DRG, it is essential to know the cost of providing specific services. Without this information, hospital administrators will have little ability to manage their institutions. In order to be cost-effective, it is necessary to know your costs. Furthermore, this DRG form of revenue generation makes strategic planning a discipline that hospitals can no longer afford to ignore [7].

As a result of PPS, hospitals are becoming more production-oriented in an effort to remain profitable in an increasingly competitive environment. In effect, hospitals now sell "products." These products are patient care services marketed along several "product lines" [7]. Product lines are groups of products or procedures that are used together, sold to the same customer, or marketed through the same channel [10]. In a hospital, these product lines would include:

1. Case types, typically defined by DRGs.
2. Patient types, defined by demographics.
3. Individual physicians or physician groups.
4. Programs (usually defined as either groups of related diagnoses or as physicians with similar specialities).
5. Specific procedural treatments, typically sold as specific services to individual outpatients [7].

This product line approach to hospital management parallels the approach which has been used in manufacturing industries for many years. Manufacturing industries have greatly utilized industrial engineering in effectively controlling costs under similarly competitive conditions. Consequently, hospitals are beginning to utilize industrial engineering to aid in cost control efforts [7].

In order to survive the radical changes that are taking place in today's hospital environment, hospitals must learn to control their costs. However, before hospitals can control their costs, they must first know their costs. Consequently, hospital administrators are beginning to look to cost accounting as a means for providing the cost visibility they so desperately need to make important managerial decisions. However, for a cost accounting system to be effective in controlling costs, it is essential that accurate cost standards be developed. Utilizing techniques developed through years of application in industry, industrial engineering is very well equipped for the task of developing accurate and reliable cost standards in a hospital.

This paper will explain what cost accounting is, the role of industrial engineering in the development of a cost accounting system, and how the information provided by a cost accounting system may be of benefit to hospital management.

2. COST ACCOUNTING

Cost accounting involves the systematic recording and analysis of both direct and indirect costs incurred in providing a product or service [18]. Cost accounting systems generally are classified as either process costing or job-order costing [13].

2.1. PROCESS COSTING

Process costing is used most often in organizations that produce homogeneous products or services. It is an averaging system that accumulates costs according to specific processes or cost centers [26]. The total cost of a specific process for a specific period is calculated and divided by the total equivalent output for the period [13]. The result is the equivalent unit cost per item for all products produced by the particular process during the period. For example, if 10,000 equivalent units were produced at a total cost of $1,000,000, the cost per equivalent unit would be $100 [32]. Using house building as an example, process costing would be used for houses

having a particular model type or floor plan [13].

2.2. JOB-ORDER COSTING

Job-order costing is used to accumulate costs for products or services that vary considerably [26]. Each product, or job, is treated as a unique entity. All costs are assigned specifically to the individual job as resources are consumed. Therefore, the resulting individual product cost is highly dependent on the costs incurred by each specific job [8]. Referring again to house building, job-order costing would be used for custom-built houses [13].

2.3. COSTING IN HOSPITALS

Hospitals provide patients with a wide range of services and products in almost endless combinations. Ideally, a hospital would use a job-order costing system and determine the actual costs of treating each patient on the basis of actual service items consumed [31]. A service item is any distinct and measurable consumption of resources that can be associated with a specific patient [7]. There are, however, significant practical constraints that exist in the implementation of a pure job-order costing system. The system most recommended for hospitals combines features of both the process and the job-order costing systems [31]. For example, a final bill would consist of cost inputs based on a process costing

approach within cost centers, collected through a job-order system [32]. Figure 1 shows the combined approach.

Determining the cost of specific service items is a difficult task and one that has not been emphasized in the past in hospitals. However, industry has used cost accounting to evaluate its products since the advent of the industrial revolution. This history provides hospitals with an opportunity to learn from others' experience. In addition, industrial engineering techniques which have developed through years of application in industry also provide a source of knowledge in cost control.

2.4. HOSPITALS COMPARED TO INDUSTRY

Hospitals are very similar to industries involved with repetitive discrete manufacturing. Such industries produce the same products repeatedly, but in relatively short production runs for each specific product or product variation. Since the repetitive manufacturer typically offers options on products, specific finished products within a given run may be slightly different from other products in other runs. [8]

The automobile industry provides a good example of repetitive discrete manufacturing. It is very rare that more than a few automobiles come off the assembly line at the same time with the exact same options. As a result,

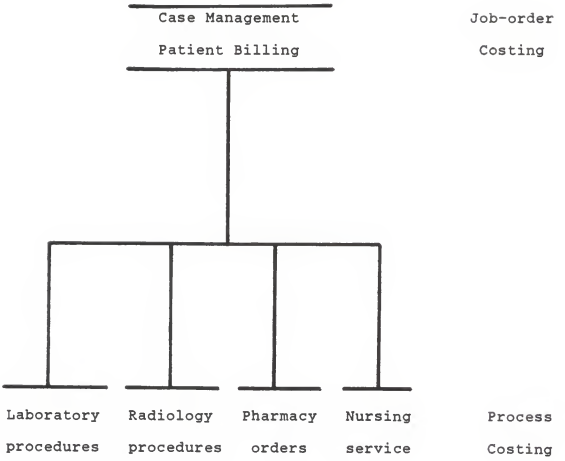

Figure 1. Basic Cost System for Health-care Providers [32].

every automobile is costed as a unique product. Such costing requires the accumulation of the standard costs for each individual option that goes into the final assembled product [8].

The costing approach used in the automobile industry is analogous to the way most patients are treated and their charges accumulated in a typical hospital. The concern about patient service variability around a DRG is similar to the effect of option variations around a base model of an automobile. For instance, individual cases in a given DRG may experience a wide variation in length of stay and services used. This variation is similar to two automobiles with identical make and model. Due to the options selected, the automobiles may vary in cost by several thousand dollars [8].

As long as the hospital costing system can isolate the "options", known as service items, used in treating a particular patient, accumulating and analyzing costs for management purposes is relatively simple. The real challenge is to determine the best way to develop standard costs for each service item [8].

3. STANDARD COSTING REQUIREMENTS

Before standard costing may take place, each cost center must be classified and each service item identified.

3.1. COST CENTER CLASSIFICATION [7]

Each cost center's activities should be homogeneous to facilitate process costing. The term homogeneous means that activities should consume resources in a similar pattern within each cost center.

For example, consider a laboratory department in which many different tests using many different pieces of equipment consume labor and overhead costs in significantly varying patterns. The laboratory does not encompass homogeneous activities and should be broken down, for costing purposes, into several separate cost centers, perhaps based upon the major pieces of equipment used to perform the different tests.

Once all cost centers are classified, process costing can be used to determine an average cost for a standard

procedure that is common to all activities within a specific cost center. Referring to the example of the automobile industry, cost centers are analogous to stations along an assembly line. Although each station performs a standard operation, variations around the standard may occur based on the options available. In relation to an automobile, an option at a station may be to insert leather seats instead of standard vinyl seats. The method used for attaching seats into a car is the same regardless of the material used in the seat construction. However, the cost of the final product varies depending upon the material you choose. Similarly, in a pharmacy, all I.V.s require the same set-up procedure. However, the drugs used in the I.V. vary greatly in cost. In this case, drug selection would be an option around the standard I.V. procedure.

The next step is to identify the options that are available in each cost center.

3.2. SERVICE ITEM IDENTIFICATION [7]

As mentioned earlier, a service item is any distinct and measurable consumption of resources that can be associated with a specific patient. Service items include both charge items and noncharge items.

Charge items are regarded as distinct identifiable items or services that can be justified to the payer as something of value for which he should be expected to pay.

Most charge items are specific supplies such as medication or specific procedures such as a chest X-ray. However, there are other charge items, referred to as usage charges, which represent a package of individual service items. These are charges for the use of various hospital facilities such as an operating room or a bed. For example, a daily room charge may include everything from routine nursing services to laundry services to meals.

Noncharge items (overhead) include all services that may be specifically identifiable to an individual patient, but for which there is no charge. For example, while an admission or a discharge is clearly a service provided directly to each individual patient, they are not charge items. Nevertheless, an admission or discharge may be a service item with standard costs that vary depending on the type of admission or discharge. If these costs are significant and of interest to hospital management, they can best be handled by treating them as separate service items, rather than noncharge items.

The utility of the service item concept is its ability to more precisely measure the resources consumed to provide a specific service to a specific patient. It certainly includes some charge items, but goes well beyond that to directly include all specifically identifiable services that in fact consume a hospital's resources.

Once every service item within each cost center is identified, the next step is to assign standard costs.

4. STANDARD COSTING METHODOLOGIES

There are three commonly used methodologies for accomplishing the task of developing standard costs for each service item provided by each cost center: 1) cost-to-charge ratios, 2) relative value units, and 3) microcosting. Brief summaries of each follow.

4.1. COST-TO-CHARGE RATIOS [3,15]

The cost-to-charge ratios method assumes that there is a correlation between the price of services sold to the patient and the cost of providing those services. After overhead is allocated to each of the cost centers, a ratio of totally absorbed cost to the department's gross revenue is determined. For example, if a department generated $1,000,000 in patient charges and incurred $900,000 in cost, the cost-to-charge ratio would be .9. Therefore, the cost of each procedure within that department would be calculated using 90% of its charge. This methodology produces very inaccurate results on an individual patient basis. Studies have proven that there was very little direct relationship of procedure cost to charges in the

past [15]. Some procedures in the department may cost 25% of the charges, while others may cost 150% of the charges. This costing methodology is extremely illogical in its approach in determining costs. Costs should be determined to establish charges, not vice versa. In the modern competitive era, more accurate cost data clearly are required.

4.2. RELATIVE VALUE UNITS [15]

Using relative value units (RVUs), each procedure is assigned a value unit that represents its resource consumption. These RVUs attempt to measure the relative amount of resources consumed by each procedure compared to all other procedures in a department. The value unit for each procedure is multiplied by the procedure volume to arrive at the total value points. The operating expenses of the cost center may be divided by the value points to yield a cost per point. Each procedure is assigned a cost by multiplying the cost per point and the value unit.

For example, suppose a department performed 50 A procedures and 50 B procedures at a total cost of $200,000. If procedure A was assigned an RVU of 4 while procedure B was assigned an RVU of 6, then the total RVU points would be 50 x 4 + 50 x 6 = 500 and the cost per point would be $200,000/500 = $400. The cost assigned to procedure A would be $400 x 4 = $1600 while the cost assigned to procedure B would be $400 x 6 = $2400.

4.3. MICROCOSTING [15]

Microcosting is the traditional bill-of-resources approach to cost accounting, and when done correctly, is both highly accurate and expensive. Under this method, a detailed list of each resource consumed by the procedure is created. Full microcosting requires that every procedure be microcosted. The 80/20 rule microcosting method involves the use of Pareto's principles in identifying and microcosting the 20 percent of procedures that account for 80 percent of the revenue. It is assumed that the procedures not microcosted will be costed using cost-to-charge ratios.

4.4. EVALUATION [15]

A study performed by Gravell and Selivanoff, found that full microcosting was 95-99% accurate while 80/20 microcosting was 90-95% accurate [15]. For 5% more accuracy, full microcosting would require analyzing 5 times the procedures required of 80/20 microcosting. As a result, 80/20 microcosting achieves the higher cost/benefit return of the two microcosting methods. Full microcosting requires 500% more cost for 5% more accuracy. According to Gravell and Selivanoff, microcosting under the 80/20 rule is significantly more accurate than the ratio of cost to charges and relative value unit method, and provides sufficient detail for enhanced decision

making. Since microcosting is a very involved process which requires the use of industrial engineering techniques, it will now be examined in more detail.

5. MICROCOSTING

It is the goal of microcosting to determine the full cost of providing specific service items. The microcosting process is composed of three components: cost modeling, data collection, and cost determination [31].

5.1. COST MODELING

A cost model details all of the cost elements that go into providing a good or service. Cost elements are the specific categories of cost to be associated with each service item. Direct labor, direct materials, and overhead are the traditional cost elements used in manufacturing environments [7]. The number of cost elements to be carried by a hospital's system must be carefully considered. The more detail desired in a system, the more cost elements required to provide that detail. However, the trade-off between information and analytical effort may be enormous. Increasing the number of cost elements will significantly increase the level of effort necessary to develop and maintain standard costs.

This effort becomes a particular burden when analyzing the variances for each element each month in each cost center [8]. The traditional cost elements of direct labor, direct materials, and overhead now will be examined in more detail to explain what is represented by each of them in a hospital environment.

5.1.1. Direct Labor. Direct labor represents the cost of workers whose labor can be traced directly to a particular product or service. Nurses, technicians, and other medical personnel are included in this category of cost.

Labor costs that cannot be traced directly to a specific product or service, yet are required as part of the production process, are known as indirect labor. Examples would include wages of maintenance personnel, supervisors, and secretaries. Indirect labor costs are usually classified as part of overhead, which is described later [13,25].

5.1.2. Direct Materials. Direct materials are those that can be traced directly to a product or service [13]. In a hospital, direct materials consist primarily of supply items and medicines [7]. For example, in a pharmacy this would include drugs, I.V. solutions, I.V. sets, needles, syringes, labels, prescription vials, and filters [25].

Material costs that cannot be traced directly to a specific product or service are classified as indirect materials. Some examples would include lubricants for

machines, lightbulbs, and cleaning materials. Like indirect labor, indirect material costs are classified as overhead [13].

5.1.3. Overhead. Overhead includes all costs that are not traceable to particular products or services as either direct labor or direct material. These are the costs that give a hospital the capacity to produce. Included in this category of cost is indirect labor, indirect material, and the cost of utilities, property taxes, equipment depreciation, insurance, rent, marketing, and administration.

5.2 DATA COLLECTION

Once a specific cost model has been established, data must be collected to determine cost standards for each cost element of each service item in each cost center [8]. The three traditional cost elements of direct labor, direct materials, and overhead now will be examined again to discuss how cost standards may be set for each of them.

5.2.1. Direct Labor. Labor costs are the largest portion of total cost for a typical hospital [7]. Nursing costs alone may constitute as much as 25% of a hospital's operating budget [7]. As a result, determining accurate cost standards for direct labor should be a top management priority. Standard direct labor costs are determined by

multiplying the hourly wage rate of each employee by the time standard for specific activities [25]. While the calculation for determining direct labor costs is relatively simple, determining the standard time that should be expended on specific activities is not. Two common industrial engineering techniques that are used for determining time standards include sequential sampling and occurrence sampling. [20,25].

5.2.1.1. Sequential Sampling. Sequential sampling involves the use of an observer who records the amount of time spent for each activity a worker performs. This data is most useful if the activities being observed are well defined before the start of the observation period. When the observer can clearly differentiate between activities, the accuracy of each observation is increased. Individual bias, and biases of the employees being studied, may be minimized by using a large sample size. This method is most effective when the work being measured is highly repetitive in nature. Most production-related activities are well suited for this type of time study. A more rigorous approach to this method of time study is examined in the book Work Design: Industrial Ergonomics [23].

An example of a department in a hospital which has production-related activities is the pharmacy [20]. Table 1 shows the results of a sequential sampling time study performed on the work activities of a pharmacist involved

in i.v. admixture production. From the data provided by the time study, an average time per i.v. should be computed.

It should be noted that direct labor costs can vary between procedures depending on the mix of employees and the time involved per employee. For example, if the time commitment remains the same, but a technician assumes a duty previously performed by a pharmacist, the direct labor cost will change [25].

5.2.1.2. Occurrence Sampling. Occurrence sampling is an indirect method of work measurement. The worker's activities are observed at several points in time rather than measuring the time span for any one activity. This allows the observer to estimate the proportion of time spent performing a defined activity. Once the proportions are determined, they are multiplied by the total amount of worker time over a specific period to determine actual times spent on each activity. It is, therefore, useful for the calculation of time spent in auxiliary activities, since these are nonrepetitive or irregular in nature. Further details on this method of time study may also be found in the book Work Design: Industrial Ergonomics [23].

Referring once again to a pharmacy, Table 2 shows the result of an occurrence sampling time study performed on the auxiliary activities performed by a pharmacist involved with i.v. admixtures. From the data provided by

Table 1. Sequential Sampling Time Study Performed on the Activities of a Pharmacist in I.V. Admixture Production [20,23].

Activities	Ave. Time (min)	Occurrences per cycle	Std. Time (min)
1. Check i.v. products prepared by technicians	5.0	1	5.0
2. Enter orders into computer	2.5	1	2.5
3. Review labels from computer	1.0	1	1.0
4. Type labels when necessary	3.0	.5	1.5
5. Check "set-up" procedures	2.0	1	2.0
6. Supervise preparation of products	8.0	1	8.0
Minutes/i.v.			18.0

Table 2. Occurrence Sampling Performed on the Auxiliary Activities of a Pharmacist in I.V Admixtures [20].

Activity	Tally	Total	%
1. Maintain the upkeep of the pharmacy	//	2	4.0
2. Read product-related literature	𝍸 𝍸	10	20.0
3. Attend staff meetings	𝍸 𝍸 𝍸 𝍸	20	40.0
4. Directly supervise other personnel	𝍸 𝍸	10	20.0
5. Idle time	𝍸	5	10.0
6. Absent	///	3	6.0
		50	100%

the sampling, the time required for each activity may be estimated.

5.2.2. Direct Materials. In a hospital, direct materials typically only constitute about 5% of the operating budget [7]. When determining the cost of a particular task or service, the cost of all materials that are normally used, but not charged to the patient separately, is calculated [25]. Costs of items that are charged to the patient separately are considered to be options.

For example, at St. Joseph's Hospital in Milwaukee, Wisconsin, since drugs are charged to the patient separately, the cost of all drugs is related to the charge for each drug and is not included in the cost of preparing an I.V. The cost of preparing an I.V. is a generic cost per unit of I.V., while total cost to the patient includes the generic I.V. preparation cost for the base service and the cost of the drugs used. The same base I.V. preparation cost applies whether the drug cost is $1, $10, or $100 [25].

5.2.3. Overhead. Overhead costs are a close second behind labor as the largest source of cost to hospitals [7]. Since there is no direct relationship between overhead costs and specific services, overhead costs must be allocated to specific services within each cost center. The allocation procedure involves four steps:

1. Selecting an activity base (for example, direct labor hours (DLHs)) for applying overhead to services.

2. Estimating the amount of overhead and the level of activity for the period (for example, a month).

3. Computing the predetermined overhead rate from the following formula:

$$\text{Predetermined Overhead Rate} = \frac{\text{Est. Cost Center Overhead (\$)}}{\text{Est. Activity Level (DLHs)}}$$

4. Applying overhead to specific services by multiplying the predetermined rate computed in step 3 times the actual activity (for example, the actual direct labor hours worked to prepare an I.V.) [13].

5.3. SERVICE ITEM COST DETERMINATION

Once a specific cost model is established and the data is collected to fit the model, the amounts of each cost element required to complete a task or service may be added together to determine the full cost [31]. Table 3 shows how full costs are determined for providing some specific drugs in a pharmacy. In this manner, standard costs may be developed for each service item in every cost center in a hospital. Once all of the standard costs are

determined, they are put into the hospital's overall cost accounting system to serve as the most fundamental unit of information [7]. It should be emphasized that the effectiveness of a cost accounting system is entirely dependent on accurate cost standards.

As shown in Table 3, in a pharmacy department, labor and materials represent the highest percentages of costs. This profile contrasts with that of radiology, which has a substantial level of overhead due to equipment depreciation involved with most procedures, and that of nursing, which is labor intensive. In the pharmacy, the material component even surpasses the labor component [25].

Table 3. Service Item Unit Cost Report for a Pharmacy [7].

($) Direct Labor	($) Direct Materials	($) Overhead	($) Unit Cost
D5-1/2 KCL-201L (code 6766)			
0.75	1.39	0.09	2.23
Aminosyn TPN 1L (code 6786)			
2.86	64.00	0.27	67.13

6. BASIC FRAMEWORK OF A HOSPITAL COST ACCOUNTING SYSTEM

The purpose of a cost accounting system is to match costs with revenues. In other words, hospitals need a system that accurately associates the precise cost of the specific resources consumed with the products that generate the hospital's income. A system that accomplishes this task at a reasonable price is the goal of most hospitals [7].

For example, consider the product line defined by case type. Each case is classified based on a patient's diagnosis or DRG. Like an automobile moving through an assembly line, each patient moves through the various cost centers during the course of treatment. As a patient consumes service items, the quantity and standard cost of each service item is recorded. Upon discharge, each patient's cost data is accumulated to arrive at a total cost for each case. This total cost then may be compared to the amount of revenue generated through DRG reimbursement to determine the profitability of each case. Figure 2 shows the basic framework of a hospital cost accounting system. Such a system may be used to analyze

revenues and costs for patients treated along each product line in a hospital.

Computer software companies and accounting firms have developed various computerized cost accounting systems. For a fee, these organizations will install the system and instruct hospital personnel on how to operate it and effectively analyze the data. In most cases, these programs can be easily interfaced with existing budget software [31].

These computerized systems can go far beyond merely identifying the full costs of providing specific service units. They can perform case-mix and cost allocation adjustments, execute patient costing systems, establish standard bill-of-service systems, and report and explain standards and variances with respect to cost. The range of computer equipment on which the software will run is well represented in the marketplace [31].

Once again it is important to note that no matter how sophisticated a system may be, it will be of no use unless accurate cost standards are developed.

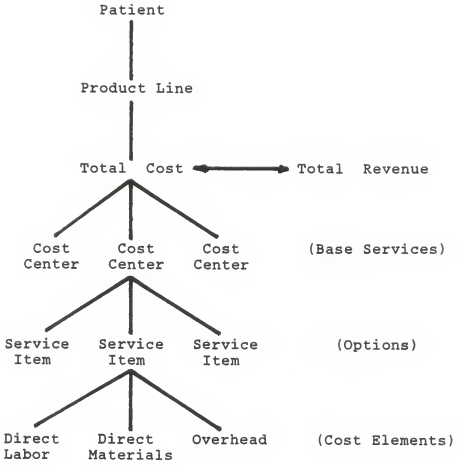

Figure 2. Basic Framework of a Hospital Cost Accounting System.

7. MANAGERIAL USES OF COST ACCOUNTING INFORMATION

Cost information is of great value in the managerial decision-making process [9]. Toward this end, cost accounting systems are attempting to link accounting principles to planning, budgeting, and fiscal control [31].

With specific cost data, managers would know the financial implications of adding tests or procedures within a particular DRG or product line. Managers and physicians could relate costs to established norms of care and could establish ranges of acceptable costs in various diagnostic groups [31].

Pricing individual service units in relation to the cost of providing them, rather than on the basis of historical experience, would be valuable in negotiations with rate review organizations, health maintenance organizations, other prospective payment mechanisms, and other regulatory entities. For a hospital to remain financially healthy in an increasingly competitive environment, management will have to know the cost of providing specific service units for which they will

receive a fixed payment under a prospective payment system. Specific cost data also would help reduce or eliminate cross subsidies, which are almost always inequitable, as those who pay the inflated price of one service often make up for the artificially depressed price of another [31].

Service item information can be summarized by department, based on the department responsible for producing each service item. This information allows the hospital to report standard costs incurred for each department on a periodic (usually monthly) basis. This standard cost information then can be compared, by cost element, against the actual cost information in the general ledger accounts. The difference between actual and standard cost is a variance that then can be analyzed as to its cause. This analysis provides management with an effective mechanism for monitoring each department's ability to provide services at the standard cost, which in turn is tied to the budgeting procedure. When the annual budget cycle begins anew, the results and standards from the current year will be used to develop next year's budget [8].

Finally, since hospital management would know the cost and profitability of providing specific services, they could actively market and advertise services that most contribute to the organization's overall financial health [31].

8. SUMMARY AND CONCLUSIONS

Today's hospital industry is facing a crisis. The introduction of PPS by the government has created a competitive environment which has caused some hospitals to close. This competitive environment has forced hospitals to become more industrialized. They are becoming very similar to facilities involved with repetitive discrete manufacturing in producing various services along product lines. As a result of this similarity, hospitals are beginning to borrow knowledge developed in manufacturing industries in an effort to remain profitable.

In order to survive, hospitals must learn to control their costs. However, before hospitals can control their costs, they must first know their costs. Consequently, hospital management is beginning to look to cost accounting as a means for providing the cost visibility necessary for making important managerial decisions. Cost accounting involves the systematic recording and analysis of both direct and indirect costs incurred in providing a product or service.

The goal of a cost accounting system is to match

patient costs with revenues. Such a system will record for each patient the quantity and standard cost of each item consumed. The total cost incurred by each patient then is compared to the amount of revenue generated by the specific product line. Various computer companies and accounting firms have developed computerized cost accounting systems.

The effectiveness of a cost accounting system is entirely dependent on the accuracy of the cost standards which are input for each service item in each cost center. These cost standards are the most fundamental units of information from which important managerial decisions are made. Of the costing methodologies used for determining cost standards, microcosting is clearly the most accurate. Microcosting incorporates industrial engineering techniques which have been developed in industry since the industrial revolution. The microcosting process involves three components: cost modeling, data collection, and cost determination. Due to the enormous number of hospital services, microcosting each service item would be extremely expensive. As a result, it is recommended that the Pareto concept be applied so that only the 20 percent of procedures responsible for 80 percent of a hospital's gross revenue are microcosted.

Knowing the true costs of providing service items will enable hospital managements to: 1) select the most cost-effective method of treating a patient, 2) know the financial implications of adding tests or procedures, 3)

relate costs to established norms of care, 4) establish ranges of acceptable costs in various diagnostic groups, 5) negotiate more successfully with rate review organizations, 6) evaluate the ability of departments to provide services at the standard costs, 7) develop a more effective budgeting process, and 8) actively market and advertise the services that most contribute to the hospital's overall financial health.

In order to survive in the 1990s, hospitals must realize the importance of cost accounting information in the managerial decision making process. For a cost accounting system to be effective, it is imperative that accurate cost standards are developed. Of the 3 standard costing methodologies discussed, microcosting is the most accurate. The key to its accuracy is the use of industrial engineering techniques. Accurate cost data provided by a sound cost accounting system is essential for hospitals to meet the challenges of the future. Such data will enable hospitals to deliver care in a profitable manner.

BIBLIOGRAPHY

1. Arwine, D., et al. The Future of Healthcare: Changes and Choices. Chicago: Arthur Andersen & Co., 1987.

2 Arenson, R., van der Voorde, F., and Stevens, J., "Improved Financial Management of the Radiology Department with a Microcosting System," Radiology, Jan. 1988, pp.255-259.

3. Baptist, A.J., "A General Approach to Costing Procedures in Ancillary Departments," Topics in Health Care Financing, Summer 1987, pp. 32-47.

4. Bennett, J. P., "Standard Cost Systems Lead to Efficiency and Profitability," Health Care Financial Management, Sept. 1985, pp. 46-53.

5. Boles, K.E., "Implications of the Method of Capital Cost Payment on the Weighted Cost of Capital," Health Services Research, June 1986, pp. 189-190.

6. Burik, D., and Carls, L., "Health Care Cost Accounting: Finding the Systems Solution," Topics in Health Care Financing, Summer 1987, pp. 48-55.

7. Burik, D., and Duvall, T.J.,"Hospital Cost Accounting: Strategic Considerations, " Healthcare Financial Management, Feb. 1985, pp. 19-28.

8. Burik, D., and Duvall, T.J., "Hospital Cost Accounting: A Basic Framework," Healthcare Financial Management, March 1985, pp. 58-64.

9. Cleverly, W.O., "Product Costing for Health Care Firms," Health Care Management Review, Fall 1987, pp. 39-48.

10. Cooper, J.C., and Suver, J.D., "Product Line Cost Estimation: A Standard Cost Approach," Healthcare Financial Management, pp. 60-70.

11. Currie, D., and Howard, D.M., "Microcosting an Emergency Department," Topics in Health Care Financing, Spring 1985, pp. 78-88.

12. D'Arco, S.H., "Microcosting Medical Intensive Care in a Tertiary Care Setting Using Optical Bar Code Scanners," National League for Nursing Publications, Dec. 1987, pp. 91-98.

13. Davidson, S., et al., Managerial Accounting, Chicago: The Dryden Press, 1988.

14. Dentzer, S., "Building the Hospital of the Future," U.S. News and World Report, April 11, 1988, pp. 49-51.

15. Gravell, J.R., and Selivanoff, P., "Costing Method Stresses Accuracy, Cost Effectiveness," Healthcare Financial Management, Nov. 1986, pp. 111-112.

16. Hackett, K. L., "Payment Patterns, " Health Care Financial Management, July 1986, p. 93.

17. Hafer, John, "Data-Base Marketing: A Tool for Health Care Administration," Hospital & Health Services Administration, May 1987, pp. 191-204.

18. Hairston, C. F., "Costing Nonprofit Services: Developments, Problems, and Issues," Administration in Social Work, Spring 1985, p. 48.

19. Harlow, P., et al. Health Care in the 1990s: Trends and Strategies. Chicago: Arthur Andersen & Co., 1984.

20. Hatoum, H., Witte, K., Biedron, G., and Hutchinson, R., "Microcosting Method for Small-Volume Injectibles," American Journal of Hospital Pharmacy, Feb. 1986, pp. 348-354.

21. Ibbott, G.S., "Determining Costs in Radiation Therapy," Radiology Management, Fall 1987, pp. 30-34.

22. Kaskiw, E.A., "Cost Accounting in Health Care: Fad or Fundamental ?," Hospital & Health Services Administration, Nov. 1987, pp. 457-474.

23. Konz, Stephan. Work Design : Industrial Ergonomics. Columbus: Grid Publishing Inc., 1983.

24. Lerner, W.M., Wellman, L.W., and Burik, D., "Pricing Hospital Units of Service Using Microcosting Techniques," Hospital and Health Services Administration, Jan.-Feb., pp. 7-27.

25. Loeb, A.J., and Kahl, K., "Microcosting Pharmacy Services: A Basic Approach," Topics in Hospital Pharmacy Management, May 1987, pp. 1-11.

26. Managerial Cost Accounting for Hospitals, American Hospital Association, Chicago, 1980, pp.26-27.

27. Mason, G.R., "Evaluating Existing Rate Structures," Topics in Health Care Financing, Fall 1987, pp. 36-49.

28. Maynard, H.B. Industrial Engineering Handbook. New York: McGraw-Hill Book Company, Inc., 1956.

29. McGrail, G.R., "Evaluating Performance for Health Care Facilities," Hospital Topics, Vol. 65, No. 3, pp. 27-32.

30. Medicare Awareness Campaign, St. Joseph Medical Center, Wichita, Kansas, Sept. 1987, pp. 1-9.

31. Sabin, Paul, "Hospital Cost Accounting and the New Imperative," Health Progress, May 1987, pp. 52-57.

32. Suver, J.D., and Cooper, J.C., "Principles and Methods of Managerial Cost-Accounting Systems," American Journal of Hospital Pharmacy, Jan. 1988, pp. 146-152.

33. Suver, J.D., and Neumann, B.R., "Patient Mix and Breakeven Analysis," Management Accounting, Jan. 1977, pp. 38-40.

USING INDUSTRIAL ENGINEERING TECHNIQUES IN THE DEVELOPMENT OF EFFECTIVE COST ACCOUNTING SYSTEMS FOR HOSPITALS

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Cost accounting for hospitals is examined as a means of accumulating cost data for services provided to individual patients during treatment. The effectiveness of a cost accounting system is dependent on the accuracy of the cost standards developed for each service item. Three standard costing methodologies are discussed: 1) cost-to-charge ratios, 2) relative value units, and 3) microcosting. Microcosting, which involves the use of industrial engineering techniques, is examined in detail. Finally, the managerial uses of information provided by a cost accounting system are explained.