

Nuclear Medicine Cost Accounting and Analyses

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Cost accounting in nuclear medicine is of such basic importance that it is considered a necessity any time a major departmental change occurs. The basic guide given here is aimed at introducing this important subject to nuclear medicine technologists.

Accurate cost accounting in nuclear medicine is of basic importance to any department.

Academic Need

Management of an enterprise that offers two or more distinct classes of services or that is divided into departments needs economic reports to evaluate the various segments of the business. Such reports are needed by management not only to evaluate the past operations of each department, but also to control costs and to plan future departmental operations.

Department accounting for a large enterprise such as a hospital is likely not only to be feasible, but usually most desirable, especially if a department has great growth potential or has already developed into a sizeable service operation. A departmental breakdown for accounting, economic analysis, and reporting helps place responsibility for the control of the operations of a department upon departmental managers. It assists top management both in evaluating the relative operating efficiencies of individual departments and in developing short—and long—range plans.

In considering nuclear medicine as a specific department and service, it should be recognized that this specialty is among, if not the, fastest growing field in medicine today. Furthermore, nuclear medicine is now recognized by the AMA as a medical specialty unto itself, just as radiology or pathology are considered separate specialties. The Joint Commission on Accreditation of Hospitals states that "every hospital shall have a mechanism

for providing nuclear medicine services". Therefore, since nuclear medicine is an essential medical specialty that has proven itself capable of self-support and contribution to hospital margin throughout the United States, it would seem strongly advisable that separate departmental accounting and responsibility be implemented for nuclear medicine.

Practical Need

Our experience in supplementing hospital management to develop various types of economic analysis for nuclear medicine and other departmental operations has indicated several additional specific needs and purposes than those already mentioned. These include

1. Establishment of "base-zero" organizational plans and economic systems for a new department or one being planned.
2. Determination of the financial status of nuclear medicine as a separate department if it had previously been included with another department or if separate cost analyses have not been performed.
3. Analysis of purchase, rent, or lease alternatives for new or expanding departments.
4. Evaluation of actual instrumentation needs for replacement or for new or expanding departments with definitions for breakeven points, rate of return, etc.,
5. Determination of total department initiation, relocation or expansion needs and costs with a re-evaluation of previous cost analyses to reflect the probable need for pricing schedule adjustments.
6. Provision for cost documentation to justify procedural charges as required by third-party payers.

It has also been our experience that many

hospitals use comparative or competitive pricing practices, i.e., to charge what other local hospitals charge for a given procedure. The accounting assumption of that practice is that the costs of the nuclear medicine departments of all hospitals are equal, which is obviously not true. The marketing assumption of the competitive pricing practice is that the services of all nuclear medicine departments are of equal quality, efficiency, availability, and comprehensiveness, which is also untrue. Finally, the competitive pricing practice implies the assumption that physicians and patients are price shoppers for health care when, in fact, such items as convenience and quality service are of primary concern since third-party payers most often bear the cost. Therefore if competitive pricing is practiced by hospitals for the benefit of third-party payers, it is the responsibility of the individual hospital to take exception, if necessary, to "figures of merit" and other pricing schedule guidelines issued by these third-party payers. Because third-party payers generally do give different allowances to different hospitals for the same procedure, the third-party payers must have been supplied with cost documentation from some of the hospitals and they must recognize that national averages do not firmly apply to all local levels or individual circumstances. Even hospitals of identical size and with identical nuclear medicine instrumentation and number of personnel may have very significant differences in costs based on such intangible variations as the degree of medical staff progressiveness, and interests and the attitudes of the nuclear medicine department director and personnel in direct cost allocation, etc.

If, for some reason, a hospital should choose not to take issue with third-party payments or not to supply cost documentation for procedural charges, it would still behoove that hospital to know what the status of its nuclear medicine department is so that the hospital can determine where costs need to be cut or alternate courses of action taken.

Types of Analysis

Now that some of the needs and purposes of economic analyses have been defined, we shall discuss the specifics of different types of analysis costing methods and terminology.

Historical cost is the cash or equivalent outlay for goods or services actually acquired. Actual cost sometimes means the same thing, especially if comparisons are made with estimates or standards. Historical costs are recorded in the basic accounting records with the expired portions reported as expenses on the income statement, and the unexpired portions as assets in the balance sheet.

Historical costs are relevant in the determination of periodic net income and current financial status. However, they may be of only slight consequence or entirely irrelevant in planning for the future.

Replacement cost is the cost of replacing an asset at current market prices and replacement cost analysis is useful in planning the replacement of worn-out or obsolete assets. For example, charts of estimated instrument lifetimes may list or imply nuclear medicine instrumentation with a ten-year expectancy whereas it has been our experience that the functional obsolescence of most such instruments is closer to 5 years. Also, the fact that your 3-in. scanner may need replacement does not automatically mean that the most expensive scintillation camera on the market with all of its accessories is actually needed at your particular hospital.

A variant of replacement cost analysis is to compare annual depreciation expense based on historic cost with depreciation based on estimated replacement cost. The difference between the two represents the estimated amount of net income that should be retained to maintain the productive capacity of the physical plant.

In discussing costing methods, the concept of absorption costing is indispensable in the determination of historical cost and net income; however, the concept of variable costing is often more useful to management in making decisions. Specifically, absorption costing would take into account the cost of nuclear medicine services to be compared to direct materials, direct labor, and overhead. Variable or direct costing considers the cost of nuclear medicine services to be composed only of those costs that increase or decrease as the volume of production rises or falls. According to this viewpoint, the cost of the service would include, in addition to direct materials and direct labor, only those overhead costs that vary with the rate of production. The nonvariable overhead does not become a part of the cost of the service but is rather an expense of the period.

Some of the applications of variable costing are listed below.

1. *Managerial aid.* Making decisions relating to cost control, pricing, and service planning involves managerial aid.

2. *Cost control.* For a specific level of management, controllable costs are costs that it controls directly, and uncontrollable costs are costs that another level of management controls. This distinction, as applied to specific level of management, is useful in fixing the responsibility for incurrence of costs and then reporting the cost data to those responsible for cost control.

3. *Pricing aid.* Essentially, the price of a ser-

vice should not be less than the variable costs of providing that service.

4. *Service planning.* By separating variable operating expenses from fixed operating expenses, variable costing supplies the cost data in a format especially useful for short-range decision making. For long-range planning, of course, management must also consider the fixed costs and expenses. Therefore, absorptive costing methods are likely the essential and full-time job for a hospital accounting department to determine historical cost and net income, as well as required procedure for financial statements. However, many other concepts of cost and revenue are useful to hospital management in making decisions, and it would be most desirable if individual departments could be assigned the responsibility of variable costing and other analytic methods. Unfortunately, a communications gap often occurs in hospitals at this point because often the directors and personnel of a nuclear medicine department are very well versed in the medical sciences, but with minimal or no management training. In contrast, accounting may probably have minimal acquaintance with the operations of the individual department and services, even if they have excellent financial management training. In this case, the most practical and usually the only real solution would be to obtain the services of a specialist trained in both fields to bridge the gap and/or implement the desired analysis project. Practically all of *Fortune's* 500 top businesses with their very comprehensive staffs have used and are using this concept in their operations with excellent success.

Another type of analysis, "differential analysis," is chiefly concerned with decision making in planning for future operations. The relevant revenue and cost data in the analysis of future possibilities are the differences between the alternatives under consideration. The amounts of such differences are called differentials and the area of accounting concerned with the effect of alternative courses of action on revenues and costs is called differential analysis.

Differential analysis can be used advantageously by management in arriving at decisions on a variety of alternatives, such as whether to

1. Buy, lease, or sell instrumentation.
2. Discontinue an unproductive endeavor.
3. Replace useable assets.
4. Expand or contract service capacity.
5. Introduce new services or abandon old services.

An analysis of proposed capital expenditures would include an expected average rate of return, cash payback period, cost estimates, and breakeven

Table 1. Summary of Analysis Components

Performance audits
Instrument rental and depreciation
Time
Radiopharmaceutical costs
Operating costs
Allowance for doubtful accounts
Hospital margin
Professional services

Table 2. Revenue Summary

Procedure	Number	Current Charge	Total
Brain	198	125.00	24,750.00
Thyroid image	153	50.00	7,650.00
Thyroid uptake	12	25.00	300.00
Lung image	52	100.00	5,200.00
Heart	3	75.00	225.00
Blood volume	62	25.00	1,550.00
B ₁₂ absorption	28	35.00	980.00
Therapy	3	125.00	375.00
Fat absorption	3	30.00	90.00
Digoxin	29	50.00	1,450.00
TOTAL	2,697		\$98,490.00

point analysis. Specific examples of these items as well as a review of the concepts previously discussed will be demonstrated in the tabular material.

A. Summary of Cost Analysis Components (Table 1).

1. *Performance audit* (an analysis of productivity and efficiency that compares the relative percentages within a department).
2. *Instrument rental or depreciation* (as indicated previously, our experience indicates 5-year functional obsolescence).
3. *Time* (personnel cost—direct labor).
4. *Radiopharmaceutical costs* (product costs—direct material).
5. *Operating costs* (variable direct and indirect costs incurred).
6. *Allowance for doubtful accounts* (this may be considered "discounted cash flow" for final expected net income).
7. *Hospital margin* (that percentage above actual costs which are necessary for maintaining and expanding services plus replacement costs).
8. *Professional services* (that portion of the total procedural charge that may be a percentage of the gross or charged under separate billing. This may or may not be considered in a cost analysis).

B. Revenue Summary (Table 2).

Revenue summary may show the actual gross revenue of a previous year, project the gross revenue for the future or be a "base zero" forecast, in this case, an actual gross revenue.

C. Expense Summary (Table 3).

Expense summary may show the actual gross expenses broken down into variable costing categories for a period of time as this shows, or a similar summary could be used for base zero forecasts or future expense projections of an expanding department.

D. Income Statement (Table 4).

Income statement exhibits the net income by subtraction of expense from gross revenue. This could be refined further to give final net income after taxes.

At this point, hospital management has defined the economic structure of the nuclear medicine service and its relative financial status compared with other departments. It would have information on the performance of service categories within the department and have the decision or basis for arriving at a decision to (A) expand or contract service capacities or (B) discontinue unproductive endeavors or pinpoint areas where cost reductions are indicated.

E. Actual Cost Schedule (Table 5).

Finally, since procedural costs have been

	Apportioned	Direct	
Depreciation-building	\$ 305.00	Salaries	11,039.00
Depreciation-instrumentation	365.00	Consulting fees	549.05
Administration and general	7,158.00	Radiopharmaceuticals	17,887.67
Employee health and welfare	902.00	Film	976.32
Maintenance of plant	1,390.00	Dues and Travel	178.02
Laundry and linen	386.00	Accessories, noncapital	219.59
Housekeeping	1,225.00	Maintenance and repair of instrumentation	263.50
Cafeteria	768.00	Stock supplies	357.55
Central service and supplies	69.00	Office supplies	28.15
Pharmacy	5,014.00	Purchased services	67.50
		Miscellaneous	131.53
		Instrument rental	12,765.01
		Instrument depreciation (yearly)	1,426.90
Total	17,582.00	Total	45,889.79
		Total apportioned and direct expenses	\$63,471.79
		Professional interpretation expense	32,534.00
		Total expense	\$96,005.79

Revenue		\$98,490.00
Expense		
Apportioned	17,582.00	
Direct	45,890.00	
Professional	32,534.00	
Revenue		\$98,490.00
Expense		
Apportioned	17,582.00	
Direct	45,890.00	
Professional	32,534.00	
		96,006.00
Net contributory margin		2,484.00

Procedure	Current Price	Actual Cost	Dollar change
Brain	\$125.00	\$95	– \$30
Thyroid image and uptake	50.00	45	– 5
Lung image	100.00	90	– 10
Heart	75.00	65	– 10
Blood volume	25.00	50	+ 25
B ₁₂ absorption	35.00	65	+ 30
Therapy	125.00	80	– 45
Fat absorption	30.00	75	+ 45
Digoxin	50.00	90	+ 40

*Figures rounded to nearest \$5 or \$10 segment.

Cost estimate	Cost Estimate = \$50,000
	Assuming straightline depreciation and no residual value, the average investment would be equal to one half of the original expenditure:
	$\$50,000 \div 2 = \$25,000$
Rate of return	$\frac{2484 \text{ (average annual net income)}}{25,000 \text{ (half of original expenditure)}} = 9.7\% \text{ average rate of return}$
Cash payback period	$\frac{50,000 \text{ (expenditure)}}{2,484 \text{ (net cash flow)}} = 21 \text{ year cash payback period}$

determined, the next step may most appropriately be to check procedural price schedules or to justify same to third-party payers. The required hospital margin would be added to the determined procedural costs to develop suggested or necessary procedural charges.

Feasibility

A. Analysis of Capital Funding (Table 6).

1. *Cost estimates.* An analysis of proposed capital expenditures for initiating a new nuclear medicine facility, replacing current instrumentation, or expanding facilities and services would involve an examination of cost estimates (quotes from suppliers), which would show the basic alternatives available.
2. *Average rate of return.* The cost estimates would be used to evaluate the average rate of return that is expected as a measure of the anticipated contributory margin of an investment in hospital assets. The amount of net income expected to be earned from the investment is stated as an annual average over the number of years the asset is to be used. Assuming straight-line depreciation and no residual value, the average investment would be equal to one half of the original expenditure. Comparison of this expected rate of return with the rate established by management as the minimum for the risks involved will indicate the comparative attractiveness or feasibility of the proposed expenditure.
3. *Cash payback period.* The expected period of time that will elapse between the date of a capital expenditure and a complete recoupment in cash or equivalent is called the cash payback period. The excess of the cash flowing in from revenue, over the cash flowing out for expenses is termed the net cash flow. The time required for the net cash flow to equal the initial outlay for the asset is the payback period. Before you become alarmed about the 21-year cash payback period in the example, this can be reduced by (A) legitimate and objective pricing, (B) developing the department to improve the amount of work, (C) maintain or increase productivity, and (D) hold or decrease expenses.

B. Breakeven Analysis (Fig. 1).

Finally, the point in the operations of a nuclear medicine service at which revenues and expired costs are exactly equal is called the breakeven point. At this level of operations, neither a net income nor a net loss is realized. Breakeven analysis can be applied to past periods but is most useful when applied to future periods as a guide to planning, especially, if either an expansion or a curtailment of operations is anticipated. In such cases, it is concerned with future prospects

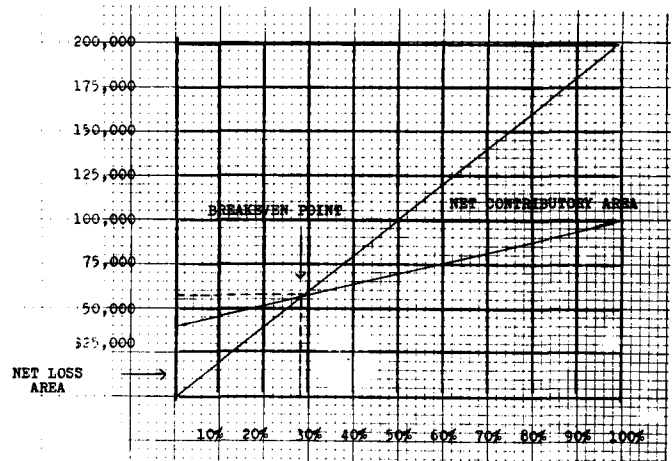


FIG. 1. Breakeven analysis.

and hence relies on estimates. Obviously, the reliability of the analysis is greatly influenced by the accuracy of the estimates. Here again, specialized experience in both the technical and management aspects of nuclear medicine coupled with objective evaluation of the hospital's situation can prove extremely valuable.

The breakeven point can be computed by means of a mathematical formula or presented graphically as the relationship among revenue, costs, and volume of productive capacity. In either case, the data required are (A) total estimated fixed costs and expenses for a future period, such as a month or a year; and (B) the total estimated variable costs for the same period stated as a percent of gross revenue. In examining the structure of the breakeven analysis graph

1. The percent of capacity is represented on the horizontal axis.
2. The gross revenue is on the left side of the chart.
3. A diagonal line is then drawn from the lower left corner to the upper right corner.
4. The fixed costs are plotted on the vertical axis to the left.
5. The total of fixed and variable costs are plotted on the right edge of the chart.
6. A diagonal line is drawn to connect these two points.
7. At the point of intersection of these two lines is the breakeven point.
8. The dotted lines represent the amount of revenues to breakeven at the indicated level of capacity.

Summary

In summary, we have discussed some of our

experiences in supplementing hospital management staffs and, through definitions and examples, we have demonstrated the practical applications of these various types of economic analyses. We have explained the need not only for general analysis of nuclear medicine economics in terms of overall hospital operations, but also the need for specific analysis at the departmental level to better aid hospital administration in decision-making, evaluating relative operating efficiencies of individual departments and within the department, base zero and expansion planning, implementing cost controls, defining the basis for procedural charges,

and documenting these to third-party payers, and finally, in short — and long-range planning.

Suggested Readings

1. Holfert EA: *Techniques of Financial Analysis*. 3rd ed, Homewood, Ill, Richard B. Erwin, 1972
2. *Cost Finding and Rate Setting for Hospitals*. Chicago, Ill, American Hospital Association, 1968
3. *Budgeting Procedures for Hospitals*. Chicago, Ill, American Hospital Association, 1971
4. Brigham EF, Weston JF: *Essentials of Managerial Finance*, 2nd ed, New York, Holt, 1971
5. Hutchinson GS: *The Strategy of Corporate Financing*. New York, President Publishing House, 1971