

## CHAPTER 2

### LITERATURE REVIEW

The primary purpose of managerial hospital cost accounting is to provide information that management can use to achieve its dual objectives of controlling costs and ensuring the facility's financial viability because they operate on as little or less net profit than a giant supermarket or a chain of discount department stores. Hospitals cannot survive without the best possible cost information, the best possible cost finding or analysis.

To evaluate the performance of the facility, management needs a measure of the average cost per unit of service. Dividing the total cost of the period by the volume of care provided during that time yields the average cost per unit. In general, unit costs should be expressed in terms that are meaningful to the organization or to individual responsible for incurring them. For example, the number of day of care, admissions, discharges, and visits may be used as measures of activity.<sup>(4,5)</sup>

#### Cost

The terms cost and expense have been used in a variety of ways and, thus frequently are a source of confusion. Basic to notion of cost is the sacrifice or exchange of one thing for another in an economic transaction. Thus, the term cost refers to an outlay of cash or other assets or service, or the incurring of liability in exchange for goods or services. Costs generally are measured in terms of the cash that is disbursed or will be disbursed in exchange for an item. They also are measured in terms of the fair market value of non-cash assets or the services that are given or will be given in an exchange transaction.

An expense, on the other hand, is an expired cost. Expenses are costs that are associate directly or indirectly with the revenue of a given period. The expiration of costs and the resultant recognition of expenses normally governed by one of the following principles:

1. Association of Cause and Effect: Since certain cost items are directly related to the generation of revenue (or are presumed to be so) they are recognized as an expense. Consequently, the recognition of revenue is accompanied by the recognition of the related expense.
2. Systematic and Rational Allocation: When cost are not directly related to the generation of a specific item of revenue, they are allocated to the time periods that benefit from the use of the corresponding resource.
3. Immediate Recognition: Some costs can be recognized immediately because the use of the corresponding resource does not contribute to a future period or to the generation of future revenue.<sup>(4)</sup>

However, the terms of cost and expense are used interchangeably. In financial accounting, a cost is classified in various definitions depend on their objectives such as fixed cost, variable cost, explicit cost, implicit cost, opportunity cost, relevant cost, incremental cost, sunk cost and so on.<sup>(6)</sup> Many terms of cost involved this study are as follows:

Direct costs are the elements that are traceable to a given expenditure objective. Direct costs emanate from the use of labor, consumable supplies and capital cost in a production process that results in an identifiable service or output.

Total direct costs refer to the sum of direct labor, supply and capital cost.

Conversely, indirect costs refer to all those other than direct costs. For example, assume the cost objective is a given procedure that is provided by one of the departments of the institution. The indirect costs consist of an equitable share of total direct cost.

Full cost refers to the money value of all resources used for a given cost objective, more specifically, to the sum of all relevant direct costs and an equitable share of all indirect costs.<sup>(5)</sup>

Labor cost includes all of personnel benefits such as salaries, wages, overtime, welfare, and travel expense.

Material cost includes all consumable supplied and other facilities for example light, pipe water, fuel.

Capital cost includes depreciation cost of building and major movable equipment. The simple method for computing depreciation in this study is straight-line method. This method is a technique that charges an equal amount of depreciation to each year of the asset's useful life. The formula for the straight-line method is:

$$\text{Annual Depreciation Cost} = \frac{\text{Cost} - \text{Salvage Value}}{\text{Estimate Useful Life}}$$

For purpose of illustration, assume the cost of new equipment is 60,000 baht and its salvage value is 0 baht. This new asset is estimated to have a five-year useful service life. The annual depreciation is:

$$\frac{60,000 - 0}{5} = 12,000$$

Thus, in each year of the asset's useful life, 12,000 baht is charged as a depreciation cost of this item of equipment.<sup>(4)</sup>

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## Cost Finding

The basic goal of cost finding is to determine full costs (direct costs plus allocated indirect costs) of each revenue and non-revenue producing cost center in the hospital. Full costs include salary, supply and overhead (including depreciation) costs. Full cost should be determined and reported to health care financial managers for setting rates, negotiating reimbursement arrangements and contracts and reporting on health care costs to external organizations. The American Hospital Association defines cost finding:

Cost finding is the apportionment or allocation of costs of the non-revenue producing cost centers to each other and to revenue producing centers on the basis of the statistical data that measure the amount of service rendered by each center to other centers.<sup>(7)</sup>

### Prerequisites for cost finding

1. An up to date organization chart separating cost centers.
2. A chart of accounts that is consistent with the organization structure.
3. An accurate hospital information system that is capable of providing:
  - a. financial and cost data for each cost center and
  - b. statistical and other non-financial data for each cost center.
4. An appropriate cost finding technique that will be practical and meaningful for the particular institution.

The organization structure is a key element of cost finding. Cost finding should ideally be consistent with the locus of authority and responsibility in the organization. Cost centers must be clearly identified. The relationships between each cost center must be identified so the services provided to other cost centers are clear. In other words, the order in which costs are distributed from one cost center to other cost centers must be delineated.

The second important prerequisite for cost finding is that the chart of accounts be consistent with the organization structure. Failure to maintain consistency here can result in inaccurate and deficient cost finding results. Therefore, an updating of the chart of accounts is the first step toward achieving an accurate information system.

The third prerequisite concerns the accuracy and adequacy of the hospital's information system. The information system must be capable of minimizing errors in recording and classifying data. It must be able to correctly match direct costs with cost center incurring those costs. Accrual accounting must be used to properly record inventories, receivables and payables. In other words, the information necessary for reclassifications and adjustments must be readily available in the accounting system.

Another important aspect of the information system is the non-financial data. Cost finding depends on knowing the quantity of services provide by or to other cost centers. The quantity of services shared by separate cost centers is usually represented by non-monetary statistical data, which portray the activity level of service in each cost center. These activity measures should be clerically feasible to compile and should be meaningful measures of the most important service provided by that cost center. Examples of such non-monetary measures include square footage, number of employees, number of full time equivalent (FTE) employees, number of meals, pounds of laundry, etc.<sup>(8)</sup>

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## Cost Center

The various cost centers used in the hospital can be easily identified from its accounting records. Usually each major department forms a cost center. Each department or functional unit in the hospital should be classified separately into one of three major groups<sup>(9)</sup> or more groups of cost center namely:

- a) Non revenue producing cost center or non-charging directly to patients
- b) Revenue producing by charging to patients for their services
- c) Patient service areas
- d) Non patient service areas<sup>(10)</sup>

The order in which the various cost centers are listed under each group is not important.<sup>(9)</sup> Table 2.1 shows example of cost centers according to the four required groups of example hospital.

Table 2.1 Example of various cost centers

(a) Non Revenue Producing Cost Center (NRPCC) :	
1. Administration	3. Laundry
2. Business Office and Data Processing	4. Medical records
(b) Revenue Producing Cost Center (RPCC) :	
1. Operating Room	3. Pharmacy
2. Laboratory	4. Delivery room
(c) Patient Service Areas (PS) :	
1. Medical	3. Intensive Care Unit
2. Surgical	4. Emergency
(d) Non Patient Service Areas (NPS) :	
1. Teaching	3. Community Service
2. Research	4. Public Relation

### Cost Finding Technique

After cost centers have been designated, the accounting system must be accurate enough to accumulate and assign appropriately all financial data to the various cost centers. This is a necessary prerequisite not only if the direct costs of each cost center are to be accurately determined, but also if accurate full cost data are to be obtained. Full costs should be defined as the total financial requirements including both direct and indirect costs of the hospital. The direct costs (labor cost, material cost and capital cost) are generally easy to trace to individual cost centers. However, the full cost of patient service areas must also include the indirect costs, which are not directly traceable to the specific service. The allocation is used to determine full cost of each "final" cost center. Figure 2.1 illustrates a simplified model of how service flow between health care departments. Each of these flows of service could be used as a basis for cost finding.

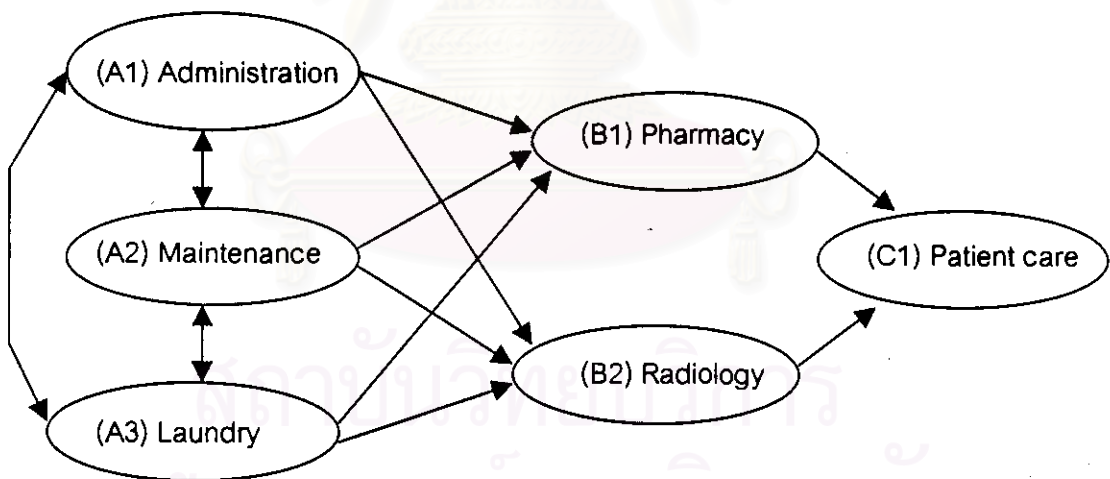


Figure 2.1 Conceptual model of health care services



Four basic methods of cost allocation technique are commonly used in cost analysis, including

Method1: The direct apportionment method

Method2: The step-down method

Method3: The double distribution method and

Method4: Algebraic or reciprocal method

The four methods differ primarily in the manner in which costs are allocated from non-revenue and revenue producing cost centers. They differ in terms of which flows are recognized as dominant.<sup>(6)</sup>

#### Direct apportionment method

In the direct allocation method, the costs of non-revenue and revenue centers are allocated directly to patient care centers. This method ignores the fact that most non-revenue and revenue centers also provide services to other non-revenue or revenue centers as well as patient care centers. Figure 2.2 illustrates the flow of cost allocations in the direct method. Costs of non-revenue and revenue centers are only allocated to patient care centers. As noted above, this method ignored all of the services provided by administration to other departments (and vice versa). The major advantages of this method are its simplicity and the ease with which it is understood.<sup>(6)</sup>

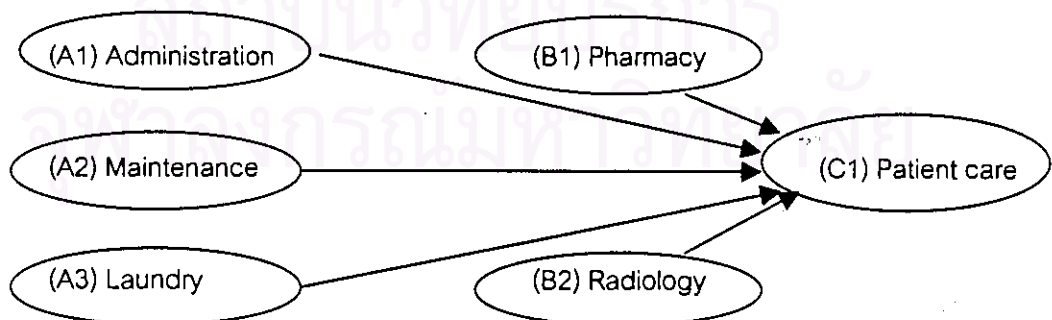


Figure 2.2 Direct allocation method

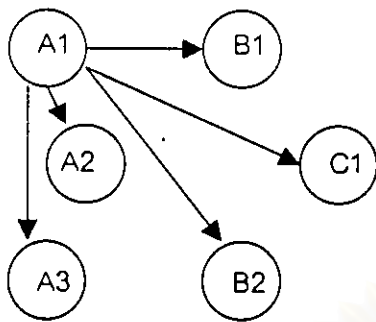


### The step-down method

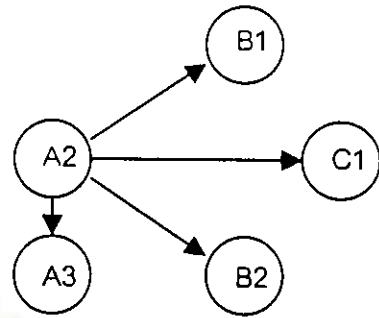
The step-down method is a more advanced cost finding technique than direct allocation. This method does compensate for some of these weaknesses in that some of services provided by non-revenue and revenue centers to other non-revenue and revenue centers are recognized. Figure 2.3 illustrates a simple step-down allocation. Note that the administration department costs (A1) are *first* allocated to all other departments that have received administration services. *Second*, A2, maintenance costs (plus its shared of A1) are allocated to the remaining departments. The administration has now been "closed" for cost allocation purposes, and no additional costs are charged to it. *Third*, A3, Laundry costs (plus its shared of A1 and A2) are allocated to other departments. At this point, all the non-revenue departments are "closed", and all their costs have been allocated to revenue and patient care departments. *Forth*, B1, pharmacy costs (plus its shared of A1, A2 and A3) are allocated to other department. *Fifth*, B2, radiology costs (plus its share of A1, A2, A3 and B1) are allocated to patient care. At the end, all non-revenue and revenue centers are closed and their costs have been allocated to patient care center so that full cost of patient care center can be determined. In summary, the step-down method consists of the following steps:

1. Allocate costs of the non-revenue and revenue centers to other centers. As a general rule, the cost center that provides the greatest amount of services to other centers and receives the fewest services should be allocated first. Alternatively, the center with the largest total costs should be allocated first.

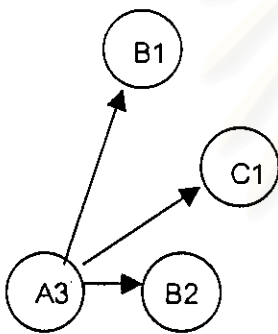
2. The order of allocation continues on this basis until the costs of all non-revenue and revenue centers have been allocated. At this point, all the non-revenue and revenue centers are "closed" in terms of the allocation process. "Closed" cost centers do not receive allocation from any other centers. This allocation process can be more or less complicated depending on the number of departments that are used as input in the cost allocation.<sup>(8)</sup>



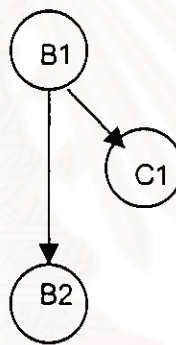
Step 1



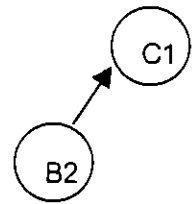
Step 2



Step 3



Step 4



Step 5

Figure 2.3 Step-down allocation method<sup>(10)</sup>

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### The double distribution allocation method

The double distribution method was designed to correct one of the major weaknesses of the step-down method. This deficiency is the step-down method's failure to account fully for interdepartmental services. As described, departments are successively closed under the step-down method. Under the double distribution method, each department remains "open" and costs can be reallocated to non-revenue and revenue centers. Figure 2.4 and 2.5 illustrate the first and the second distribution of the double distribution method. This method may use two iterations, at which time all non-revenue centers are "closed" or the iterations may continue successively until further iterations result in immaterial changes in the allocations. In each case, the final allocation is made successively to the patient care center (as in the step-down method).

The first allocation under the double distribution method is identical to the first step in the step-down method. However, the second step may selectively exclude a few departments or it may be based on different service measures. The iteration corresponds to the patterns of services between centers. Consequently, each institution's approach to double or multiple distribution methods will be unique at the second or third (or more) stage of the allocation processes.

Double distribution methods provide a better approximation of the full cost of patient service centers. The results are more representation of actual patterns of activities and flows of services. This allocation method more precisely represents the interaction between cost centers. Even though these methods are gaining in popularity, they lack some objectivity. They are ambiguous about when to stop reallocating costs to cost centers and with regard to the order of priority in which to consider the cost allocations. Any change in the order of precedence in the allocation, or a change in the stopping criteria, will change the results perhaps significantly. For these reasons, the algebraic or reciprocal methods are recommended as the most accurate representations of all known patterns of services and activities.<sup>(B)</sup>

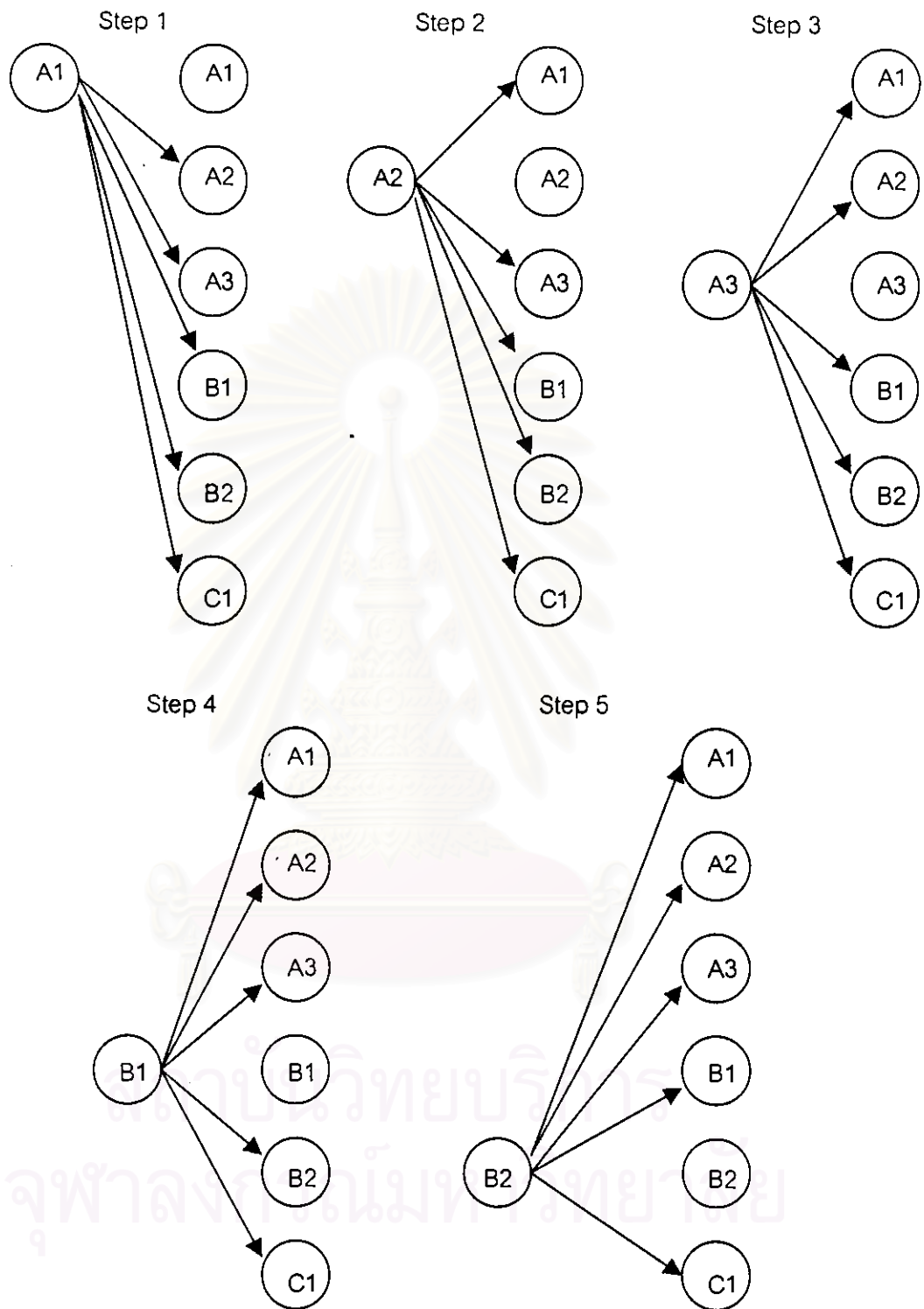


Figure 2.4 the first distribution of double distribution method

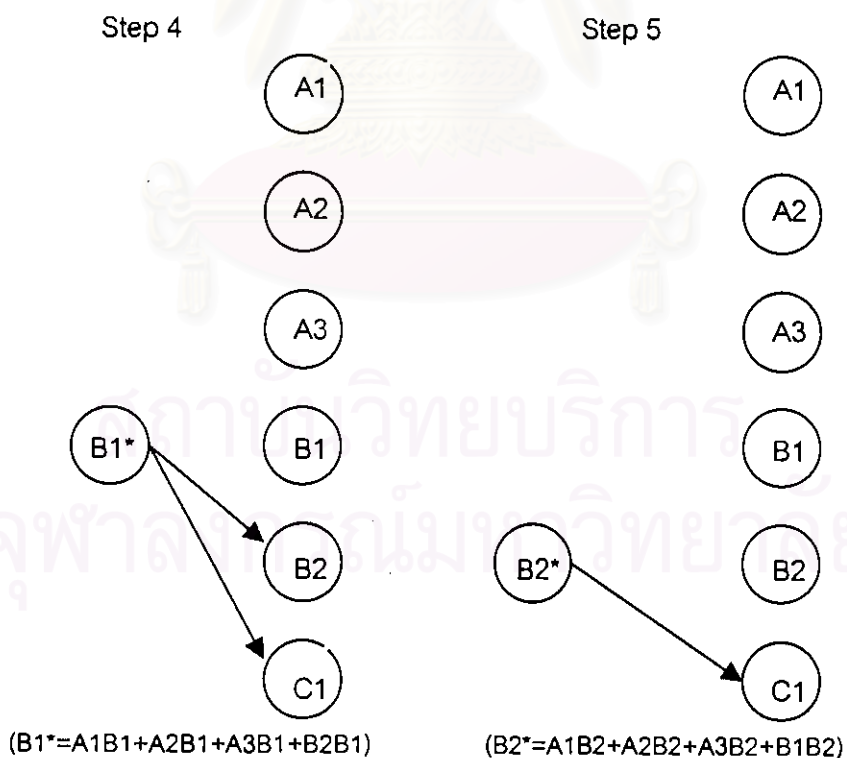
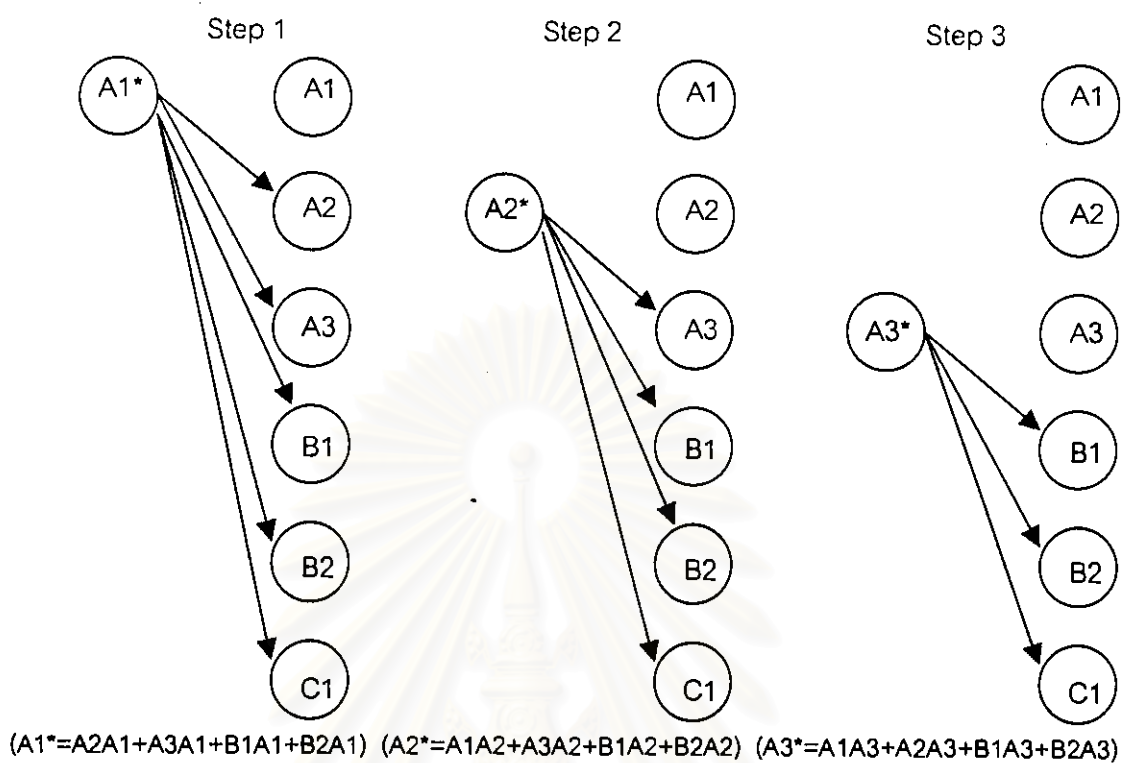


Figure 2.5 the second distribution of double distribution method<sup>(10)</sup>

### Algebraic or reciprocal method

The reciprocal method involves the simultaneous solution of a series of equations. This method results in the most complete allocation of all costs. It is the most defensible method. It is also the most complex and it usually requires the aid of a computer program. Manual use of simultaneous equation method is limited to four to six cost centers. Most hospitals have more than six departments and would have to use a computer to do cost finding. Method 1, 2 and 3 can be computed manually with a calculator for hospitals that have 10 to 20 non-revenue and revenue centers and 30 to 40 patient service centers. Method 1 would take the least amount of time; method 2 would take more time than method 1, and method 3 would take at least twice as long as method 2.

The reciprocal allocation method recognizes all the services that are provided for other centers and because of this recognition should result in a more accurate cost finding than any of the other three methods.<sup>(11)</sup>

Figure 2.6 details the relationship of the cost flows under reciprocal allocation technique. Ultimately, all non-revenue and revenue centers are allocated to the patient service centers. Consequently, under the reciprocal or simultaneous allocation method, the total amount of a particular non-revenue and revenue center's costs that are allocated to each patient service center is affected by the reciprocity of services that each non-revenue and revenue centers provides the other patient service centers.

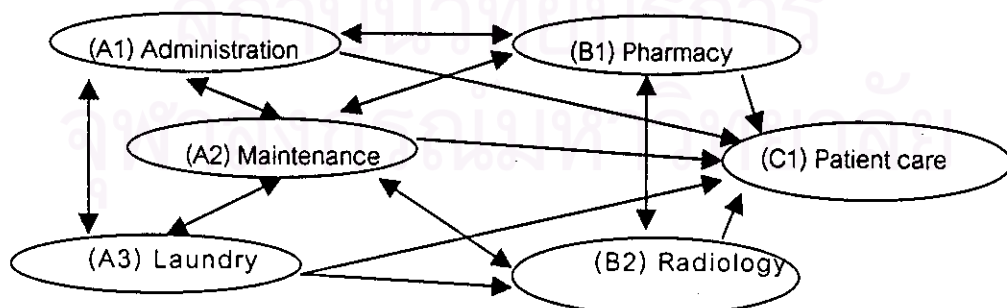


Figure 2.6 Reciprocal allocation method

Mr. Foyle could demonstrate the difference in apportionment by the various methods of cost analysis, but conclude that the mathematical method was not the only factor to be considered in cost distribution. Certain management decision made in the beginning, such as the basis of allocation (square footage, pounds of laundry, number of meal), might widen differences more than mathematical methodologies.<sup>(12)</sup>

Consequently, on the basis of accuracy alone, the order of preference is: (1) algebraic or reciprocal method; (2) double distribution method; (3) step-down method; and (4) direct apportionment method.<sup>(13)</sup>

### Costing Methodology

Several important steps in costing methodology<sup>(10)</sup> include:

1. System analysis of the hospital
2. Cost center identification
  - ◆ Non Revenue Producing Cost Center (NRPCC) i.e. Administration, central supply, laundry, medical records, catering
  - ◆ Revenue Producing Cost Center (RPCC) i.e. laboratory, radiology, operating room, delivery room, pharmacy
  - ◆ Patient Service areas (PS) i.e. out-patient service, in-patient ward
  - ◆ Non Patient Service areas (NPS) i.e. teaching, community service
3. Determination of labor cost (LC), material cost (MC), capital depreciation cost (CC) for each cost centers
4. Total cost calculation (LC+MC+CC) by each cost centers
5. Cost allocation criteria determination: Appropriate criteria must be determined to allocate total cost from NRPCC, RPCC to PS and NPS.



6. Cost allocation technique

- ◆ Direct allocation
- ◆ Step-down technique
- ◆ Double distribution technique
- ◆ Simultaneous equation : multiple allocation

7. Full cost calculation

total direct cost + indirect cost = Full cost by cost center

8. Determine hospital products: number of out-patient visits, number of in-patient cases and hospitalization days provided

9. Unit cost or average cost calculation

unit cost = full cost of PS divided by its relevant output

**Review of the Related Literatures**

Some of the different hospital cost studies are reviewed. Pracha Vasuprasat<sup>(14)</sup> studied "Hospital cost functions in Bangkok" in 1979. The purposes of his study were to search for the optimal size of hospitals in term of beds , the optimal turnover rate of patient and the nature of hospital cost curve. The basic model specification is that average cost per patient day is a function of the number of beds , case flow and characteristic of hospital. His study suggested that hospital should maintain its capacity utilization at approximately 29 - 33 cases per bed per year range, the average cost curve is U-shaped and optimal size is 542 beds for all hospitals under consideration , since there is no interaction between size and characteristic of hospital.

Kanongyud et.al.<sup>(15)</sup> studied in fiscal year 1980 and found that proportion of LC:MC:CC of extraordinary large hospital (more than 360 beds) is 35:53:12. Somsak Pongprasert et.al.<sup>(16)</sup> studied in fiscal year 1986 and found that proportion of LC:MC:CC of Lampang provincial hospital is 36:59:5. Research of Surachai Rungtanapirom et.al.<sup>(17)</sup> who studied in fiscal year 1986 and found that proportion of LC:MC:CC of Sappasittiprasong hospital Ubon Ratchatani province is 43:55:2. Suwit Vibulpolprasert et.al.<sup>(18)</sup> studied financial information system development of 8 hospitals (Doi Saket hospital and Chiang Mai hospital, Chiang Mai province, Si Bun Ruang hospital and

Udon Thani provincial hospital, Udon Thani Province, Tha Mai and Prabokkuan hospital, Chanthaburi Province) in the fiscal year 1989 and found that proportion of LC:MC:CC is 5:4:1.

Srisurang Jitchinakul studied unit cost of Lerd-Sin Hospital in the fiscal year 1977-1979.<sup>(19)</sup> Costs were allocated by step down method. The unit cost of out-patient was 90 baht per visit. The unit cost of in-patient for medical , surgery , orthopedic surgery, pediatric, obstetric and gynecology, EENT, VIP and ICU ward were 268, 268, 168 , 238 , 199 , 200 , 391 and 1951 baht per patient day for each patient respectively.

Jeerawan Wannawake studied The unit cost of the new out-patient of Chulalongkorn hospital in the fiscal year 1990 from the perspective of provider.<sup>(20)</sup> Costs will be allocated by the simultaneous equation method using appropriate allocation criteria. The unit cost of the out-patient department was 241.73 baht.

The unit cost of out-patient in the department of Medicine , Chulalongkorn Hospital in the fiscal year 1990 was studied by Sukalya Kongsawatt.<sup>(21)</sup> Costs were allocated by the simultaneous equation method. The unit cost of the out-patient in the department of Medicine was 253 baht. The unit cost of the general medicine clinic, dermatology clinic and specialty clinic were 266, 217 and 251 baht respectively. The total direct cost of the department of Medicine consist of 59 % labor cost , 28 % material cost and 13 % capital cost.

Sunee Chalapirom et al. studied costing of Somdet Chaopraya psychiatric hospital in 1990.<sup>(22)</sup> The operating expense excludes the capital depreciation was studied. The objective of her study was to present the unit cost of out-patient and in-patient from provider perspective. Indirect costs were calculated by simultaneous equation method. The results revealed that the labor expense : material expense was 1.72 :1.

Bovorn Ngamsiriudom et al.<sup>(23)</sup> studied unit cost and cost recovery of Maternal and Child Hospital, Chiang Mai Province in 1994. The prospective study was beginning from 1 June 1994 to 31 January 1995. The total direct cost consists of labor cost, material cost and capital cost. Ratio of LC:MC:CC equals 6.23:2.69:1. The overall unit costs of an out-patient and in-patient service are 152 baht/visit and 922 baht/hospital day, respectively.



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