CHAPTER 4

METHODOLOGY

4.1 Scope of Study

1. The research design of this study is a retrospective study made by secondary data of catheter unit to identify /analyze cost, output (patient) and revenue during the year 2003.
2. Cross sectional data by primary data from individuals to determine willingness to pay to this unit.

4.2 Cost analysis

4.2.1 Allocate overhead costing

Cost allocation involves the transfer or allocation of costs from one department to another. The purpose of such allocations is to develop a price for service, determine the relationship of total revenue and total cost for a department or service, and to determine profitability on a product line or departmental basis. In health care most allocations involve cost transfers from overhead centers (non-revenue department) to revenue centers (revenue department) (Ward, 1992).

Step-down method has been used to allocate the overhead costing. The steps as follows:

1. Rank the support cost centers in order, the one that is consumed the most by others would be ranked the first, and next would be the second.
2. Allocate direct costs from the first rank down unit, the last support cost center.
3. Allocate denominators is the sum of allocation criteria of all cost centers that are not yet allocated.
4. Never allocate back to the previous support cost centers.

Table 4.1: Allocation bases criteria

Number	Cost center	Allocation criteria
1	Building	Square meter
2	Administration	Salary
3	Cleaning	Square meter
4	Guard	Salary
5	Utility	Square meter
6	Maintenance- building	Square meter
7	Rent	Square meter

4.2.2 Classify the cost for catheter unit

The cost of the catheter unit can be classified into two elements (fixed cost and variable cost).

1. **Fixed cost**: fixed costs are those cost that tend to remain constant over the course of many accounting period, such costs are not influences by changed in volume or intensity of service. Four main cost items are taking into consideration to calculate fixed cost.

Cost of medical equipments: calculate the annual depreciation of medical equipments.

Cost of furniture and equipments: calculate the annual depreciation of furniture and equipments.

Salary of doctors, nursing, and all staff for catheter unit: calculate the salary for all staff that not influenced by changed in the volume of patients.

Overhead allocation from overhead centers to catheter unit: calculate the overhead cost that not influenced by changed in the volume of patients.

2. **Variable cost**: Variable costs are those that rise and fall in relation to changes in the level of activity. Examples include disposable supplies (e.g. intravenous tubing, contrast dye, stents); variable costs can be pay from catheter earning or subsidy from government.

Using the following formula to calculate unit variable cost for each function inside catheter unit:

$TC=\gamma_1$ Diag $+\gamma_2$ Ball+ γ_3 Pace+ FC+ ϵ_i

Where

TC= total cost.

γ= gamma (unit variable cost).

Diag= number of Diagnosis patients.

Ball= number of Balloon patients.

Pace= number of Pacemaker patients.

FC= fixed cost.

ϵ= error term.

Using regression analyses to analyze the results that determine the unit cost per each function **by enter the data monthly**.

Convert each of Ball and Pace to Diag to find the equivalent number of patients for all functions (diagnosis, balloon, and pacemaker), this equivalent number of patients will be used to estimate break-even point for catheter unit; cost ratio has been used by divided unit variable cost for each balloon and pacemaker over diagnosis to get the equivalent number of patients (total output).

γ_2/γ_1 Ball= Diag

γ_3/γ_1 Pace=Diag

$\gamma_1 * Q= \gamma_1$ Diag+ γ_2Ball+ γ_3Pace

Q=Diag+γ_2/γ_1Ball+γ_3/γ_1 Pace

By assuming that γ_1 is the unit variable cost. Equivalent diagnosis has been used because the majority of patients are diagnosis patients; this also should be minimizing statistic error. However, using γ_2 or γ_3 as unit variable cost will give the same result.

Data collection: collect data from Catheter Unit, Medical Store, Center Store, Finance Department, Palestinian Health information System, and Maintenance Department.

4.2.3 Total Revenue

Total revenue include payments from patients and from government

TR=f (patients charges, government)

Use the following formula to set the price

Equivalent Diag= Diag+γ_2/γ_1Ball+γ_3/γ_1 Pace

Average price=Σ Total revenue/Equivalent Diag

4.3 Break-Even Analysis

The analysis of the break-even point answers many questions which managers often face, such as:

1. What is the minimum production to make sure the organization is profitable?
2. What is the minimum production capacity before the organization becomes unprofitable?
3. What are the maximum production expenses for one product without becoming unprofitable?

The analysis is based upon the following values; amount of product **q**, product price **p**, product variable cost **b**, fixed cost **FC** (e.g., energy, water, and wages), costs **TC** and revenues **R** (insurance company payments).

The Break –Even Point with Constant Price and Linear Costs

It holds that with constant price the revenue develops according to the relation:

$R = p*q$

And the expenses with linear (proportional) develop according to this relation:

$TC = FC + b*q$

Then, if that is true, then profit is the difference between revenues and expenses

$P = R - TC$

It is obvious that we get profit when R> TC; in the opposite situation there is loss. When R= TC, there is neither profit nor loss. We can analytically derive it from the equations above:

$R = C;$

$p * q = FC + b * q$

$$q = \frac{FC}{p-b}$$

Where

FC=fixed cost.

q = number of patients.

p = price.

b = unit variable cost.

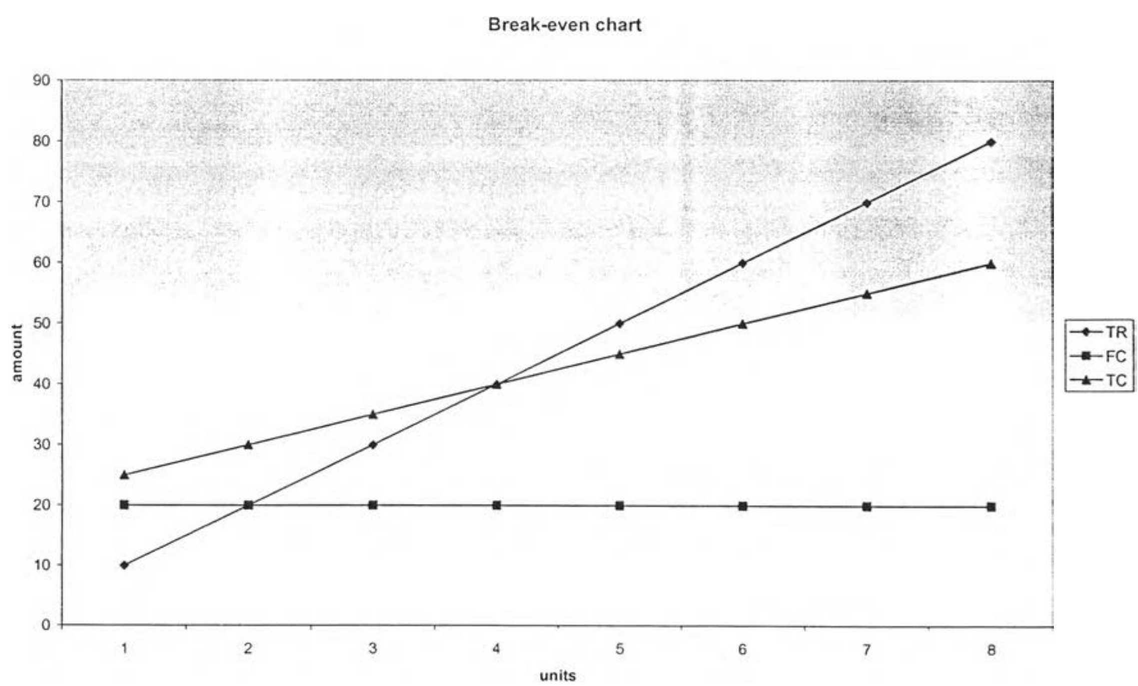


Figure 4.1: The Break –Even Point with linear development of expenses and revenues
Source: Stritecky and Pubal, 2000.

After calculate BEP, the number of patients where total cost= total revenue is allocated on the functions of catheter unit to estimate the number of patients for each functions by using the following formula

Equivalent Diag= Diag+γ_1/γ_2Ball+γ_1/γ_3 Pace

Break-even point is an analytic technique that helps determine the level of volume needed to reach the financial break-even point, the point at which net revenue exactly equals cost. At this point there is neither a loss nor a profit (Ward, 1992).

Break-Even Analysis will fall into two categories: fixed cost and variable cost. Fixed costs are those that there are incurred regardless of how much service is provided. They include items such as the capital costs of equipment and facilities, overhead items such as utilities and maintenance, and minimum personnel requirements to operate the facility. Variable costs are items of expense that relate to the direct cost of providing care and are expressed as costs per unit of service delivered (Austin et al. 1995).

Break-even chart assumes that the firm's average variable costs are constant in the relevant output range, hence, the firms total cost function is assumed to be a straight line. Since average variable cost is constant, the extra cost of an extra unit-marginal cost-must be constant too, and equal to average variable cost.

To construct a break-even chart, you plot the firms total revenue curve on the same chart with its total cost function. Typically, it is assumed that the price the firm receives for its product will not be affected by the amount it sells; with the result that total revenue is proportional to output.

Under the right conditions, break-even charts can produce useful projections of the effect of the output rate on costs, receipts and profits. For example, a firm may use a break-even chart to determine the effect of a projected decline in sales on profit, or it may use to determine how many units of a particular product it must sell in order to break even (Mansfield, 1999).

Calculate how government subsidy this unit if break even point for patient more than the real number of patients who visited catheter unit. In another ward, government covers the difference between total cost and total revenue.

Operation loss= Total cost-Total revenue + (any cost subsidy that included in fixed cost & variable cost).

*=fixed cost+ variable cost*no. of patient- price*No. of patient+ (any cost subsidy that included in fixed cost & variable cost).*

4.4 Willingness to Pay (WTP)

The willingness to pay approach is an evaluation method used to determine the maximum amount of money an individual is willing to pay to gain a particular benefit (e.g. receive a healthcare service). The method is often used in cost-benefit analysis to quantify a benefit in monetary terms (European Observatory on Health Systems and Policies, 2000).

Willingness to pay introduces the concept of monetary value. The foundation for this is that people are accustomed to making decisions about how much they are willing to spend upon most things relating to life-from small items such as food and clothing, and medium-cost decisions such as annual holidays, through to major expenses including car and house. The amount that the individual is willing to pay is an indicator of the utility or satisfaction that they expect to gain from the particular commodity.

Various methods have been used to elicit WTP values, including basic questions such as "what is the most that you would be willing to pay for? A variation on this is to present a list of options or a set of cards containing "bids" of increasing amounts, from which the respondent selects the amount they would be willing to pay.

One of the two fundamental building blocks of microeconomics is the demand function, the relationship between price and quantity. Demand function is requirements to determine consumer surplus and economic benefit. In determining the demand, Willingness to pay and Ability to pay is important, therefore, in this study WTP by individuals is estimated to determine the demand function for health services in the catheter unit.

Individuals willingness to pay: gathering primary data from population sample to see how the individuals willing to pay for catheter unit, by assuming that WTP depend on the following independent variable age, education, income, work status, gender, marital status, health insurance, knowledge about CVD, and health status.

$$WTP=\beta_0+\beta_1 age+\beta_2 educ+\beta_3 inc+\beta_4 work+\beta_5 gen+\beta_6 mar+\beta_7 resid$$
$$+\beta_8 hi+\beta_9 know+\beta_{10}CVD+\beta_{11}kind+\epsilon i$$

Where

β_0=constant.

$\beta_{1,2,3,4,5,6,7,8,9,10,and 11}$= parameters.

Age = age of individuals.

Educ= level of education.

Inc= monthly income in USD.

Work= work status.

Gen= male & female (dummy variable).

Mar= marital status.

Resid=place of resident.

Hi = health insurance.

Know= knowledge about CVD (dummy variable).

CVD= Cardiovascular disease.

Kind= kind of CVD.

The following formula will be use to estimate the size of the sample need to collect primary data for WTP.

$$N=\frac{Z^2{}_{1-a/2}P*Q}{d^2}$$

Where

N= the desired sample size.

Z^2 1-a/2 =the standard normal deviation, set at 1.96 corresponding 95% confidence interval (0.05).

P= the variability of the characteristic to be measured in the population.

Q= 1-P.

D= the degree of accuracy required.

Set a new price depend on willingness to pay for patient for each functions inside catheter unit, and then calculate the new break even point and do the government subsidy or not, and how much.

Economic value of catheter unit will be calculated by using sensitivity analysis. The difference between the price and the unit cost will be estimated.

Depending upon the difference obtained the government might have to cover the cost if the new price is less than unit cost, but government may benefit if new price is more than unit cost. Benefit for the government in terms of GDP from extending life saved of patients can be estimated using sensitivity analysis for 5, 10, 15, and 20 years.

1. Economic value for patient (EVP) = number of years saved * GDP per capita
2. Economic value for Government (ENG) = Price - cost for treatment = Difference subsidy from government compare with EB
3. Expected benefit

$$EB = (1-x)*-\$23 + x\left[\frac{yearssaved * GDPpercapita - \$23}{employee / population}\right]$$

x = proportion of population with CVD

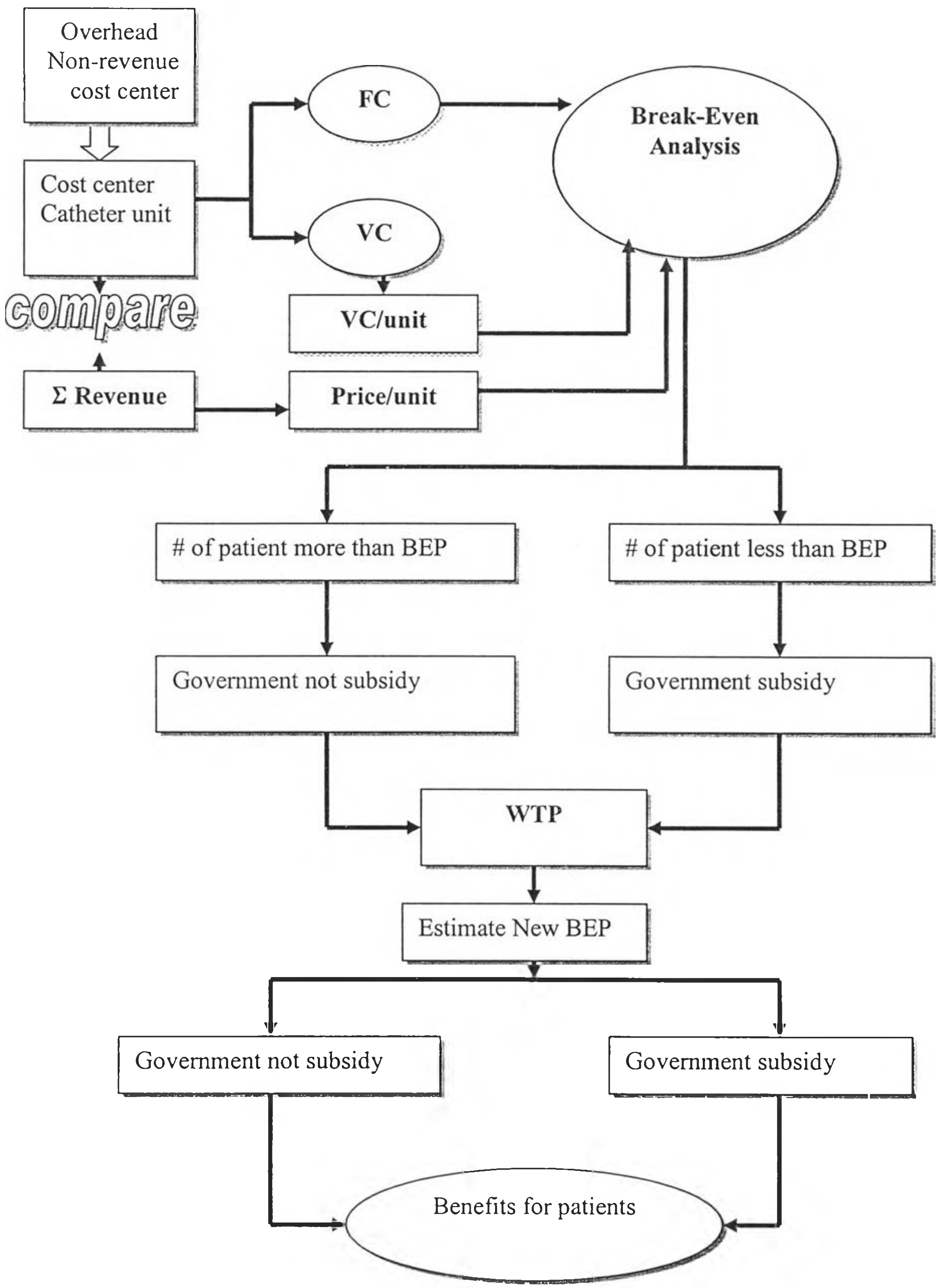
-\$23= Transportation (\$6.4) & Time Loss (\$16.6)

Using second formula, the economic value for government can be calculated, this can be obtained by subtracting unit cost for each function from new price, and adding to expected benefit.

In third formula, it shows the average patient who visits catheter unit, the probability of this patient without CVD is (1-x), and the probability with CVD is x, first half (1-x) is multiplied by -\$23, because some patients without CVD disease may use diagnostic test, which means catheter unit doesn't save life of these patients. But the patients stand the racket of transportation and the loss of time.

In the second half of third formula, x is multiplied by (-$23) because the probability patient with CVD also stand the racket of transportation and the loss of time, individual employee divided by total population because it is assumed that not all patients work, e.g. some of them less than 15 years old. By excluding patients under 15 years old, GDP per worker can be obtained by divided GDP per capita upon working age (population more than 15 years old), as GDP per worker multiplied by x (proportion of population with CVD) multiplied by years saved to estimate benefit using sensitivity analysis for 5, 10, 15, and 20 years. This is also because government benefit by treating patients in working age group at the catheter unit.

4.5 Conceptual Framework



4.6 Time Frame

This study will be conducted between January-May 2005, the activities explain in the following table

Duration: 5 month (1/1/2005 to 13/5/2005)

Activities	**Time Frame: Weeks**																			
Starting January 2005	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Prepare research proposal																				
Collect secondary data																				
Collect primary data																				
Data editing & perfecting																				
Data analysis																				
Write-up first draft of the report																				
Thesis examination																				
Submission 4 copies of thesis																				