สำนักงานวิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

It is the retrospective design. Data were collected retrospectively from the medical records of the patients transplanted during 1991 to 1997.

3.2 Population

1.Target population and population to be sampled :

Patients who underwent bone marrow transplantation at Chulalongkorn Hospital during 1991 to 1997.

2.Inclusion criteria :

The patients who had bone marrow transplantation and survived until the initial discharge without any complication.

3.Exclusion criteria :

- The patients who died during the operation and before discharge.
- Patients with active uncontrolled infection , active non - malignant gastric or duodenal ulcer , uncontrolled diabetes mellitus , or other severe medical conditions which would preclude aggressive cytotoxic chemotherapy.
- Patients with history of malignant disease in the previous 5 years
- Serious medical or psychiatric illness which prevent informed consent.

4.Sample size :

56 cases of bone marrow transplantation patients who met the inclusion criteria of the study.

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3.3 Data Collection

The cost categories were retrieved from each patient 's medical record about treatment , laboratory tests, medical and nursing services. Some data are collected from the record of the unit which provide the service to the patients including intensive care unit of hematologic ward. The costs of drugs , medical supplies and equipment were taken from the Pharmacy department and Purchasing department.

3.4 Costing Methods

This study will examine only the provider costs from the day of admission to the day of discharge and follow up at 6 months.

3.4.1.Cost Components : there are 2 cost of cost components in this study. First is capital cost and second is recurrent cost (labor cost and material cost)

I. Recurrent costs : are those costs associated with the operation or maintenance of facilities or assets. The items mentioned below will be considered as the recurrent costs

I.I Labor cost : Expenditure for personnel and fringe benefits.

I.II Material cost :

a) Expenditure for supplies

b) Expenditure for diagnostic laboratory tests and other special treatment.

c) Expenditure for drugs

d) Expenditure for office facilities

II. Capital costs : Costs of items which have a life expectancy of one year or more , have value equal to or more than $100 and are concentrate at the beginning of a project and associated with the establishment of productive capacity and physical infrastructure (Abell-Smith and Creese , 1992)

a) Building : The space for Bone Marrow Transplantation Unit at Chulalongkorn Hospital and it's infrastructure furnishing , also built - in equipment. For the building cost in this study under the assumption as all of the capital inputs are fully utilized.

b) Equipment : All equipment in Bone Marrow Transplantation Unit at Chulalongkorn Hospital such as bone marrow aspiration set , hepafilter , suction vacuum , and etc.

c) Long term training : All expenditure occurred for long term training in Bone Marrow Transplantation Unit.

3.4.2 Cost Identification

I. Identification costs incurred to the provider according to BMT activities which are shown in Figure 2.1

II. Identification of input resources according to these direct medical item :

a) Physician services.

b) Nursing care services.

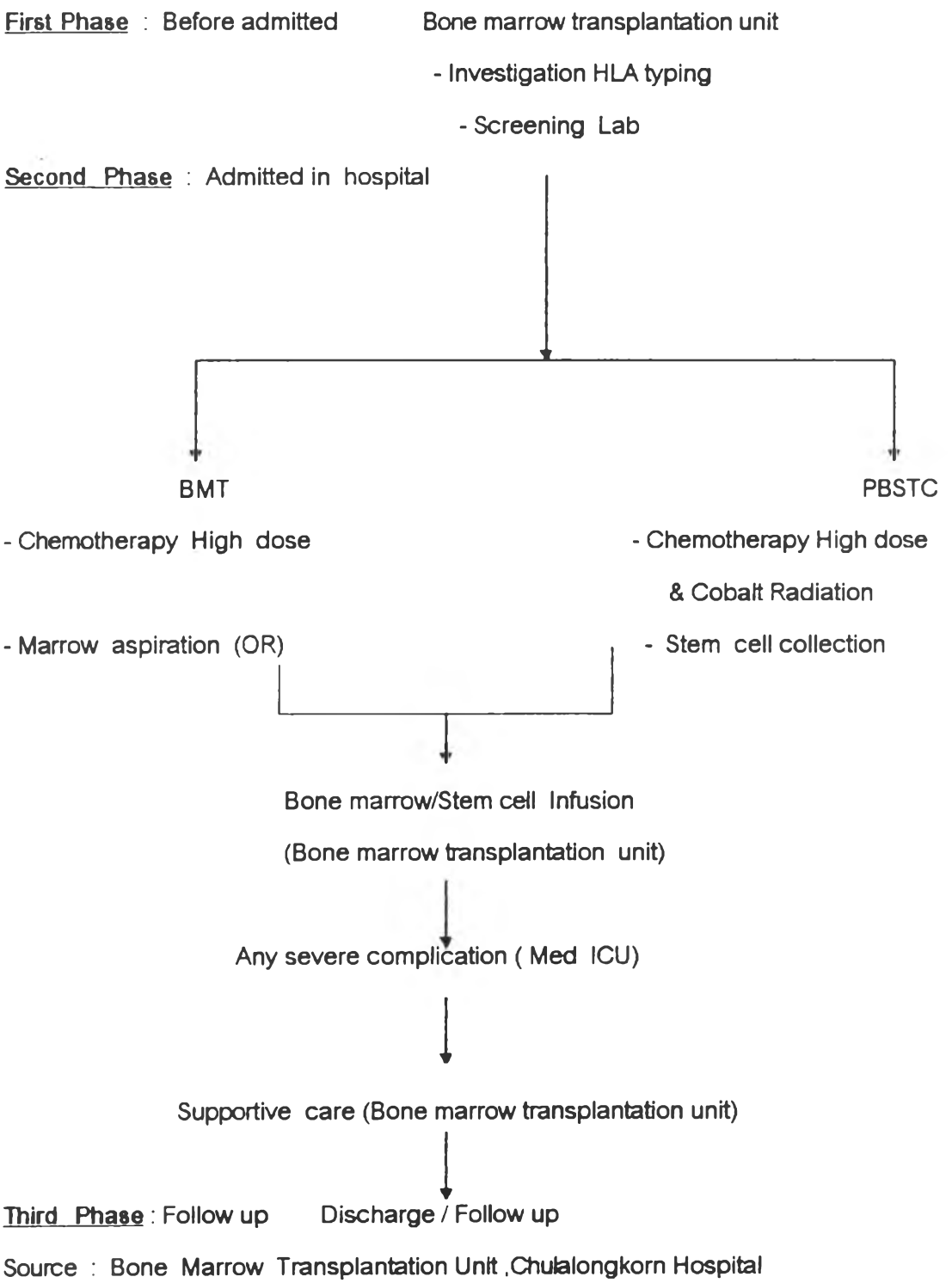
c) Overhead allocated of capital costs which are building and equipments.

d) Diagnosis tests.

e) Treatment services.

The following Table 3.1 gives a detailed lists of capital costs for bone marrow transplantation procedure and Table 3.2 lists all the direct recurrent costs items for the bone marrow transplantation.

Figure 2.1 Typical Operative Orders for Bone Marrow Transplantation



Source : Bone Marrow Transplantation Unit ,Chulalongkorn Hospital

Table 3.1 Identification of Capital Cost Items for Bone Marrow Transplantation

Category	Items
Building	Bone Marrow Transplantation Unit
	utilization space
Equipment	OR : Bone marrow aspiration set
	Ward : Hepa filter
	Bird's respiration
	O2 sat
	EKG
	Micro wave
	Air condition
	Beds
	Water bath
	Wheel chairs
	Stretcher
	Fans
	Televisions

Source : Bone Marrow Transplantation Unit , Chulalongkorn Hospital

Table 3.2 Identification of Recurrent Cost Items for Bone Marrow Transplantation.

Category	Items
Personnel	A team of BMT physicians Ward nurses Nurse aid and PN
Blood & Fluid Infusion	0.9% NSS TPN & Lipid 5% NSS Platelets 5% N/2 Whole blood 5% D/W Packed red blood cell Fresh frozen plasma
Drugs	Antibiotics Cyclosporin Cyclophosphamide Calcium gluconate and etc.
Medical supplies	Disposable items & materials
Laboratory tests	Blood cyclosporin level Blood sugar , blood gas, blood group,CBC , BUN , CR , Electrolyte Anti HIV , HbsAg , and etc.
Diagnosis & Radiology	Chest X ray Electrocardiogram
Gas mixture	Oxygen , nitrous oxide

Source : Bone Marrow Transplantation Unit , Chulalongkorn Hospital

3.5 Determination of Measuring Unit.

The measure unit of the cost items are shown in the Table 3.3

3.6 Cost Calculation

3.6.1 Total cost = capital cost + recurrent cost

The calculations below would be used to calculate capital costs.

3.6.2 Present value (PV) :

The present value of a single payment of B Baht in year T when the interest rate is R is given by the formula : PV = B / {(1 + R)^T}

The present value of a series of payments is just the sum of the present values of the individual payments. For example , the PV of a sequence of payments of B1 Baht in year 1 , B2 Baht in year 3 , zero Baht in year 4 , and B4 Baht in year 4 would be : PV = B1/(1+R) + B2/{(1+R)^2} + B4 /{(1+R)^4}

3.6.3 Discount rate : The rate of interest obtained from the bank if the money was put into the bank instead of buying the capital inputs. This study used the World Bank discount rate = 10%

3.6.4 Depreciation : The loss in value of an item, due to wear and tear, obsolescence, or other reasons. Depreciation is usually computed on an annual basis as Initial Cost/Years of Useful Life. It would be inappropriate, for example, to charge the full cost of a new equipment to the project in the year it was purchased. The equipment has a useful life year of 10 years or so. Therefore, its cost should be spread out over that 10-year period. That is called "depreciation". Each year the value of the vehicle declines (depreciates) by a certain amount until at the end of 10 years its value is zero. (Reynolds , 1992)

Table 3.3 The Measuring Unit of the Cost Items

Identification	Measurement	Value
Capital costs		
Building	space utilized (sq.m)	depreciate the building's price
Equipment	time allocation (apportion)	depreciate the equipment's price
Long term training	time used for training	amount of money spent per year
Recurrent costs		
Labor cost	salary , wages	time allocation for patient (hour)
Supplies and drugs	units of used	cost price
Blood & Fluid infusion	units of used	cost price
Laboratory tests	number of tests	charge price
Dx radiology	number of diagnosis radiology	charge price
Gas mixture	volume of used (liter)	cost price
Operation & maintenance	space utilized (sq.m)	market price

Source : Creese and Parker , 1994

3.7 Cost Allocation Criteria

For the capital cost calculation, we used annualization or depreciation to estimate the annual costs which can be described as below :

Firstly, estimate the current value of the capital item i.e. the amount for purchasing a similar item at the present time. Then estimate the expected years of useful life year of the capital item, after being received, expert judgment or opinion has to be taken from interviews with staff who use if necessary. Next, find out the discount rate used for the economic appraisals , as the inflation rate is higher than interest rate so the World Bank rate of 10% should be used. And finally, calculate annual cost by dividing the current value of the item by the annualization factors obtained from the table (Appendix IV)

3.7.1 For building (Bone Marrow Transplantation Unit)

Adjusted yearly cost = Current value of building / annualization factor

Total building cost = $\Sigma_{i=1}$ [B_{ia}] where B = Annual costs of building

i = Number of building; i = 1,.....,n

a = Proportion of apace used for BMT

3.7.2 For equipment

Adjusted yearly cost = Current value of equipment / annualization factor

Cost per hour = adjusted yearly cost / yearly hour used

Cost per patient = Total hour used * cost / hour

Total equipment cost = $\Sigma_{i=1}$ [E_{ie}] where E = Annual costs of equipment

i = Number of equipment; i= 1,.....,n

e = Proportion of time used for BMT

3.7.3 For long term training

Adjusted yearly cost = Current value of training / annualization factor

Cost per patient = Adjusted yearly cost / number of patients

For the recurrent cost , in order to calculate the allocation of time spent by health personnel for BMT, all of them have to fill the forms for the empirical study. The total personnel cost can be calculated by multiplying the total annual income of individual health personnel by the proportion of time spent by BMT then sum up all the individual personnel costs.

3.7.3 For personnel

Salary plus fringe benefits and per diem has to be considered for calculating the per day cost for the personnel.

Unit cost = (salary + benefits + per diem) / working hour

Cost of personnel = time spent for patient * unit cost

Material costs can be calculated by multiplying unit cost for each material into number of these material used for BMT within one year.

3.7.4 For materials and supplies

Costs for medical supplies and materials for bone marrow transplantation based on individual consumption , which are cost of items clearly identified with the patients , such as drugs , supplies and TNP & Lipid.

Total material cost = $= \Sigma_{i=1} [M * N_a]$ where M = unit cost of material

i = items of material, i = 1,.....,n

Na = no. of material used for BMT

3.7.5 For facilities

- Electricity & Water supply : cost calculated from the unit cost per person

Unit cost = Total expenditure in one year divided by the total number of person in Chulalongkorn Hospital

- Telephone : cost calculated from the number of calling * price in each month

3.8 Costing Assumptions

1.The cost calculation is based on the uses of resources and can be classified into these categories :

a) Individual patient cost : medical cost such as drugs, supplies, blood, infusion, etc. which depend on the patient consumable

b) Capital cost : all of the capital inputs are fully utilized

c) Labor cost : all of the labor inputs are fully utilized , there are 18 staffs work in one day for 24 hours.

2.There was only one donor in candidacy cost to be calculated in this study.

3. The cost was based on the value in the fiscal year 1997.

4. Charge prices are used in case there are no unit cost available in some items i.e. laboratory tests, TPN , etc.

3.9 Data Analysis

3.9.1.This study is intended to examine only the direct provider cost of BMT . The costs analysis will be the average cost or unit cost of one patient performed bone marrow transplantation.

Average cost or **Unit cost** is the total cost (TC) divided by the number of all patients who undertook transplantation (n). AC = TC / n

Cost per intermediate effectiveness is the total cost (TC) divided by the number of the patients who survived after transplantation more than 6 months but less than 5 years (n1). = TC / n1

Cost per effectiveness is the total cost (TC) divided by the number of patients who can survive after transplantation more than 5 years (n2) = TC / n2

3.9.2.The components of costs will be analyzed by classification into capital cost and recurrent cost (Labor cost and Material cost). Cost by area of activity in two areas , including OR and ICU of hematologic ward where the patients stayed will be examined in this study as well.

3.9.3.The average and percentage of the cost components will be calculated and compared among each category.

3.9.4.Sensitivity Analysis was undertaken to evaluate the effect of length of stay , number of the donors , and economic crisis on the total cost.