CHAPTER 2

RESEARCH METHODS

On the basis of what should be done as mentioned in the conceptual framework, the required research methods include:

* Methods of design research
* Methods for making model and equations
* Methods for data collection
* Cost benefit analysis
* Methods for costing
* Method of linear regression
* Methods for testing the model

1. Methods of Design Research

According to Kaewsonthi and Harding (1992), there are 3 types of research methods:

* Evaluative research methods
* Forecasting research methods
* Design research methods

This study is a design research. Design study may be concerned with 2 areas: Initial design and/or improvement in the method of inquiry and analysis used in other types of research and design of systems. This is a design of systems for analysis of cost and outcomes from introducing a new rapid on the spot diagnostic test. The stps of the design are:

* Definition of the functions and establishment of a specification to be met.
* Definition of criteria by which the performance of the design can be measured
* Design

* Prospective evaluation of the design
* Testing and evaluation using agreed criteria
* Judgement and modification

This thesis defines functions of the design as follows:
* To cost inputs for introducing a new diagnostic test.
* To predict outcomes from introducing a new test.
* To value outcomes and to judge outcome values against input costs for evaluation.

Specification to be met has been established: The model should be used for testing any new rapid diagnostic test in any country of high endemicity and high drug resistance rate.

Performance criteria include: feasibility, input data more or less available; sensitivity, ratio between cost of potential outcomes and cost of input reflects easily the value of the test; practicability, easy for use and acceptability, acceptable by malariologists.

Design development in this study should be based on cost benefit analysis and forecasting methods in order to make the modelling equation.

Prospective evaluation of the design: The design is necessary for evaluation of new tests for rapid on the spot malaria diagnosis.

Testing the model using estimated data of the ParaSight test. Adjustments of the model will be done on estimates from Thailand Malaria Control Program.

2. Methods for Development of Model and Setting Model Equations

Framework for a model system should be similar to what was suggested by Clarke and Wilson (1992).

The model should use two approaches: 1) The technological forecasting approach: "forecasting outcome when a given new process or

product will become widely adopted" (Ayres, 1969; Cetron, 1969; Gerotenfeld, 1971; Linstone and others, 1967) and 2) The cost benefit analysis approach: "costing inputs and value expected outcomes, comparing outcome value with input costs for evaluation" (Mishan, 1971; Tarasovsky, 1976; Willians, 1977).

This study should forecast outcomes from introducing a new diagnostic test. Cost inputs and outcome values have to be judged whether outcomes are worth the costs.

The model has to develop an appropriate equation. The various steps for setting the equation of the model are:
* Declaration of sets
* Definition of parameters for input of data
* Identification of variables
* Setting of equation

There are two sets, one for costs (establishing new test, running new test) and one for outcomes (cost saving by patient, reduction of presumptive treatment, reduction of self treatment).

Definition of parameters should be made for input of data, (element costs should be defined for entry of data for cost calculation, information such as incidence, size of population at control area, proportion of self treatment/ proportion of presumptive treatment, etc... among consumers of diagnostic test).

Among specificity, sensitivity and predictive value of the malaria diagnostic test, specificity should be taken into special consideration in relation to the issue of drug wastage. The less specificity of test the more false positive cases and the more false treatment, consequently the more drug resistance. Identification of variables such as the level of service points (number of services), the level of endemicity, the level of acceptance, should be made. In brief, an equation model can be developed on the following basis:

SETS   /Establishing a new test
                 Running a new test/
                /Reduction of costs incurred to patients,
                /Reduction of presumptive treatment cost,
                 Reduction of self treatment cost/

PARAMETERS   Cost elements of the new test
                Cost elements incurred by patients
                Population at control area
                Incidence
                Proportion of presumptive treatment
                Proportion on self treatment
                Population per service points, etc...

VARIABLES   Interest rate
                Decrease rate of malaria incidence
                Population growth rate

EQUATIONS   Y is gain or loss from introducing a new
                diagnostic test

                $Y = f(C, B_1, B_2, B_3,)$
                Parameters
                C total input costs
                B1 saving cost incurred to patients
                B2 saving gained from reduction of presumptive
                treatment
                B3 saving gained from reduction of self treatment.

                Functions
                C= f(cost elements of the new test)

                B1= f(cost saving elements incurred by patients:
                travel cost, time cost, accompanying person rate).
                B2= f(population at control area, number of waiting

cases, proportion of presumptive treatment among waiting cases, cost per case of presumptive treatment).

B3= f(level of coverage, number of diagnostic cases, proportion of self treatment, cost per case of self treatment).

3. Methods for Data Collection

Data collection should be made on:
* Analysis of related documents such as:
- Annual reports of malaria control programs
- Organization of Malaria Control Program in Thailand,
- Description of ParaSight test and other diagnostic tests.

* Interview with related persons in Thailand Malaria Division for information such as:
- Activities of malaria surveillance, positive and negative aspects,
- Training costs for introducing ParaSight test
- Material costs of ParaSight test
- Costs for each presumptive treatment case
- Costs for each self treatment case

4. Cost Benefit Analysis Method

As the main issue of the modelling is to judge benefit against cost of introducing a rapid malaria diagnostic test, cost benefit analysis should be considered in this study. Cost benefit analysis is potentially a broad form of economic evaluation, although in practice the range of costs and benefits investigated is often restricted to by measurement difficulties such as in the case of savings from drug

resistance reduction in this study.

Cost benefit analysis in this study is restricted to the narrowly defined economic changes brought about by introducing a rapid malaria diagnostic test. There are 4 different approaches to valuation of costs and consequences:

* Market valuation
* Clients willingness to pay estimates
* Policy makers views
* Professional opinions

All 4 approaches should be considered in this study. Costing of inputs (equipment, space,etc...) should consider market valuation. Forecasting outcome values should consider professional opinions and policy makers views. Costs incurred by patients should consider clients willingness to pay estimates. Principles underpinning the various approaches are those that are grounded on the idea that cost benefit in health care is firmly linked with welfare economics theory. A key component of welfare economics is the Paretian value judgement. The essential features of the Paretian judgement are that:

- A global efficiency optimum is reached when resources cannot be reallocated to make one person better without making at least one person worse off.
- The existing distribution of income is accepted or can be treated as a separate issue.

The main arguments for applying the Paretian concepts to cost benefit analysis in health care are that:

- It is consistent with welfare economics principles
- It leads economists to concentrate on efficiency questions, leaving politicians and others to concentrate on the equity questions.
- It forces consideration, by decision makers, of clients values.

5. Methods for Costing

Costing is a big part of the modelling. There are methods responding to the question "How costs are measured" and methods responding to the question "How to calculate costs" (Kaewsonthi and others,1986; 1988; 1989).

Methods responding to the question "How costs aremeasured?"

For both financial and economic costs, it is the cost of resources consumed (including wastage) that are important, not the amount ordered or budgeted. The costs are basically calculated as the sum of all the inputs used. The cost of each input is simply calculated as the unit cost of that input multiplied by the number of units used.

For financial costs, inputs are always valued at the price paid for them. With economic costs inputs are valued in terms of their opportunity cost value, the value in money of time. The construction of itemized cost menus for introducing a new diagnostic test should make explicit the unit cost of each item, ensure that all inputs are included and allow changes in unit prices and quantities to be considered. The cost menus can be used for prediction and application in various places for various tests.

There are specific inputs only used for introducing the new diagnostic test, then the entire cost of it has to be assigned to the program. There are also inputs which have multiple uses, only part of which are used for introducing the new diagnostic test to be evaluated. In this instance, it is necessary to take into account shared costs.

Cost allocation is determined by the dimension of inputs that determine the costs. These dimensions should be used directly as the basis for allocating resources, e.g. for personnel, the time devoted to the new diagnostic test and for vehicle, the distance travelled and the time used etc.

Methods responding to the question "How to calculate costs"

Measuring the costs of resources used in introducing a new diagnostic test involves a number of steps as follows:

* Identify inputs
* Calculate the quantity of input-the time or amount consumed.
* Identify the unit cost
* Sum unit costs and quantity to obtain total cost.

6. Correlation Regression

In order to estimate the number of test will be performed in some years, we should make the relationship between incidence and number of test used.

We assume that a relationship exists between the variable we want to forecast (the dependent variable) and another variable (the independent variable). Further more, we assume that the basic relationship is linear. The linear regression correlation equation will be created by using the data of previous times.

7. Methods for Testing the Model

Testing the modelling by fitting estimated data of the ParaSight test on preliminary experiences from Thailand Malaria Division in collaboration with WHO.

Results should be discussed with experts of the Malaria Division (MoPH) and the Health Economics Center (Chulalongkorn University).