CHAPTER 3

RESEARCH METHODS

Three main sections are presented in this chapter.

1. How to identify possible behaviors of patients in receiving leprosy services. The possible behaviors of patients in receiving leprosy services provide the basis for determining the components of costs incurred by patients and relatives and, based upon the frequency of particular actions, to determine total costs through the cost models.

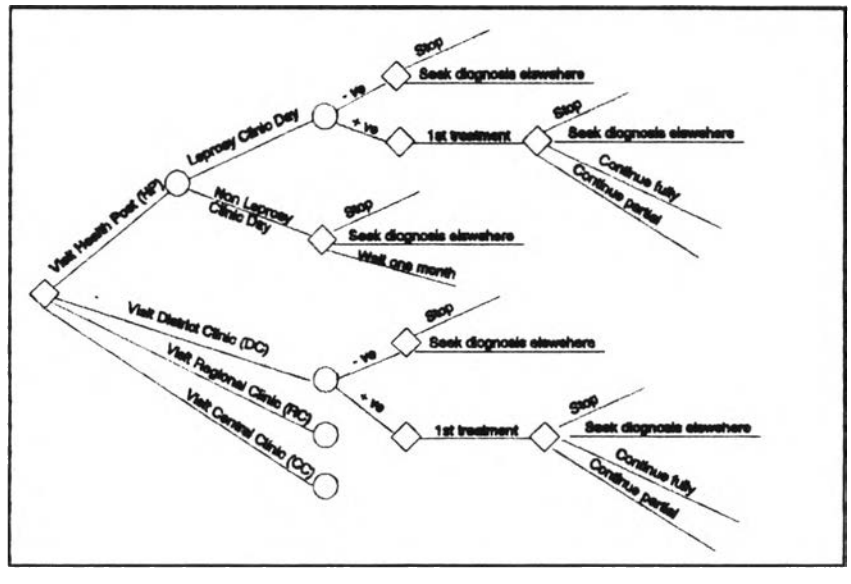
2. How to measure the costs incurred by patients and relatives in attending outstation clinics for leprosy care. This section includes cost models, data requirement and how these data might be obtained.

3. How to extrapolate the potential cost saving for the whole country if all leprosy patients were to attend local clinics for leprosy services.

3.1 Identifying Possible Behavior of Patients in Receiving Leprosy Services.

The principles of decision trees are applied to identify alternative practices of leprosy patients in seeking leprosy care. As described in section 2.1, an analysis is made of the decisions and alternative actions available to patients. As an example, the outcome from an initial analysis of decision and alternatives on where to seek care is presented in Figure 3.1.

Figure 3.1 Initial Analysis of Decision and Actions of Leprosy Patients.



Consideration has to be given to the outcome of diagnosis, the patients compliance with prescribed treatment and the places to which the patient may turn for subsequent treatment.

A more comprehensive study of costs incurred by patients should include all the costs incurred by patients and relatives prior to the current diagnosis and treatment along each branch of the decision tree. This would give a more realistic cost figures for policy formulation concerning leprosy services in Nepal.

However, given the limitations of the retrospective data available and time constraints on the thesis, this study concerns only the costs incurred by patients and relatives in attending outstation clinics under current diagnosis and treatment. The study does not include the costs incurred by patients in seeking diagnosis and treatment prior to the current service point. Nor does the study include the costs incurred by suppliers and society due to the alternative actions of patients.

3.2 Measurement of costs incurred by patients and relatives

This section is presented in 4 subsections ; cost models, data requirement , primary data, secondary and derived data.

3.2.1 Cost models

Models on the costs to be incurred by patients and relatives attending local and outstation clinics are formulated from the framework presented in Chapter 2. The models are used, in subsequent chapters, to estimate the magnitude and components of costs incurred by patients and relatives in attending local as well as outstation clinics.

The meaning of outstation clinics in this study is defined as the clinics outside the district in which a patient resides.

Definition of variables and abbreviations :

i = location of patients (districts)
i = 1,2,3,.....n

j = location of services (districts)
j = 1,2,3,.....m

D = Clinics in district

R = Regional clinic

C = Central clinic

W = Wage rate (per day)

XD_1 = Number of local patients seeking and receiving treatment at clinics in their resident district

XR_1 = Number of local patients seeking and receiving treatment at regional clinics

XC_1 = Number of local patients seeking and receiving treatment at the central clinic.

XD_{ij} = Number of patients from district i attending clinics in district j.

XR_{ij} = Number of patients from district i attending Regional clinic in district j.

XC_{ij} = Number of patients from district i attending Central clinic in district j.

O_1 = Average opportunity costs (per person per day) of delay in treatment for patients attending at local clinics. (i = j)

O_0 = Average opportunity costs (per person per day) of delay in treatment for patients attending outstation clinics.

T_1 = Average time delay (days) between onset of symptoms and seeking / receiving treatment for patients attending local clinics.

T_{ij} = Average time delay (days) between onset of symptoms and seeking / receiving treatment for patients in district i attending outstation clinics at district j ($i \neq j$).

D_1 = Average time (days) required for patients (per visit) in seeking and receiving treatment at local clinics.

D_{ij} = Average time (days) required for patients (per visit) in seeking and receiving treatment from district i at outstation clinics in district j ($i \neq j$).

a_1 = Average travel costs per person per visit for patients attending local clinics.

a_{ij} = Average travel costs per person per visit for patients from district i attending outstation clinics in districts j.

b_1 = Average food costs per person per day for patients attending at local clinic.

b_{ij} = Average food costs per person per day for patients from district i attending outstation clinics in district j.

C_1 = Average accommodation costs per person per night for patients attending local clinics.

C_{ij} = Average accommodation costs per person per night for patients from district i attending outstation clinics in district j.

Tc_0 = Total costs incurred by patients attending outstation clinics.

Tc_1 = Total costs incurred by patients attending local clinics.

A_1 = Total opportunity costs of delayed treatment for patients attending local clinics.

A_0 = Total opportunity costs of delayed treatment for patients attending outstation clinics.

B_1 = Total travel costs for patients attending local clinics (per visit).

B_0 = Total travel costs for patients attending outstation clinics (per visit).

E_1 = Total costs of time required for travel and waiting for services at local clinics (per visit).

E_0 = Total costs of time required for travel and waiting for services at outstation clinics (per visit).

F_1 = Total food costs required for patients attending local clinics (per visit).

F_0 = Total food costs required for patients attending outstation clinics (per visit).

G_1 = Total accommodation costs required for patients attending at local clinic (per visit).

G_0 = Total accommodation costs required for patients attending at outstation clinic (per visit).

V = Average number of visits per year.

Cost Components and models

Total costs incurred by patients attending outstation clinics :

$$TC_0 = A_0 + \left| (B_0 + E_0 + F_0 + G_0) * V \right|$$

$$A_0 = O_0 * \left| \sum_{i \neq j} T_{ij} * (XD_{ij} + XR_{ij} + XC_{ij}) \right|$$

$$B_0 = \sum_{i \neq j} a_{ij} * (XD_{ij} + XR_{ij} + XC_{ij})$$

$$E_0 = W * \left| \sum_{i \neq j} D_{ij} * (XD_{ij} + XR_{ij} + XC_{ij}) \right|$$

$$F_0 = \sum_{i \neq j} b_{ij} * (XD_{ij} + XR_{ij} + XC_{ij})$$

$$G_0 = \sum_{i \neq j} C_{ij} * (XD_{ij} + XR_{ij} + XC_{ij})$$

The above models can be used to illustrate the magnitude of total costs incurred by patients and the magnitude of each cost component. The separation among XD_{ij} , XR_{ij} and XC_{ij} will allow the comparison of costs incurred to patients receiving care at district level, regional level and central level. Average total costs per patients (ATC_0) and average total costs per patients per visit (ATC_{0v}) can also be derived .

$$ATC_0 = TC_0 / (XD_{ij} + XR_{ij} + XC_{ij})$$

$$ATC_{0v} = TC_0 / V (XD_{ij} + XR_{ij} + XC_{ij})$$

Total Costs Incurred by Patients Attending Local Clinics :

$$TC_1 = A_1 + \left| (B_1 + E_1 + F_1 + G_1) * v \right|$$

$$A_1 = O_1 * \left| T_1 * (XD_1 + XR_1 + XC_1) \right|$$

$$B_1 = a_1 * (XD_1 + XR_1 + XC_1)$$

$$E_1 = W * \left| D_1 * (XD_1 + XR_1 + XC_1) \right|$$

$$F_1 = b_1 * (XD_1 + XR_1 + XC_1)$$

$$G_1 = c_1 * (XD_1 + XR_1 + XC_1)$$

$$ATC_1 = TC_1 / (XD_1 + XR_1 + XC_1)$$

$$ATC_{1v} = TC_1 / V (XD_1 + XR_1 + XC_1)$$

The above models can be used to compare magnitude of total costs and each of the components of costs incurred by patients attending outstation and local clinics. The separation of XD_1, XR_1 and XC_1 is unnecessary for computing purposes. But such separation may allow detail comparison of costs incurred by patients attending leprosy services at each level. Comparison of average cost per patient (ATC_1) and average cost per patient per visit (ATC_{1v}) for patients attending outstation clinics and local clinics can also be obtained.

Total Costs Incurred by Relatives Accompanying Patients:

Assumptions

1. Proportion of relatives (Rl) accompanying patients in seeking diagnosis and treatment at local and outstation clinics are the same as the proportions observed from sampled patients.
2. Relatives do not incur accommodation costs since they share the accommodation with patients.

The following costs can then be estimated for relatives accompanying patients to outstation clinics:

* Total costs incurred by relatives accompanying patients at outstation clinics (RTC_0)
* Average costs incurred by relatives per leprosy patient ($ARTC_0$)
* Average costs incurred by relatives per visit of leprosy patients ($ARTC_{0v}$)

$$RTC_0 = Rl_0 * (B_0 + E_0 + F_0) * V$$

$$ARTC_0 = RTC_0 / (XD_{ij} + XR_{ij} + XC_{ij})$$

$$ARTC_{0v} = RTC_0 / V * (XD_{ij} + XR_{ij} + XC_{ij})$$

The following costs can also be estimated for relatives accompanying patients to local clinics:

* Total costs incurred by relatives accompanying patients at local clinics (RTC_1)
* Average costs incurred by relatives per leprosy patient ($ARTC_1$)
* Average costs incurred by relatives per visit of leprosy patients ($ARTC_{1v}$)

$$RTC_1 = Rl_1 [(B_1 + E_1 + F_1) * V]$$

$$ARTC_1 = RTC_1 / (XD_{ij} + XR_{ij} + XC_{ij})$$

$$ARTC_{1v} = RTC_1 / V * (XD_{ij} + XR_{ij} + XC_{ij})$$

3.2.2 Data Requirement

Data required for the cost models and the sources of data are presented in Table 3.1. The methods to obtain primary data and derivative data are presented in subsequent sections.

Table 3.1 Data Requirement and Sources of Data

Data required for cost models.	Secondary data sources	Primary data	Derivative data
i,j	Map of Nepal		
D R C	Leprosy Annual Report		
W	Wage Table, Ministry of Social Affairs		
XD_i XR_i XC_i XD_{ij} XR_{ij} XC_{ij}	Leprosy patients record " " " "		Some XD_{ij} to be derived from the i to j distances and feasibility of travelling
Distance i to j	Map of Nepal and transport department report		
O_1 O_0 T_i T_{ij} D_i D_{ij}		Small sample survey " " " "	Develop proxy to estimate O_1 , O_0 * Derive from sample surveys for some values of i,j
a_i a_{ij} b_i b_{ij} c_i c_{ij}		" " " " " "	" " " " " "
V	Leprosy patient record		
Prevalence rate	"		
Incidence rate	"		
Deformity rate	"		

3.2.3 Primary Data

No data are available from secondary sources on costs incurred by patients. To complete the data requirements (as presented in Table 3.1) within the time available for the thesis, a small sample survey was therefore conducted with the collaboration of officers from the Leprosy Control Division in Nepal.

Three leprosy clinics, two at regional level and one at the central level, were selected for conducting the patient surveys.

The two criteria for selection of the clinics were :

1. To reflect the range of costs incurred by patients in receiving leprosy services from different levels of clinics

2. Immediate cooperation of leprosy workers to conduct the interviews at a few days notice.

Two leprosy workers employed in leprosy clinics were assigned to the selected clinics to conduct the interviews of the patients. Full instructions were given to them before the activities.

Thirty patients at each of the three clinics were randomly selected by leprosy workers as sampled patients. The sampled patients were interviewed using questionnaires as guidelines to collect the information required for the cost models.

The survey questionnaires was developed by the writer and then tested. The main purpose of the questionnaire was to gather information on the costs incurred by the patients in attending leprosy clinics. Twenty questions included in the questionnaires (Appendix 1) focussed on time delayed between onset of symptom and seeking diagnosis and treatment, travel cost and travel time required in attending the clinic, awaiting time for receiving services and cost for food and accommodation.

Information on work status, wage and education of patients was also gathered. In addition to costs incurred by patients, similar information was gathered on the costs incurred by relatives attending patients and the number of patients attended by relatives.

The sampled data was to be used to estimate costs incurred by patients and, in some cases, to be the basis for derivative data for the cost models.

3.2.4 Secondary and Derived data.

The secondary data obtained from Annual reports are not in the detailed format as required for the cost model. Aggregate data can not provide the breadth and depth of the research required for a thesis.

The small sample surveys provided additional information concerning costs. But it does not provide complete information as required in the cost models, particularly the sample patients do not cover every i and j.

Three questions therefore present themselves:

1. Should the cost models be simplified to match the available data ?

2. Should proxies be developed to derive the required data for the cost models ?

3. Should more complete data be gathered so that the research can provide reliable cost figures for policy formulation.

The third option was not feasible given the time and resources available. The first option was not appropriate for educational purposes. The only option available therefore was the second alternative. This will serve the educational purpose for a thesis, provide some measure and be feasible within the time and resources.

The derived data are therefore estimated based upon a set of assumptions and the data available from the secondary sources and sample surveys.

Assumptions

1. O_1 , T_1 , D_1, a_1 ,b_1 ,c_1 are constant and can be obtained from the mean value of the sampled patients attending local clinics.

2. There are significant relationships between distances from i to j and the T_{ij} ,D_{ij} , a_{ij} ,b_{ij} , c_{ij} and XD_{ij} , XR_{ij} XC_{ij} where $i \neq j$.

3. There are significant relationships between the total number of patients (X_{tj}) and number of outstation patients (X_j).

Models

$$T_{ij} = \frac{R_{ij} * ST}{SR}$$

$$D_{ij} = \frac{R_{ij} * SD}{SR}$$

$$a_{ij} = \frac{R_{ij} * Sa}{SR}$$

$b_{ij} = \frac{R_{ij} * Sb}{SR}$

$c_{ij} = \frac{R_{ij} * Sc}{SR}$

T_{ij} = Time delayed (between onset of symptoms and receiving care) of cutstation patients from i to j.

R_{ij} = distance from i to j

SR = Average distance of sampled outstation patients

ST = Average time delayed (between onset of symptoms and receiving care) of sampled outstation patients

D_{ij} = Days required for travelling and receiving service of patients from i to j

SD = Average number of days required for sampled outstation patients to travel and receive services

Sa = Average travel costs of sampled outstation patients

Sb = Average food costs of sampled outstation patients

Sc = Average accommodation costs of sampled outstation patients

The derived data for XD_{ij} , XR_{ij} , and XC_{ij} where $i \neq j$ and not included in the sampled patients were explored using principles of regression relationships from the sampled data. The methods and results are presented and analyzed in Chapter 4.

A further area in which complete detailed data were not directly available from reports is the distance between each district clinic (r_{ij}). The distance r_{ij} and the feasibility of travel (q) was therefore determined from a topographic map 1:50,000 scale. Feasibility was based upon three criteria; the existence of roads/tracks and transport between districts and whether the districts which could be reached were beyond the Central clinic. For example a track over a mountain requiring two days walking would not be considered as feasible when a regional and or central clinic can be reached within one day.

Estimation of the opportunity cost was based upon the following:

Assumptions

1. Given the stable incidence rate, on average, each infected case can infects one other person each year
2 Infective mandays per year is therefore the all new cases/year * 365

3. Costs of infection are the lost income for patients with grade 2+ deformity
4. The average age of infection is 30 years
5. The income loss is over 30 years, at the average wage rate 5 days per week

The opportunity cost per infective patient day is Lo

$$Lo = (Ln * LD * LI)/Lin$$

Ln = new cases per annum
Ld = percent deformity grade 2+ in new cases
LI = Income loss per deformed person (over 30 years) = (30*52*5*W)
Lin = Ln * 365
W = Daily wage rate

3.3 Extrapolation of Potential Cost Saving

The total costs, estimated from the cost models, reflect the costs incurred by the patients attending local and outstation clinics under the study of this thesis. But the total costs incurred by all patients attending outstation clinics in Nepal should be estimated if the information is to be used as a basis to support decision making of Leprosy Control managers.

This section explains the methods used to estimate potential cost saving for total leprosy patients in Nepal from the information available through the sample of patients studied in this research, if the patients received diagnosis and treatment at local clinics instead of clinics outside their district.

Due to the limited information available on the number of patients attending outstation clinics, the estimation of potential cost saving is based upon the following assumptions:

1. The estimate of potential cost saving is limited to the number of patients in 1992

2. The proportion of local patients and outstation patients for the whole country in 1992 is the same as the proportion in the sample studied in this research

3. The data on costs incurred by patients and relatives attending patients seeking diagnosis and treatment at local and outstation clinics, taken from the sample, are reliable and can be used to estimate the potential costs saving for the whole country.

4. Potential transport costs, food cost, accommodation costs and time costs remain unchanged.

3.3.1 Potential Cost Saving per Person

Potential costs saving if patients seek care at local instead of outstation clinics.

$ATC_s = (ATC_0 - ATC_1) + (ARTC_0 - ARTC_1)$

ATC_0 = Average costs incurred by patients attending outstation clinics

ATC_1 = Average costs incurred by patients attending local clinics

$ARTC_0$ = Average costs incurred by relatives accompanying patients to outstation clinics

$ARTC_1$ = Average costs incurred by relatives accompanying patients to local clinics

3.3.2 Potential Costs Saving for Total Patients

Saving is estimated for three assumed conditions; maximum (X_{max}), moderate (X_{mod}) and minimum (X_{min}) numbers of patients attending outstation clinics.

Maximum estimated potential cost saving
$= ATC_s * X_{max}$

Moderate estimate of potential costs saving
$= ATC_s * X_{mod}$

Minimum estimate of potential costs saving
$= ATC_s * X_{min}$