Chapter 4

Research Methodology and Data Collection

This chapter discusses the theoretical framework and how to collect the necessary data. In theoretical framework, It consists of two parts concerned with empirical model development: (1) measurement of efficiency in health budget distribution; (2) evaluation the equity of the public health budget.

Understanding the interrelation between disease, socioeconomic and environmental conditions is useful for a number of reasons. With socioeconomic development affecting health, rapid economic develop is always focused on the impact of income, and higher income is generally associated with improved sanitation, public hygiene, nutrition level and awareness of disease. Consequently, it tends to reduce the prevalence of disease and lead to better health. On the other hand, better health of a population will lead to higher productivity and higher economic growth. Thus, an interrelation clearly exists between a country's health condition and its economic development and it can be represented by an appropriate model.

All nations are facing the problem of health resource limitations, so health authorities need to allocate resources as well as possible in order to gain the most benefits and to solve the most important health problems. This requires setting priorities and making choices. Overall allocative efficiency and equity are always among the stated objectives of health policy planning. Based on economic theory, allocation of resources is efficient only if the resources are distributed so that all market prices and profits are consistent with real resource cost of supplying products and the marginal effects of each product on the level of social welfare are equal. Social welfare is the

sum of all the utility in the society. Illness will reduce the utility. Health programs can protect consumers from illness and death, and to reduce the threat of disease so as to increase the consumers' utility.

In health care, there are many examples of the presence of consideration of equity. Equity is always cited as a goal of public health care system. Some policies have been made to consider how resources for health care can be deployed more equitably across different regions and efforts have been made to promote geographical equity by controlling capital development to alter the location distribution of medical services.

According to the equity definition of equal access for equal needs, the absolute equity of resource distribution among counties should ensure that everybody in each county has possess the same amount health budget. Here we assume that everyone share the same amount of preventive or curative budget in each county. In this study, the equity of average preventive and curative budget among 5 counties over 9 year was compared.

Efficiency allocations are not necessarily equitable. In most cases there is a trade-off between equity and efficiency. Based on the idea of equal opportunity, the most favorable definition of equity in health care should be equal access for equal needs. Regarding health resource distribution, the most equitable allocation should involve an equal allocation of resources among all the members of society. Thus differences in the share of health resources among the people will indicate the degree of inequality of resources distribution among counties, will give an overview of the degree of equity and point the way for policy change to improve equity.

4.1 Study Framework

A model will be established to illustrate the relationship between the local people's health status and some

related factors in the context of the following scheme (Figure 4.1).

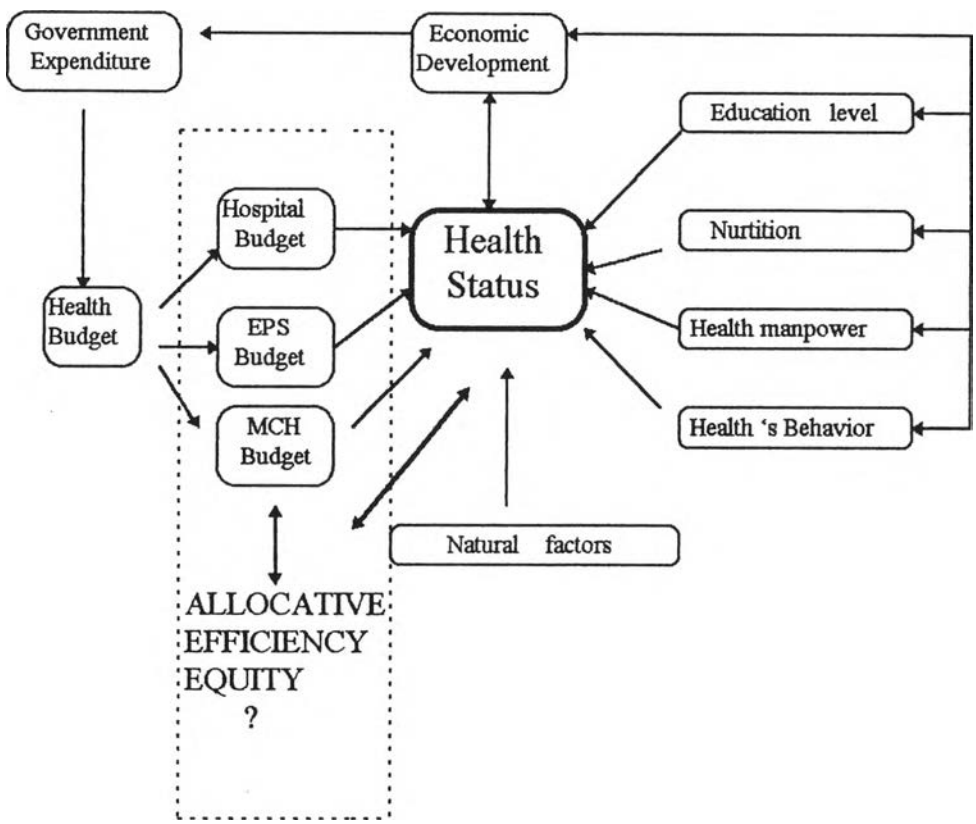


Fig. 4.1 Study framework

4.2 Measurement of Outcome

There are many indicators to measure the health status of local people. For example mortality rate , morbidity rate , life expectancy, YPLL, DALY QALY and so on. In this study the indicators should satisfied the following:

1. It can be obtained year by year form routine reporting systems, official reports or special surveys;

2. It should be reliable;

3. It should be specific .

DALY and QALY were viewed as two more perfect general indicators to reflect the health status, but they need more detailed information to calculate. Another indicator is life expectancy which is always used as a long-term health outcome measurement. Its main disadvantage is that it is not sensitive from year to year. So in this study, mortality and morbidity were selected as the measurements of the health status.

4.2.1 Mortality Rate

$$\text{mortality rate} = \frac{\text{number of deaths in the year}}{\text{average number of population in the area}} * 1{,}000$$

Mortality rate are available from Chinese Disease Surveillance Points year by year.

4.2.2 Morbidity Rate

$$\text{morbidity rate} = \frac{\text{number of patients with a specific disease in a year}}{\text{average number of population in that area in the year}} * 1{,}000$$

Here a ''patient '' means that he or she was diagnosed by a clinic doctor. It is very difficult to get the morbidity rate for each kind of disease at county level for every year. Moreover the morbidity rate of the 5 counties are not available. The Ministry of Health conducted a national health service survey in 1992 in 90 counties selected from the whole China . The data can be used to establish a model. There are many factors affect on the local people health status. They

are natural factors, social economic factors, local people behavior and so on. The natural factors include agent, temperature, rainfall etc. Social economic factors include economic level, education level, health resource and manpower possess and so on. Local people behavior include smoking situation, drinking situation, exercising habits, eating habit and so on. All of these factors should include in the model to predicate the morbidity rate. Since the purpose of this survey was to know the health service situation, so there are not sufficient indicators which are related to the morbidity. Only limited indicators are available to be used in the model. They were GNP/per capita, average doctors and hospital beds possess, urban population proportion, and the average health budget. The model is employed to predicate the morbidity rate in the 5 counties for 9 years.

$Y_{kit} = f(x1, x2, x3, x4, x5)$

Y_{kit} : k^{th} county morbidity rate in year t

i = 1 : communicable disease

i = 2 :non-communicable disease

x1 : GCP per capita

x2: doctors per 1000 population

x3: hospital beds per 1000 population

x4: population propitiation

x5: public health budget per capita

For simplicity, two classes of disease were neglected due to their having less affect on the final result:

1. Rare disease: if the mortality < 1/ 10000

(for example: haemorrhagic fever, polio, congenital anomalies).

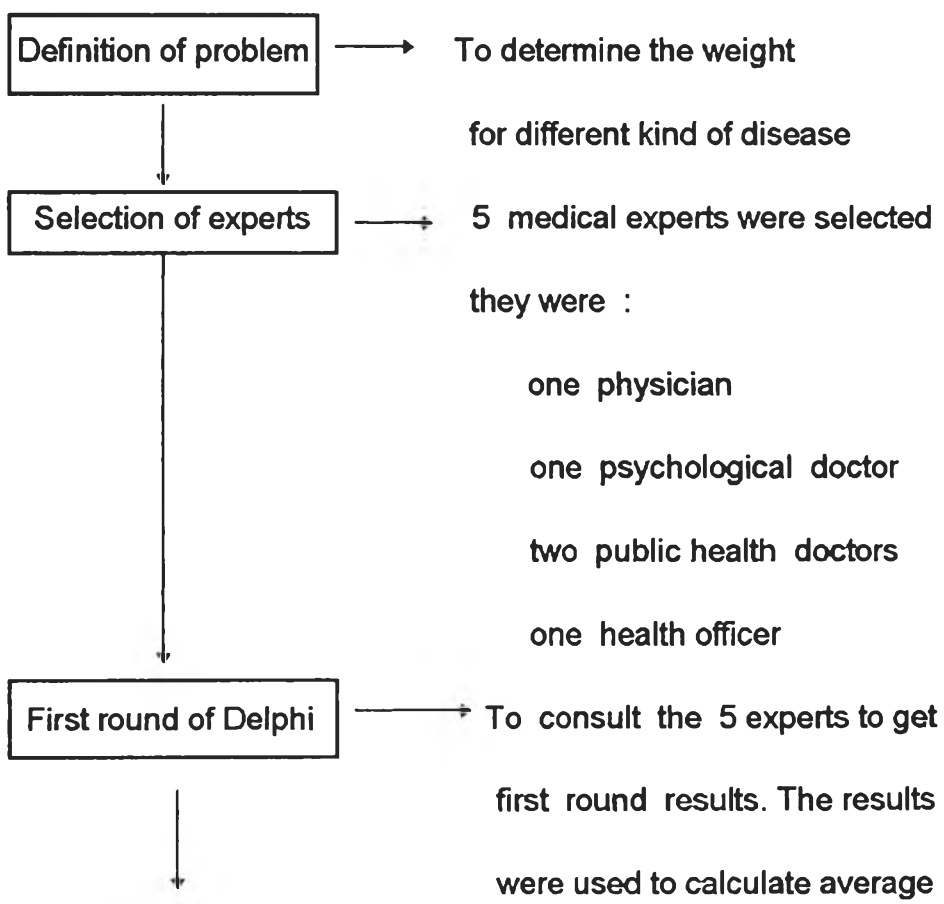
2. Mild disease : If the weight is less than 0.3 . (how to determine the weight for each kind of disease will be explained in the next section) For example : influenza,

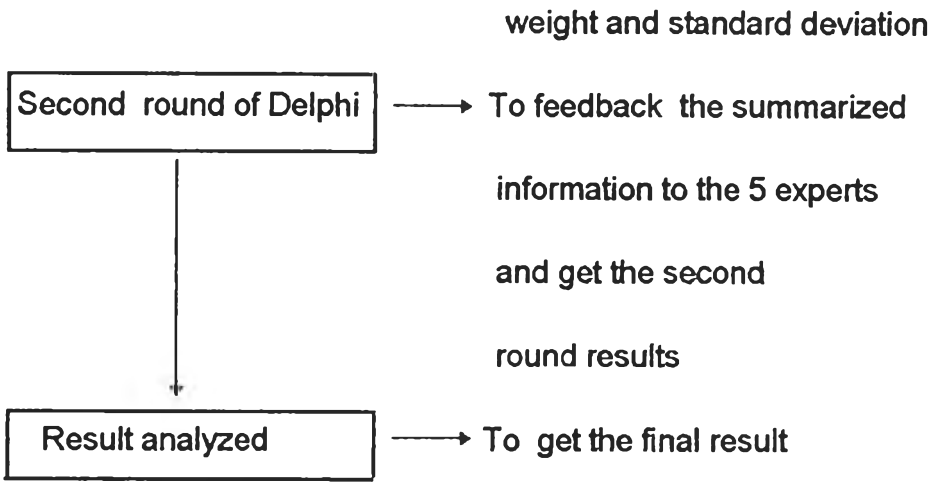
glaucoma, cataract, infection of skin and subcutaneous and so on.

4.2.3 Determination of a Weight for Each Disease

When measuring general health status, mortality and morbidity of different diseases should be combined into a general indicator by giving weights to diverse diseases. The Delphi process , one kind of consensus method, is used to determine the weight for different health problems (Jeremy jones and Duncan Hunter ,1995).

The Delphi process takes its name from the Delphi oracle 's skills of interpretation and foresight and proceeds in a series of rounds as follows:





The Delphi technique has been used widely in health research in the fields of technology assessment, education and training, priorities and information. It enables a group of experts to be contacted cheaply, usually by mail with self-administered questionnaires(computer communication has also been used), with few geographical limitations on the samples.

4.3 Evaluating Allocative Efficiency of the Public Budget between the Curative and Preventive Health Care

Efficiency means low input and high output. We want to get maximum output using limited resources. There are several aspect concerning the efficiency of resources allocation for health care. In order to analyze the efficiency of health resources allocation, it is necessary to distinguish between technical efficiency, allocative efficiency and social efficiency. Technical efficiency is where the costs of producing a given output are minimized, or where output is maximized for a given cost. It is studied in the search for optimal combinations of input which give the most output. The notion of allocative efficiency is derived from the nineteenth century work of Pareto (Alistair, 1988), whose 'principle of optimality' holds that there is a point at which the pattern of consumption of

goods or services in a society can not be rearranged to make any individual better off without making anyone worse off.

In our study, we want to know how the health budget could be allocated to get the best outcome. According to the theory, we can get maximum output when the marginal effect of curative care is equal to the marginal effect of preventive care.

Based on current knowledge, some important determinants of health status are discussed in following paragraphs, in order to define terms that must be incorporated in the model.

4.3.1 Health Status Measures:

The health sector, all institutions including hospitals , EPS and MCH want to improve local people's health status as much as possible. The expected outcome is decreased mortality and morbidity for all kinds of disease. In the model, the outcome measurement is the change (increase or decrease of mortality and morbidity in different regions between each two years.

4.3.2 Economic Factors:

Low economic development and high prevalence of disease are strongly and positively correlated both within developed and developing counties. Rapid economic development leads to a reduction in the risk of disease and better health. The reason is that good health, like most 'goods', costs money. Those who can afford to spend on averting the risk of disease spend money on medicines and medical attention, but also expend money on maintaining a healthy environment, with safe streets and roads, pollution control, better sanitation and safe water. As

economics develop, people's nutritional status improves and their resistance to disease will also increase. Prosperity allows communities to improve their physical environment and hygiene, which can reduce the disease transmission rate. Poverty and ill-health are mutually reinforcing, they are in a 'vicious cycle' in which poor health produces poor productivity, which in turn means low income.

4.3.3 Average Public Health Budget for Treatment

In China different levels of hospitals (provincial, prefecture, county, township) provide curative health services. Hospitals get regular revenue by selling drugs and providing services. Since the health industry is a kind of welfare, the price of most services is determined by government and it is often lower than its real cost. Hospitals can not survive without government subsidy. The more subsidy they receive, the more clinical services they can provide. But the problem is that the public health budgets are limited. The increasing hospital budget is always associated with decreased budget for prevention. The final result may be not good.

4.3.4 Average Public Health Budget for Prevention

In China , the different level EPS and MCH provide preventive services for the whole population and for special population groups. For the health result ''effectiveness of one ounce prevention is greater than one pound of treatment ''. Public health services are public goods. It provided freely. if preventive institutes can not get enough support from government, the quality and quantity of public health services will drop. The results are immunization coverage decreases; quality of disease surveillance decreases; health education is canceled .....All of this will affect the local people's status greatly.

4.3.5 Immunization

The basic immunization schedule includes: BCG, DTP, polio and measles. They can prevent 6 kinds of disease: TB, tetanus, whooping cough, diphtheria , polio and measles . Past study shown that mortality and morbidity of EPI preventable diseases have been reduced significantly since 1978 because of implementation of the EPI program .

The Chinese government has worked out a relevant plan and promised 85% coverage rate at the provincial level by 1988, and 85% coverage rate at county level by 1990. The decision was incorporated into the ''Seventh Five-Year Plan of China's National Social Economic Development '', and the targeted EPI coverage rates listed in ''National Program of Child Development in China in the 1990s: are : to maintain the high level EPI coverage; to get 85% coverage rate at the township level and accomplish 90% coverage by 2000.

In conclusion , overall socio-economic , health care and environmental factors are influential on the health status. They are considered as the basic of the empirical model which use to evaluate to allocative efficiency.

4.3.6 Empirical Model of Evaluating Allocative Efficiency

Based on the theoretical framework discussed above and data obtained, the empirical model is specified as follows. Data to be used in the model are county based, in 9 counties among 3 provinces from 1985 to 1993 .

Here Pornchaiwiseskul's (1993) model (discussed in Chapter 2) which is concern about communicable

disease should be employed as a basis to develop a new model.

To some extent , the other diseases is different from communicable disease. For example: usually the cause for the communicable disease is simple and clear compared with chronic disease. But in certain respects they are same: e.g. the cause of communicable disease can not change too much from year to year. The incidence of this year depends on last year to some extent. For chronic disease, the most common causes are people's behavior and environmental. The same applies to communicable disease, the model concerned with communicable disease can thus be used in a basic sense for other diseases.

$$\Delta \ln Y_{k,t,1} = a_{o1} + a_{11} Y_{k,t-1,1} + a_{21} X_{k,t,2} + a_{31} X_{k,t,3} + a_{41} X_{k,t,4} + a_{51} X_{k,t,5} + a_{61} X_{k,t,6} + a_{71} X_{k,t,7} + a_{81} X_{k,t,8} \quad \text{..... (4.3.1)}$$

$$\Delta \ln Y_{k,t,2} = a_{o2} + a_{12} Y_{k,t-1,2} + a_{22} X_{k,t,2} + a_{32} X_{k,t,3} + a_{42} X_{k,t,4} + a_{52} X_{k,t,5} + a_{62} X_{k,t,6} + a_{72} X_{k,t,7} + a_{82} X_{k,t,8} \quad \text{.....(4.3.2)}$$

$$\Delta \ln Y_{k,t,3} = a_{o3} + a_{13} Y_{k,t-1,3} + a_{23} X_{k,t,2} + a_{33} X_{k,t,3} + a_{43} X_{k,t,4} + a_{53} X_{k,t,5} + a_{63} X_{k,t,6} + a_{73} X_{k,t,7} + a_{83} X_{k,t,8} \quad \text{.....(4.3.3)}$$

where

t = subscript index of year

k = Index of county

$Y_{k,t,1}$ = mortality of k^{th} county $(1/10^5)$ in year t

$Y_{k,t,2}$ = weighted morbidity of communicable disease in k^{th} county ($1/10^5$) in year t

$Y_{k,t,3}$ = weighted morbidity of non-communicable disease in k th county ($1/10^5$) in year t

$X_{k,t,2}$ = k^{th} county year t public health budget for the preventive service (EPS, MCH)/per capita

$X_{k,t,3}$ = k^{th} county year t public budget for curative service Hospital)/ per capita

$X_{k,t,4}$ = per capita general county production (GCP/per capita) for k^{th} county in year t

$X_{k,t,5}$ = number of health staff per 1000 person for k^{th} county in year t

$X_{k,t,6}$ percentage of urban population for k^{th} county in year t

$X_{k,t,7}$ k^{th} county t immunization coverage rate in yeat t

$X_{k,t,8}$ k^{th} county complex indicator of MCH in year t

From equation (4.3.1) :

$$\Delta \ln Y_{k,t,1} = \ln Y_{k,t,1} - \ln Y_{k,t-1,1}$$

So:

$$\ln Y_{k,t,1} = a_{o\,1} + \ln Y_{k,t-1,1} + a_{11} Y_{k,t-1,t} + a_{21} X_{k,t,2} + a_{3\,1} X_{k,t,3} + a_{4\,1} X_{k,t,4} + a_{5\,1} X_{k,t,5} + a_{6\,1} X_{k,t,6} + a_{7\,1} X_{k,t,7} + a_{8\,1} X_{k,t,8}$$

For: $$a_{21} = \frac{d \ln Y_{k,t,1}}{d x_{k,t,2}} = \frac{dY_{k,t,1}}{Y_{k,t,1}\, dx_{k,t,2}}$$

so the preventive marginal effect of death reduce for k county at t year is

$$\text{Marginal effect } (ME_{p,t}) = \frac{dY_{k,t,1}}{dx_{k,t,2}} = a_{21} Y_{k,t,1}$$

This is the marginal effect for the current year. In fact the action of budget allocation can affect not only the current year but also has the long term affect.

For the second year:

$$\Delta \ln Y_{k,t+1,1} = a_{o1} + a_{11} Y_{k,t,1} + a_{21} X_{k,t+1,2} + a_{31} X_{k,t+1,3} + a_{41} X_{k,t+1,4} + a_{51} X_{k,t+1,5} + a_{61} X_{k,t+1,6} + a_{71} X_{k,t+1,7} + a_{81} X_{k,t+1,8} \quad \ldots\ldots\ldots\ldots (4.3.4)$$

so:

$$\ln Y_{k,t+1,1} = a_{o1} + \ln Y_{k,t,1} + a_{11} Y_{k,t,1} + a_{21} X_{k,t+1,2} + a_{31} X_{k,t+1,3} + a_{41} X_{k,t+1,4} + a_{51} X_{k,t+1,5} + a_{61} X_{k,t+1,6} + a_{71} X_{k,t+1,7} + a_{81} X_{k,t+1,8} \ldots\ldots\ldots\ldots (4.3.5)$$

$$\frac{d \ln Y_{k,t+1,1}}{d X_{k,t,2}} = \frac{d \ln Y_{k,t,1}}{d X_{k,t,2}} + a_{11} \frac{dY_{k,t,1}}{dX_{k,t,2}}$$

$$= a_{21} + a_{11} a_{21} Y_{k,t,1}$$

$$= a_{21} (1 + a_{11} Y_{k,t,1})$$

So:

$$\frac{d \ln Y_{k,t+1,1}}{d X_{k,t,2}} = a_{21} (1 + a_{11} Y_{k,t,1})$$

the marginal effect for the second year is

$$ME_{p,t+1} = \frac{dY_{k,t+1,1}}{dx_{k,t,2}} = a_{21}(1 + a_{11} Y_{k,t,1}) Y_{k,t+1,1}$$

Similary, the marginal effect for the third year is

$$ME_{p,t+2} = \frac{dY_{k,t+2,1}}{dx_{k,t,2}} = a_{21}(1 + a_{11} Y_{k,t,1})(1 + a_{11} Y_{k,t+1,1}) Y_{k,t+2,1}$$

For simplicity, we assume that it can affect 3 years(t, t+1 and t+2 year). The total death preventive marginal effect of t year budget allocation is sum of the three years:

$$\text{total } ME_p = ME_{p,t} + ME_{p,t+1} + ME_{p,t+2}$$

Similarly, we can get marginal effect for prevent different serious rank disease. The total preventive marginal effect in t year for k county is:

$$\sum_{j=1}^{3} (\text{total}ME_p)$$

j= 1: death

j= 2: communicable disease

j=3: non-communicable disease

the total curative marginal effect is:

$$\sum_{j=1}^{3} (\text{total}ME_c)$$

After the marginal effect has been calculated for different regions and different years, some suggestions give to the policy maker, for example, in t year, the marginal effect of prevention is greater than curative care in A county, if the local health authority moves some budget from curative to preventive health services, they can get better outcome than the existing situation.

4.4 The Equity of Public Budget

In this part, the equity of government health budget will be analyzed.

There are two basic type of equity: vertical equity and horizontal equity Vertical equity refers to the unequal treatment of unequal, this means if people have different health conditions they should be treated differently. Horizontal equity is concerned with the equal treatment of equals. It is perhaps simpler to handle largely because recognition of both conditions and treatment is easier.

In health care, equity is always cited as a goal of public health care system. Some policies have been formulated to enable consideration of how resources for health care can be distributed more equitably across different regions.

In order to set policies to promote equity in health care, measures have to be developed to identify the inequality of distribution of health resources. In recent times, many different measures of equality have been developed and employed. After assessing the advantages and limitations of each measure,

The Gini coefficient is generally used to measure the inequality of income distribution among population. It can be applied to measure the variation of health resource distribution between different population groups . The method is that the percentage of the population group arranged from least resources to most resources shared is represented on the horizontal axis and the percentage of resources shared by X% of the population is shown on the vertical axis. If the same proportion of population have the same percentage of resources, e.g. 10% of the population has 10% resources, 50% of population has 50% of resources, the resources are distributed with absolute equality. But in most situations, the resources distributed to the bottom groups represent a proportionately lower share of resources.

The Gini coefficient is the ratio of the areas between the line of absolute equality (the egalitarian line) and the actual distribution curve (Lorenz curve) (Fig. 4.2). The value of the Gini coefficient is restricted to the range from 0 to 1. If everyone has the same share of resources (perfect equality situation), the Lorenz curve will simply be the diagonal and the Gini coefficient is zero. But if one takes all the resources (perfect inequity situation), the value of Gini coefficient is one.

Amartya Sen(1973) provide a formula for calculation of the Gini coefficient

$$G = (1/2n^2 m)\sum_{n=1}^{n}\sum_{j=1}^{n} |y_i - y_j|$$

$$= 1 - (1/n^2 m)\sum_{n=1}^{n}\sum_{j=1}^{n} \text{Min}(y_i, y_j)$$

$$= 1 + (1/n) - (1/n^2 m)\sum_{n=1}^{n} i\, y_i \qquad \text{..... (4.4.1)}$$

for $Y_1 \geq Y_2 \geq \text{.....} \geq Y_n$

Where y is the resources distributed in each of equal population group.

n is the number of groups

m is the mean of health resources

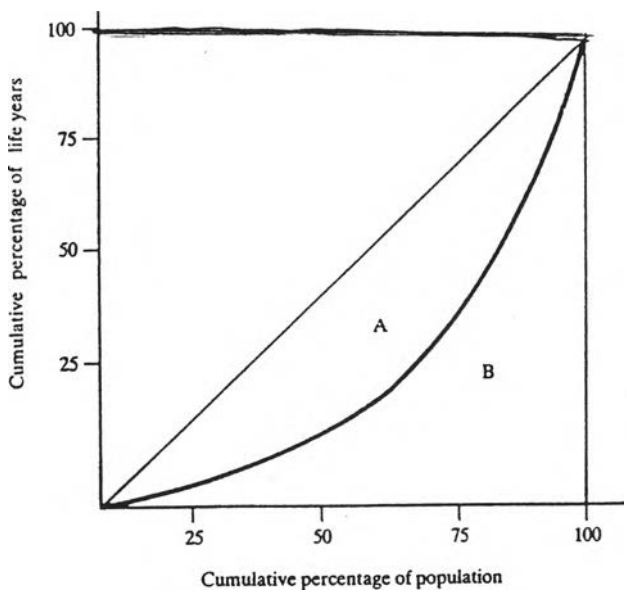


Fig. 4.2 Derivation of Gini coefficient

Leiman and Yitshaki (1984) developed a new formula for estimation of Gini coefficient

$$G = \frac{2 * Cov(x, F)}{\mu} \qquad \ldots\ldots\ldots \qquad (4.4.2)$$

here:

x is the variable which will be evaluated. In this case x is the per capita public health budget (prevention and curative budget)

F is the cumulative distribution of x

μ is the mean of x

The value of the Gini coefficient shows the degree of inequality. Zero means perfect equality and one means perfect inequality.

For evaluate the equity among different economic develop areas, we rank the county by their GCP per capita, and then calculate the Gini coefficient.

Through using this inequality measure, we can find out how the health resources are allocated in terms of equal access, and whether the inequality of health care is ''large'' or ''small''. Moreover they also can be used to assess what influences alternative health care policies will have on resource allocation and how much equality can be promoted through resources redistribution.

4.5 Data Collection

For establish the model we need the information about health status, economic indicators, health input, and other related information.

Dependent variables:

1. Mortality rate : Obtain from Disease surveillance of CAMP.

2. Morbidity rate: There are a communicable disease route reporting system in CAPM. It includes 35 kinds of communicable disease in each county for each month. But due to the limited time, we could not obtain it in time. So here we used a model to predicate the morbidity of communicable disease and non-

communicable disease. The data in the model came from a survey by MOH in 1993.

Independent variables:

Population, GCP, urban people proportion , preventive budget, curative budget, immunization coverage, mother and new-born health service coverage all of these indicates collected from a special survey which conducted by CAPM in 1993. It include total 3 provinces, 3 prefectures and 5 counties. In the study we only use the data at county level.

Other information as the average number of doctors and hospitals, consumer price index, were collected from three province ''Year Books'' .