CHAPTER III

RESEARCH METHODOLOGY

The School-based Oral Health Programme has been conducting in many primary schools in the North of Vietnam. But this Programme can cover only the provincial cities and major cities because of budget and man power limitation.

Among the schools where the Oral Health Programme has been conducted, the Dong Da and Nghia Hung primary schools were selected as case study. The Dong Da primary school located in Hanoi is representing for urban area, while the Nghia Hung located in Hai Hung province is representing for rural area. These two schools have the most highest number of school children. There are 2,879 students in the Dong Da school comprising 58 classes. Each teacher is in charge of one class from the beginning to the end. The Nghia Hung school has 1,987 school children devided into 40 classes. Some of the students have moved out to other schools due to the change of their residence. After each year, only students in case study were given checked up. The case study comprised of seven important components: a) Definition of DMFT index and DMFS index; b) Conceptual framework; c) Method of design; d) Method of sampling; e) Method of data collection; f) Method of costing; g) Method of analysis.

3.1 Definition of DMFT and DMFS Index

DMFT index and DMFS index are used to measure the average level of dental caries in a community. These indexes are defined by WHO as follows:

DMFT index is obtained by counting the number of decayed teeth (D), missing teeth (M)due to caries and filled teeth (F)in the mouth per person.

DMFT score equals the sum of the average number of decayed teeth per person plus the average number of missing teeth due to caries per person plus the average number of filled teeth per person.

$$DMFT = D + M + F$$

Where D is the average number of decayed teeth surfaces per person = total number of decayed teeth divided by total children that were examined

M is the average number of missing teeth due to caries per person = total number of missing teeth divided by total children that were examined.

F is the average number of filled teeth per person = total number of filled teeth divided by total children that were examined.

In more detail, DMFS is obtained by counting the number of decayed teeth (D), missing teeth (M) due to caries and filled teeth surfaces(F) in the mouth per person.

DMFS score equals the sum of the average number of decayed teeth surfaces per person plus the average number of missing teeth due to caries per person plus the average number of filled teeth surfaces per person.

DMFS = DS + M + FS

Where DS is the average number of decayed teeth surfaces per person = total number of decayed teeth surfaces divided by total children that were examined

M is the average number of missing teeth due to caries per person = total number of missing teeth divided by total children that were examined.

FS is the average number of filled teeth surfaces per person = total number of filled teeth surfaces divided by total children that were examined (WHO, 1994).

In this study, DMFT index was used to measure the dental status of school children in both groups.

3.2 Conceptual Framework:

The target school children were divided into two groups: the one implementing programme was called the intervention group and the other not implementing the programme was called the no intervention group. Before implementing the programme, school children in both two groups were examined and evaluated by Basic Methods of Oral Health Survey (Quang, 1990)

The conceptual framework consists of four steps:

a. Identify and analyze the input costs for establishing and operating the school-based oral health programmme at primary schools in the North of Viet nam.

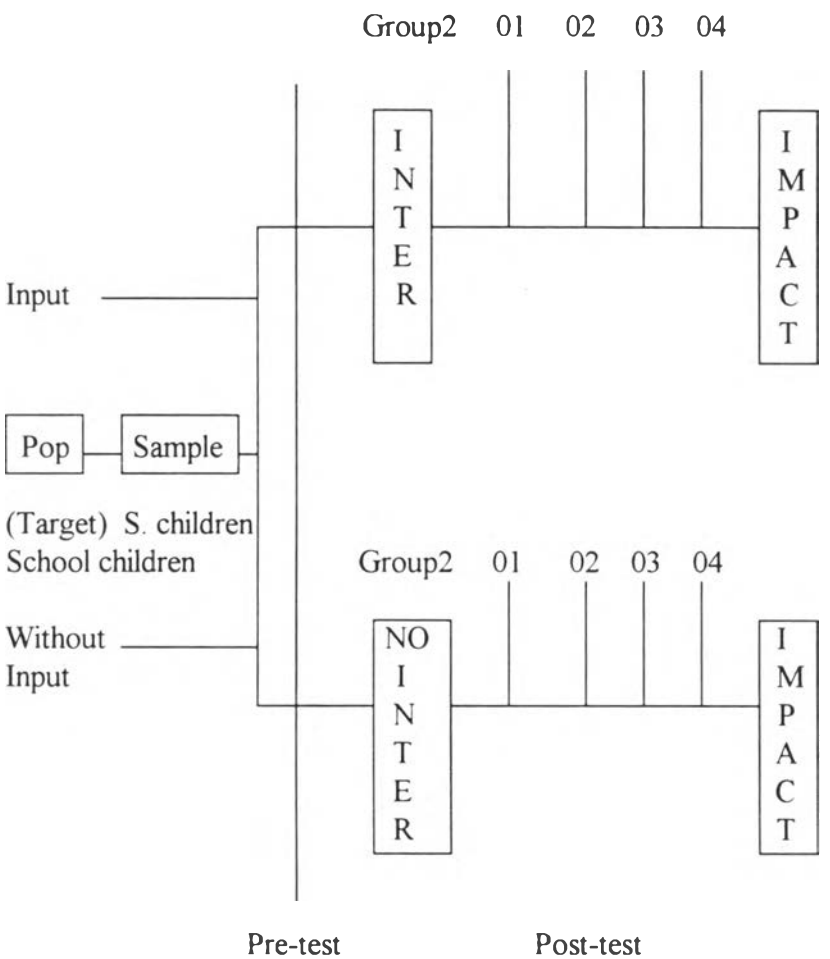
b. Identify and evaluate the outcome of the group of school children implementing the programme and the group of school children not implementing the programme.

c. Test the hypothesis concerning the difference in outcome between the two groups of school children one implementing the programme and the other not implementing the programme.

d. Evaluate the impact of input on the outcome of the programme using cost/effectiveness analysis year by year.

Conceptual framework of research is expressed by Figure 3.1

Figure 3.1: Conceptual framework of the study



Where: Group 1:Intervention group : this group applied the programme - with input

Group 2: No intervention - no programme - no input

O1 : Observation of the 1st year : DMFT per person and % students suffering from dental caries.

O2 : Observation of the 2nd year : DMFT per person and % students suffering from dental caries.

O3 : Observation of the 3rd year : DMFT per person and % students suffering from dental caries

O4 : Observation of the 4th year : DMFT per person and % students suffering from dental caries.

3.2.1 Identify and Analyze the Input Costs of the Programme Establishment and Operation

The input costs include:

- Capital costs.
- Recurrent costs.

Costs of the programme establishment and operation were calculated for all activities of the programme year by year in the period 1990-1994.

a) Cost component of the programme establishment (capital costs).

- Dental equipment:
  - Chinese-made dental chair.
  - Chinese-made dental machine.
  - Equipment for examination.
  - Equipment for treatment and sealing.
- Education equipment.
- Other equipment for dental services.

b) Cost Components of The Programme Operation (recurrent costs)

- Labour costs:
  - Salary of dental nurse.
  - Cost for training teacher.
  - Supervision costs

- Material costs: Cost of expendable supplies:
  - Materials for education.
  - Fluoride agents.
  - Chart for examining and monitoring.
  - Drugs and materials for treatment.
  - Materials for sealing.

- Costs of maintenance and repair of equipment.

- Administration and logistic costs

c) Total Cost (TC)

$$\boxed{\mathbf{TC} = CP + RC}$$

$CP = DEC + EEC + OEC$
$RC = LC \quad MC + MRC + AC + SC$
$TC = DEC + EEC + OEC + LC + MC + MRC + AC + SC$

Where:

TC is total costs.
CP is capital costs.
DEC is dental equipment costs
EEC is educational tools costs
OEC is other equipment cost
RC is recurrent costs
LC is labor costs.
MC is recurrent material costs.
MRC is maintenance and repair cost of equipment.
AC is administration and logistic costs.
SC is supervision costs

d) Average Cost (AC)

$$AC = \frac{TC}{PP}$$

Where: AC is average cost
TC is total cost
PP is total children who received the programme

e) Marginal Cost (MC)

$$MC = \frac{\Delta TC}{\Delta DMFT}$$

Where:
MC is marginal cost
ΔTC is equal the change of TC
ΔDMFT is equal the change of DMFT between the group not implementing the programme and the group with implementing the programme.

- Input cost system is shown by Figure 3.2

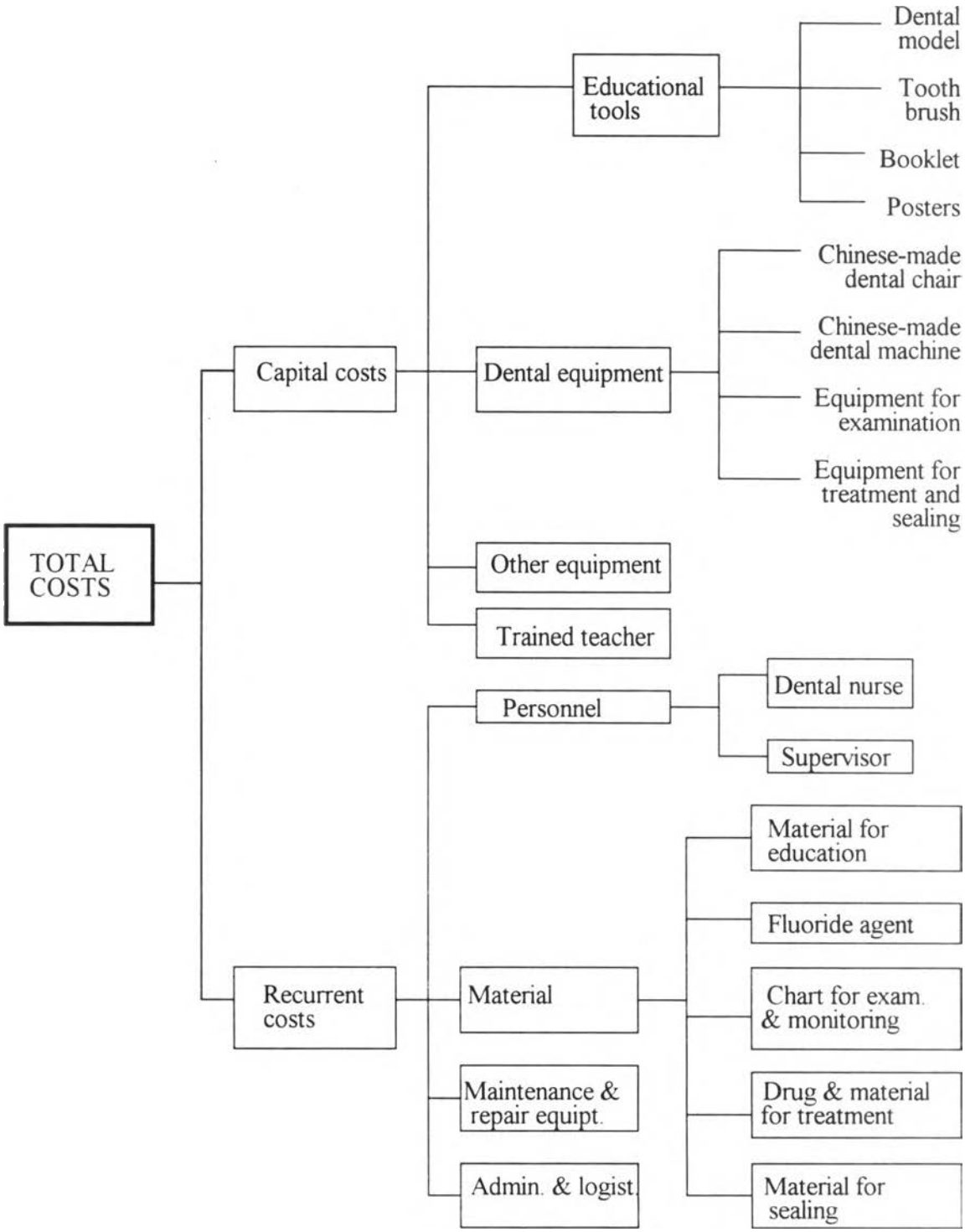
- Costs per year for implementing the programme are the sum of costs per year for establishing a programme plus costs for running the programme for all activities and these costs will be calculated year by year

- Cost per person is total costs divided by population number.

- Cost system should be given in detail so that any expected cost element for implementing programme can be included.

- Costs for the use of school facilities and for the service of school personnel and the teacher will not be included because they are usually provided gratis.

Figure 3.2: Cost Component and their Classification



3.2.2 Identify and Value Outcome.

a) Identify and Measure Outcome of Two Groups of School Children:

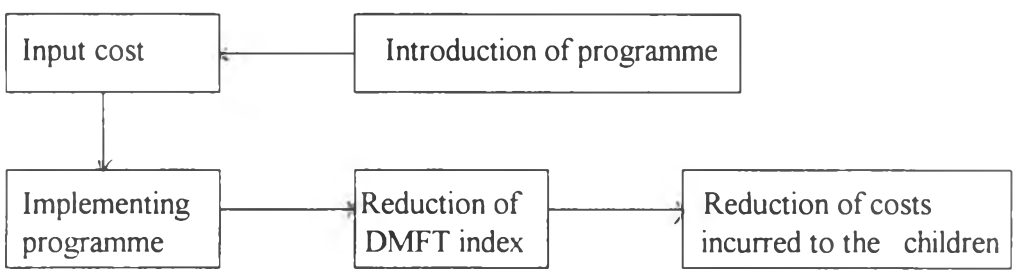
Outcomes of the two groups,one implementing the school- based oral health programme, the other not implementing the programme will be measured by DMFT index per person per every four years.

Prevalence of students suffering from dental caries is the percentage of students suffering from this disease.

b) Value outcome:

Valuing the outcome for the group of school children with programme is shown in the following figure:

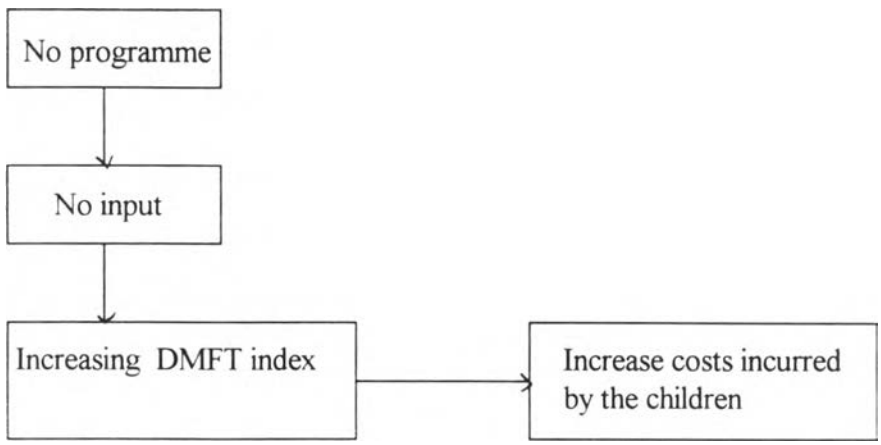
Figure 3.3: Predict and Value Outcome of Group of School Children with Programme



Implementation of school-based oral health programme reduces DMFT index and also reduces the number of students suffering from dental caries and consequently reduces the costs incurred by them.The costs incurred by the children are not only the costs they have to pay for the bill of dental services as well as transportation costs when they go to dental clinic but also the cost of days lost from study.

Valuing outcome of the group of school children not implementing programme in figure 3.4

Figure 3.4: Value Outcome of Group of School Children not Implementing the Programme



Not implementing the school based oral health programme make increasing the DMFT index, and causes the bad consequence to the students.

3.2.3 Test the Hypothesis Concerning the Difference of the Outcome Between Two Groups of School Children, One Implementing the Programme "Case"and the Other Not Implementing the Programme "Control" by T-statistic

The t-test was used for testing the difference of the student's outcome between two groups of school children while F-test will be used for testing variance.

Steps for testing are as follow:

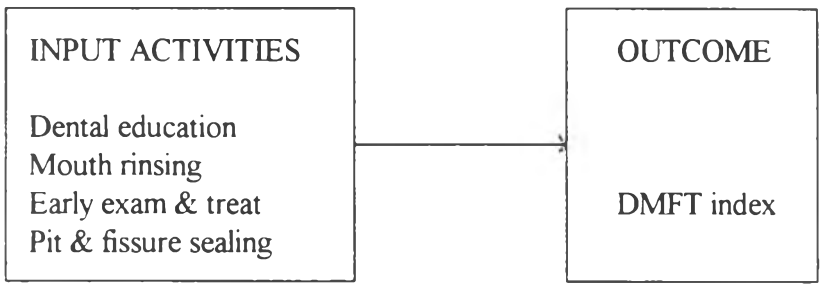
1 Formulate the null hypothesis (Ho) in statistical terms.
2.Formulate the alternative hypothesis (Ha) in statistical terms.
3.Set the level of significance and the sample size n.
4.Collect the data and calculate the statistic.
5.If the calculated statistics fall in the rejection region Ho will be rejected according to the rejection rule in favor of Ha. If calculated statistics fall outside of rejection region Ho will be accepted

3.2.4 The Impacts of Input Factors on the Outcome of the Programme

There are four input factors that have effects on the DMFT of the programme. Each of them has an effect on the DMFT index.

The impact of input factors on the outcome of the programme was expressed by following scheme (Figure 3.5):

Figure 3.5: The Impacts of Input Activities on the Outcome of the Programme



3.2.5 Evaluate the Impacts of Input Costs on the Outcome of the Programme by Cost-Effectiveness Analysis year by Year:

Calculation of cost- effectiveness of school-based oral health programme year by year

Cost-effectiveness

$$= \frac{\text{Cost of procedure / person / unit of time}}{\text{Mean DMFT saved / person /unit of time}}$$

$$= \frac{\text{Cost}}{\text{1 DMFT saved}}$$

Cost of procedure/person = total cost / total population
Unit of time = 1 year
Effectiveness = Mean DMFT saved = DMFT/person of control group minus DMFT/person of "case" group

Cost-effectiveness will be compared year by year over the four years period

3.3 Method of Design

This study is retrospective study

The time-series data during 1990-1994 and case-control study in two schools,one implementing the programme as case,another not implementing the programme as control were used to analyze input factors,costs and outcome of the programme.

In a sense this study uses a quasi- experimental method,since the effect of active intervention are measured overtime in term of output.

3.4 Method of Sampling

3.4.1 Target Population

School children aged between 6-12 years in primary schools at Hanoi and Tuloc.

3.4.2 Population to Be Sampled

School children aged between 6 to 12 years of the two schools, one in Hanoi and one in the Tuloc district were sampled. All the children of different classes involving in the study are divided into two groups one as case, another as control.

Since the programme has been applied under constrains of limited budget and manpower, some schools in Hanoi and the delta province were chosen already for study because of their ready accessibility.

The criteria for selecting the population to be sampled:

The children at the same school were selected for both case and control group in order to have similar social-economic status, similar habits, similar dental status, and the same environment.

3.4.3 Sampling Unit

Sample unit: Class
Study unit : School child

3.4.4 Sampling Technique

There are three steps in sampling:

Step 1: Choosing schools for study: Two schools were selected for this study with highest population in order to avoid error, one in the Hanoi representing an urban area, the other in Tu loc, Hai hung representing a rural area.

Step 2: Choosing classrooms: Classes from class 1 to class 3 were selected because they can be followed up. These classrooms were divided into two groups randomly

Step 3: Choosing school children: All school children at age from 6 to 9 in the classes who were selected for the study were examined and followed up every year.

3.4.5 Sample Size

Although this is a retrospective study so that the sample sizes (case and control) are predetermined, calculation of adequate sample size was be done to assess the adequacy of the samples selected,using the formula

$$n = \frac{Z^2PQ}{\Delta^2}$$

Where.

Δ is acceptable error = 0.03
P is proportion of dental caries = 0.37
Q = 1 - P
α = 0.05
Z_α = 1.96

$$n = \frac{(1.96)^2 0.37(1 - 0.37)}{(0.03)^2}$$

n = 995 per 1 group

3.5 Method of Data Collection

Using time series data during 1990-1994 as follows:

- Cost data
- Outcome data

3.5.1 Cost Data

Interview with relevant persons for each component of costs:

At Institute of Odonto-Stomatology Maxillo-Facial-Surgery in Hanoi:

- Price of dental machine,dental chair, drugs, fluoride, chart for examining and treatment, material for education,salary of dental nurse, cost of supervisor.
- The useful life of each kind of equipment

At the schools:

- The time used for each activity, the cost for administration and logistics

3.5.2 Source of Outcome Data:

Annual reports of dental caries surveys at the Institute of Odonto - Stomatology - Maxillo Facial Surgery

3.6 Method for Costing

Costing is an important part of evaluation.There are methods of responding to the question " How costs are measured and " How to calculate costs?".

3.6.1 Method of Responding to the Question " How Costs Are Measured"

Both financial and economic costs represent the costs of resources consumed For financial costs,inputs are always valued at the price paid for them while economic cost inputs are valued in terms of their opportunity cost value.

In this study, financial costs were used for measuring of costs The total costs are basically calculated as the sum of the costs of inputs used The cost of each input is simply calculated as the unit cost of that input multiplied by the number of units used.

The contracture of itemized cost menus for implementing the programme should:
- Make explicit the cost for each item.
- Ensure that all inputs are included.
- Allow changes in the unit price and quantity to be considered.

Cost allocation is determined by the dimensions of input that determine the cost.With specific inputs that only use one activity then the entire costs have to be assigned to this activity.With inputs that are used for multiple activities of the programme,the cost will be shared for these activities.

3.6.2 Method of Responding to the Question " How to Calculate Costs"

1. Identify the resources used for the programme.
2. Calculate the quantity consumed of each input.
3. Assign monetary value to each unit of inputs and calculate the total cost of each input.
4. Allocate the cost to the activities for which they are used.

For example:

Costing of training the teachers includes:

- Number of teachers to be trained.
- Number of required training days for each teacher.
- Required number of trainers.
- Per diem per trainer
- Travel cost per trainer.
- Administration cost (renting of conference room,printing)

3. 7 Method of Analysis

3.7.1 Statistical Technique to Test the Impacts of the Programme

Test the difference of the mean of decayed, missing due to caries and filled teeth surfaces (DMFS index) between the two groups of school children, one implementing the programme and the other not implementing the programme and the other no programme

Hypothesis: There is a difference in the outcome between two groups of school children, one implementing the Programme and the other not implementing the Programme Null hypothesis[Ho] is compared with alternative hypothesis (positive) [Ha]

Before testing the hypothesis some assumption will be made to advoice insignificance of the test.

Assumption:

1. The number of students who withdraw from the programme is small.
2. The interaction between the students in school has little effect on the outcome
3. Advertisements on the consumption of sugar have the same affect on both groups

a) Before Testing the Difference of the Outcome of the Two Groups School Children, Variance Will be Tested:

Using F-test for testing of variance:

$$Ho : \sigma_1^2 = \sigma_2^2$$

$$Ha : \sigma_1^2 \neq \sigma_2^2$$

$$F = \frac{S_1^2}{S_2^2}$$

Rejection rule : If $F > F_{\alpha/2;\, v_1\, ,\, v_2}$ then reject Ho.

Where $v_1 = n_1 - 1$

$v_2 = n_2 - 1$

b) To Test the Difference of the Outcome Between the Two Groups of School Children by Using t-test :

If $F < - F_{\alpha/2;\, v_1\, ,\, v_2}$ then $\sigma_1 = \sigma_2$

Null hypothesis Ho : $\mu_1 \geq \mu_2$

Positive hypothesis Ha : $\mu_1 < \mu_2$

μ_1 is the mean of DMFT per person of group with intervention.

μ_2 is the mean of DMFT per person of group without intervention.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{\bar{x}1-\bar{x}2}}$$

Where : $S_{\bar{x}1-\bar{x}2} = \sqrt{S^2_{pooled}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$

$$S^2_{pooled} = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

t value has $n_1 + n_2 - 2$ degrees of freedom.

Rejection rule : If $t < -t_{\alpha 2}$, $n_1 + n_2 - 2$ then Ho will be rejected

If $F < F_{\alpha 2}$, v1, v2 then $\sigma_1 \neq \sigma_2$

Null hypothesis: Ho $\mu_1 \geq \mu_2$

Positive hypothesis: Ha $\mu_1 < \mu_2$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{\bar{x}1-\bar{x}2}}$$

Rejection rule : If $t < -t_{\alpha 2}$ v , or $t > t_{\alpha 2}$, v

Then Ho will be rejected

Where

$$S_{\bar{x}2-\bar{x}1} = \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}$$

n_1 is population of intervention group

n_2 is population of no intervention group

v is the degrees of freedom

$$v = \frac{(S_1^2/n_1 + S_2^2/n_2)^2}{\frac{(S_1^2/n_1)^2}{n_1 - 1} + \frac{(S_2^2/n_2)^2}{n_2 - 1}}$$

3.7.2 To Analyze the Costs to Provider for Establishing and Operating the Programme

In this study,total cost, average cost, marginal cost and cost / effectiveness ratio for programme year by year were considered.

Where the components of total costs are:

- Total costs of dental health education
- Total costs of mouth rinsing.
- Total costs of treatment.
- Total costs of pit and fissure sealing.

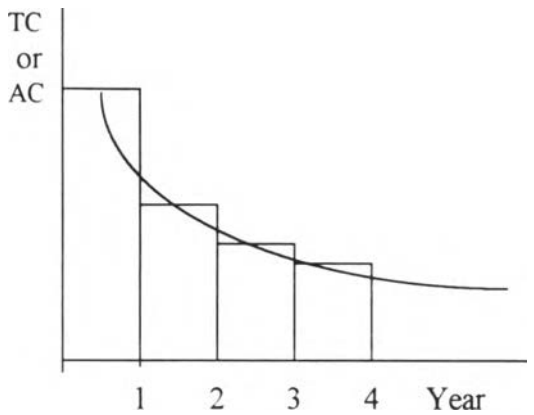
Average cost equals total costs divided by students with programme.

Marginal cost equals the change of total costs divided by the change of DMFT

Effectiveness = Mean DMFT saved / person /year.

If the programme is effective, the year by year cost curve should be of the general shape shown in Figure 3.6

Figure 3.6: The General Shape of Cost Curve



In the first year, TC and AC are high,even though capital costs are depreciated equally over four years, because recurrent costs (teacher training, treatment etc.) will likely be higher. In years 2,3,4 TC and AC will likely decrease below the value for year 1. The marginal cost should move in the same general direction as TC and AC. If TC and AC in the direction as indicated in the graph, the programme will have been effective. At that point, if quality of these services is to be improved, the marginal cost will rise subtantially, that is the cost for each additional tooth saved will be high.

If the programme is effective, the effectiveness should also increase from year to year. As the cost decreases,so the cost/effectiveness ratio will decrease and the programme is successful in preventing dental caries.

If the cost increase year by year and the DMFT index remains unchanged or increases, changing the programme should be considered carefully on the basis of factors that have an effect on the cost and the outcome of the programme.

The factors affecting the cost of the programme include the prevalence of dental caries, the number of dental clinics, etc. and the factors affecting the outcome of the programme include the interaction between students,students entry into and withdrawal from the programme, the advertisement about consumption of sugar and candy. These factors can be important in actuality but can't be controlled and they can cause bias in the study; assumption will be made if the errors are to be allowed.

3.7. 3 Sensitivity Analysis : to Analyze the Impact of Input Factors on the Outcome of the Programme

There are four input factors that can have effects on the outcome of the programme :

1. Dental health education including correct tooth brushing technique. This task is performed by the teacher now.

2. Weekly mouth rinsing with 0.2% sodium fluoride is supervided by the teacher

3. Regular periodical examination to detect dental caries and early treatment. This activity is performed by the dental nurse.

4. The pit and fissure sealant performed by the dental nurse.

In these actions, assume the costs for each action are unchanged.

The changes of each of the four input factors above can have effects on the outcome of the programme. It has been found that tasks 3,4 depend on available skills of the dental nurse.

When conducting this programme, the amount of fluoride and the skills of dental nurses were assigned by WHO standards, so they can be considered to be constant

Assumptions

1. Tasks 3, 4 have no effect on the outcome of the programme.

2. The students entering and withdrawing from of school during study period were very few, so that it is possible simply to detect these students from the sample without detriment to the study outcome.

3. The advertisement about consumption of sugar in the mass media has the same effect on both groups.

4. Some interaction between students in different classes (hence between case and control groups) will inevitably occur. However, the children do not eat lunch at school and interaction time is very limited. So it is reasonable to assume that this has very small effect on the outcome of the study.

If the effectiveness (DMFT) is 10% or 20% lower than observed, the cost-effectiveness ratio will be increased. In that case, the DMFT of the programme depends on the knowledge of the teachers and their co-operation.

The dental health education plays a very important part in preventing the disease because by getting the education the children know how to brush their teeth correctly ,how to use good diet, how to take care their teeth,what kind of tooth paste should be used. If the teacher has bad knowledge of preventing this disease, or she does not want to co-operate with the dental nurse the outcome will be adversely affected and vice versa.

Beside the good knowledge of the teachers, their co-operation also plays an important part in implementing this programme because they will guide and help students in rinsing their mouths with sodium fluoride.

In order to improve the results of the programme the teacher should be trained carefully and should be encouraged to do this work. Together with training the teachers, their knowledge will be examined.

Assumed effectiveness remained unchanged, the cost-effevtiveness ratio will be increased if the costs inflated. Together with the lack of dentists and dental nurses, teacher should be trained in the long run not only for doing tasks 1, 2 but also for tasks 3, 4 as well.