Chapter III

3. Research Methodology

3.1 Study design

This study was a cross-sectional survey. In a sense this study used a quasi-experimental method. This paper provides an illustration of the way that economic appraisal may be used to assess the costs and outcomes of a program of preventive dentistry offered as an alternative to doing nothing for school children in public primary school in Bangkok. It mainly tried to analyze costs to provider to establish and operate oral health preventive program at public primary schools in Bangkok and to calculate cost-effectiveness of this program. I collected the information from secondary data of patient record and lists of cost of the Faculty of Dentistry, Mahidol University during 1995-2000. It calculated the total cost, average cost, and incremental cost of provider for dental preventive care at public primary schools in Bangkok. In addition, it also tried to examine the difference of outcome between experimental group, implemented this program and control group, not implemented this program.

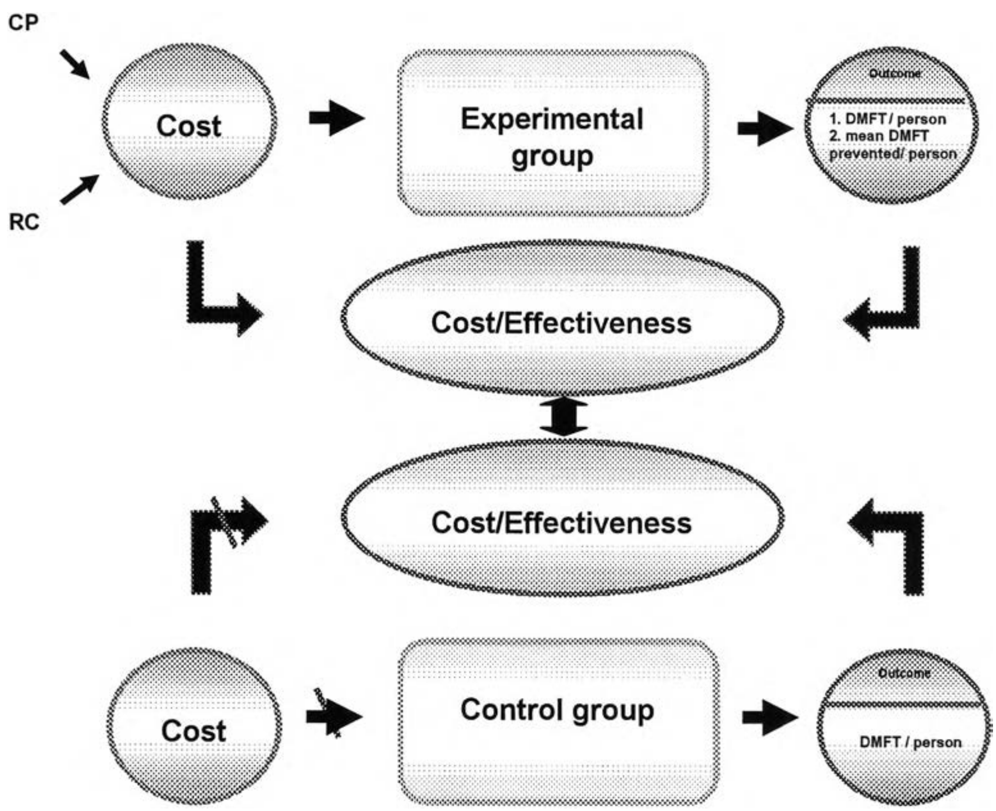
3.2 Conceptual Framework of study design

A cross-sectional patient record analysis was conducted to calculate the costs to providers and cost-effectiveness of oral health preventive program received by two groups of patients, one group that received the program was called the intervention group or "experimental group" and the other group that did not, called non-intervention group or "control group". The children in this study were in Bangkok, which same socio-demographic backgrounds and risk factors of dental caries.

The conceptual framework consists of five steps:

1. Identify and analyze the input costs for establishing and running the oral health preventive program at public primary schools implemented by Faculty of Dentistry, Mahidol University.
2. Identify and evaluate the outcome of children group implementing the program and children group not implementing the program.
3. Test the hypothesis concerning the outcome of children's group not implemented greater than one of the other implemented.
4. Calculate the effectiveness of preventive program which equals proportion of caries reduction.
5. Calculate the cost-effectiveness ratio of school-based oral health preventive program.

Figure 3.1: Conceptual Framework of study design



3.3 Area of study

Unit of analysis of this study was school children, who were classified by using multistage cluster technique. Schools in this study were chosen from public primary schools in Bangkok. These schools were classified according to the district and then some classes of students in these schools were participated in this program. The school children selected had to have been enrolled in public primary schools in Bangkok at between 6 and 7 years of age in 1995, when the school-based oral health preventive program began. Since this program spent for 5 years, therefore, the school children chosen should give full cooperation. Students in this study were assumed to be homogeneous and risks of dental caries were not different.

3.4 Methodology

This study was conducted in Bangkok, Thailand. At the start of the study, the subjects selected from the 6-7 year olds who had been enrolled at the public primary schools in Bangkok, entered the program in 1995. Total subjects were divided into 2 groups, one group of school children whom their parents allowed to participate in the oral health preventive program, implemented by dental student from Faculty of Dentistry, Mahidol University called "experimental group", and the other group of school children who did not receive the oral health preventive program implemented by dental student from Faculty of Dentistry, Mahidol University called "control group". Eight dental students and two dental assistants supervised by a staff member of Community Department, Faculty of Dentistry, Mahidol University, visited the school 2-3 times per week during school terms. The 5th year dental students performed all examinations and treatment during their involvement in this project. Treatment need for children was documented on an examination form specially designed for this project. The children's parents were given a letter of notification that informed them of the project and the need for treatment. Parents were requested to provide consent before treatment could commence.

The program evaluated was a "package" of preventive techniques for children which, usually are conducted entirely in school settings or what we called 'school-based programs'. The program incorporates several established preventive methods whose efficacy has been demonstrated in a series of clinical evaluations.

The program consisted of the following treatment modalities: oral health education, full mouth polishing with fluoride paste, fluoride mouthwash application, pit and fissure sealing (sealant), and preventive resin restoration (PRR) by using mobile dental unit at those schools. There are criteria for providing each preventive care as follows:

- Oral health education : provide all children of experimental group
- Polishing with fluoride-containing prophylaxis paste : provide to children who have poor oral hygiene
- 0.2% Fluoride mouthwash : provide to children who have poor oral hygiene
- Pit and fissure sealant : sealing on chewing surface of deep groove tooth (especially on first and second permanent molar teeth)
- PRR : narrow enamel caries

The main focus of the program was on the prevention of dental caries, and as result the placement of fissure sealants; oral health education played a very important role.

The age group was chosen primarily because the first and second permanent molar teeth would on average have just erupted, or would be erupting during the trial period and, therefore, would be at the most appropriate stage for dental sealing. On the entry, each subject's oral health status was recorded using DMFT index on school tables by dental student, and then subjects answered the questionnaire about socio-demographic data and oral behaviors which can relate to risk factors of dental caries. The dental examination was undertaken using mouth mirror. No radiographs were taken.

Dental students provided oral health education to groups of children. The oral health education materials were used. The content of the education included oral anatomy, the etiology, development, prevention, and treatment of dental caries and periodontal disease. The importance of oral hygiene and how to brush their teeth was emphasized, using disclosing tablet, poster and pamphlets held annually.

In addition, 1.23% acidulated phosphate fluoride-containing paste application was applied to children who had proximal caries more than 2 positions and/or the Simplified Debris Index (DI-S) more than 1.9 for 1 visit per year and reapplied at each 12-month interval on the basis of individualized treatment plans established at the time of the annual dental examinations. A 0.2% fluoride mouthwash was also applied to poor oral hygiene children as fluoride paste criteria for 1 visit per year.

Furthermore, the dental sealant application was undertaken by dental students (aided by a chair-side assistant by four to one (dental student: dental assistant)). Sealants were placed on all appropriate first and second permanent molar teeth based upon the morphology. The dental sealants were placed, repaired, or replaced at each 12-month interval on the basis of individualized treatment plans as well.

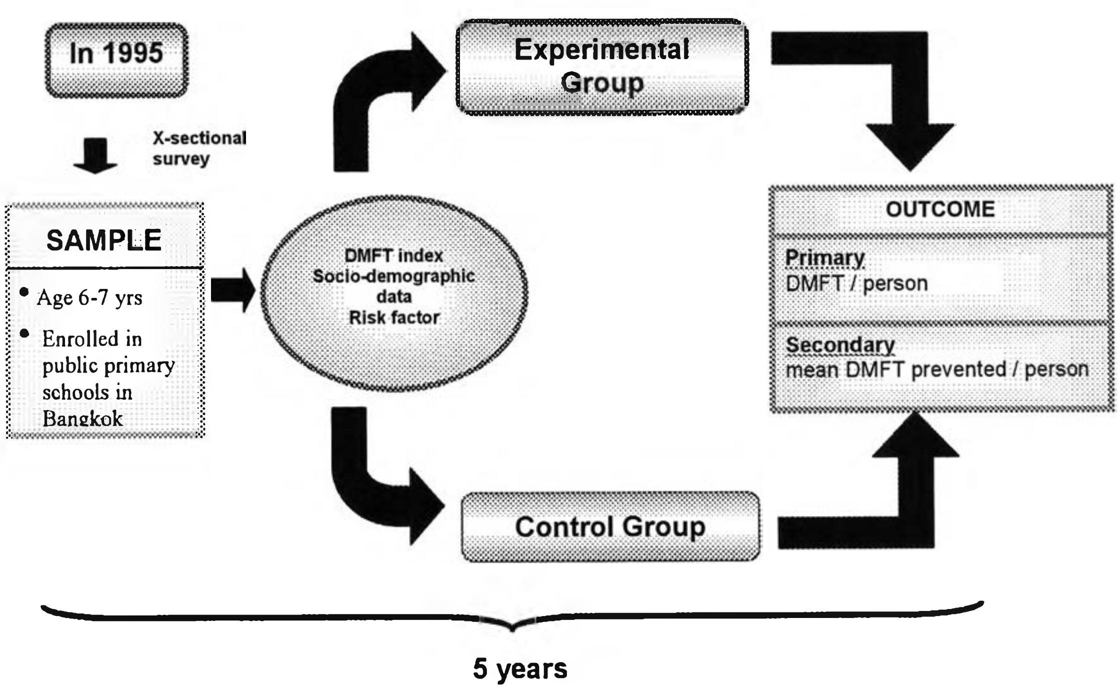
Moreover, preventive resin restoration was treated by dental students aided by chair-side assistants on the basis of individualized treatment plans annually.

These oral preventive programs attended continuously for a period of 5 years to this experimental group. In 2000, the total subjects at the age 11-12 year olds were reexamined oral health status by using DMFT index, this study then compare the outcome of two groups of children and calculate cost-effectiveness of this program.

(**Note**: there were oral examinations to subjects in experimental group every year in the period of study)

3.5 Conceptual Framework of methodology

Figure 3.2: Conceptual framework of methodology



3.6 Socio-demographic data and risk factors of dental caries

Socio-demographic data and risk factors of dental caries can affect the outcome of two groups of school children, therefore, these factors of two groups should be similar, and then two groups are comparable. The information which should be compared consists of age, sex, oral health policy, water fluoride level, location/urbanization, oral behaviours, dental visit and DMFT index. Before testing the research hypothesis, DMFT index were determined by Z test. Since these two groups were children in public primary schools (not the same schools between two groups) in Bangkok, they were in the same oral health policy, water fluoride level and urbanization as well.

Table 3.1: Baseline of control group and experimental group

Characteristic	Control group	Experimental group
Sample size (n)	353	104
Gender--% female	46 %	41 %
DMFT (SD)	0.2 (0.017)*	0.23 (0.611)*
Tooth brushing frequency		
• Once a day	21.3 %	38.1 %
• Twice a day	51.1 %	50.5 %
• Unknown	27.4 %	11.4 %
Number (%) of children have visit to dental hosp./clinic in the last year:		
• Visit	52.9 %**	40.2 %**
• Not visit	47.1 %	53.6 %
• Unknown	0 %	6.2 %

* There was no statistically significant difference between control and experimental group in baseline permanent tooth caries experience.

** There was no statistically significant difference between control and experimental group in baseline percentage of children who have visit to dental hospital or clinic in the last year.

3.7 Method of Data Collection

This study using data available during 1995 - 2000 as follows:

3.7.1 Source of Cost Data

- List of price of mobile dental unit, material for education and treatments, transportation
- The useful life year of each type of equipment
- List of staff's salary

3.7.2 Source of Outcome Data

- Chart record form for this program

3.8 Input costs of school-based oral health preventive program

The input costs include:
- Capital costs
- Recurrent costs

Costs of the preventive program establishment and operation were calculated for all activities of the program in the period 1995-2000. Cost data will be analyzed year by year over five years from 1995 to 2000 (except incremental cost-effectiveness ratio, it can be calculated only final year of study).

3.8.1 Capital Costs (CP) were calculated by using depreciation and time allocation for the program.

1. Cost of Dental equipment
   - Dental mobile unit
   - Equipment for dental care
   - Other instrument for dental services
2. Cost of vehicles
3. Cost of school facilities

3.8.2 Recurrent Costs (RC)

1. Labor cost
   - Salary of supervisor
   - Salary of dental student
   - Salary of dental assistant
   - Salary of driver
   - Salary of teacher
2. Material cost
   - Cost of material for sealing
   - Cost of material for PRR
   - Cost of material for fluoride
   - Cost of material for oral education
   - Cost of other drugs and materials
   - Cost of gasoline and maintenance
   - Cost of school utilities (electricity)

3.8.3 Total Cost (TC)

Total cost was equal to the summation of capital cost and recurrent cost incurred of this program.

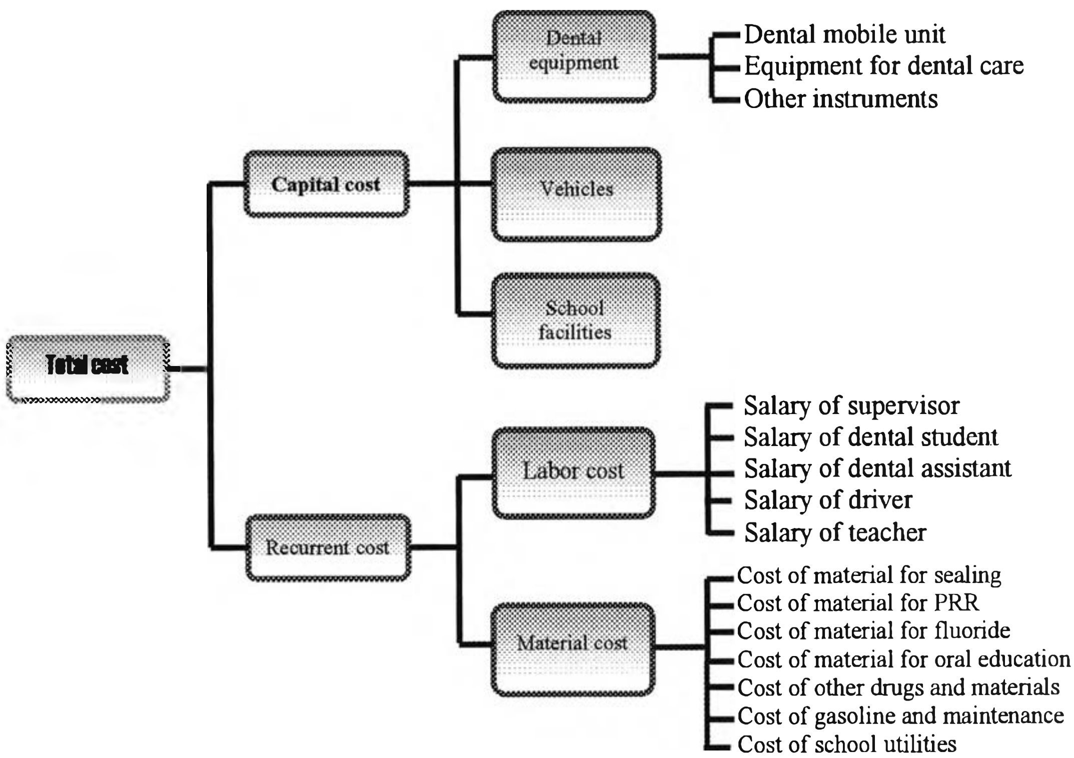
$$TC = CP + RC$$

CP = DEC + VC+ SFC
RC = LC + MC
So, TC = DEC + VC+SFC+ LC + MC

Where:

TC = Total Cost
CP = Capital Cost
RC = Recurrent Cost
DEC = Dental Equipment Cost
VC = Vehicle Cost
SFC = School Facility Cost
LC = Labor Cost
MC = Material Cost

Figure 3.3: Conceptual framework of input cost components



3.8.4 Average Cost (AC)

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

Where: AC = Average Cost
TC = Total Cost
Np = No. of children in experimental group who participate in the program

3.8.5 Differential timing of costs

Dental care programs with different time profile typically involve a stream of costs occurring over time. In order that these can be compared, costs must be converted to future values by involves the technique of discounting. Costs in preventive dentistry usually incurred heavily at many first years of program, but effectiveness of preventive dentistry often increases in the last years, therefore this study will not discounting the outcome.

The time profile of costs and benefits is likely to be especially important in the case of preventive care, which typically involves the sacrifice of resources now in order to achieve benefits in the future. As Niessen and Douglass (1984) pointed out, the main caries preventive measures vary markedly in the length of time taken to attain maximum effectiveness, from around a year in the case of fissure sealants, to five years for topical fluoride applications.

As comparison of programs or services must be made at one point in time (usually the present), the timing of program costs which do not fall entirely in the present must be taken into account. In this study, costs are discounted to the year 2000 using formula as follows:

$$FV = PV(1+r)^n$$

where; PV =Present value
FV =Future value
n =years
r =interest rate

Since the period of this study involved in the economic crisis of Thailand (1997), the interest rates were important for calculation costs. Therefore, costs of this program would be affected from the change of interest rate. According to data of Bank of Thailand (BOT 2005) in period 1995-1997 the average interest rate was 10%, and in 1998-2000, the average interest rate was 5%. Then this study will use these rates to discounting costs of each period.

1995-1997: r =10%
1998-2000: r =5%

3.9 Method for calculating costs

The calculation of the costs of this program involved four steps.

1. Identify the input costs of establishing and running the program
2. Calculate the quantity consumed of each input
3. Valued these costs to each unit of inputs and calculate the total cost of each input
4. Allocate the cost to the activities for which they were used

3.9.1 Calculation of capital cost

The annual economic value is based on cost of the capital items (their costs in the year for which costs are valued i.e. 1995), their expected useful lives, and the interest rate or discount rate. To calculate the annual economic costs of all capital inputs the following formula (Drummond, *et al.* 1997) is used:

$$\text{Annual economic cost} = \frac{\text{Current value of the item}}{\text{Annualization factor}}$$

Or,

$$C_a = \frac{C_{k1}}{A_{f1}(n_1, r_1)}$$

$$C_b = \frac{C_{k2}}{A_{f2}(n_2, r_2)}$$

Where, C_a = equivalent annual cost of capital input in 1995-1997
C_b = equivalent annual cost of capital input in 1998-1999
C_{k1} = the current initial costs of capital inputs purchased at the beginning of investment's year
C_{k2} = the current remaining costs of capital inputs at the beginning of 1998
A_{f1} = annualization factor for calculation at the first 3 years of study
A_{f2} = annualization factor for calculation at the last 2 years of study
n_1 = the useful lives of the equipment
n_2 = the remaining useful lives of the equipment
r_1 = interest rate at the first period of study
r_2 = interest rate at the last period of study

Because the period of this study involved in Thailand economic crisis (1997), the capital costs could not calculate in one step. The capital costs then were calculated in 2 periods by the first period was calculated in 1995-1997 and the last period was calculated in 1998-2000. The annual costs for the last period were calculated by using the current market value of the old equipment and its remaining useful life.

For example, the annual capital cost of dental mobile unit was calculated as follows:

The current initial cost of dental mobile unit in 1995	=	118,000 baht
Interest rate in 1995-1997	=	10%
Interest rate in 1998-2000	=	5%
Estimated useful lives	=	10 years
A_f (10, 10%) obtained from the annualization factor table	=	6.145
A_f (7, 5%) obtained from the annualization factor table	=	5.786

Supposed 7.63% of costs of dental mobile unit were allocated to this program.
Supposed that there were 6 dental mobile unit used in this program.

So, C_{k1} = 7.63% * (118,000*6)
= 54,020.40

$$C_a = \frac{54,020.40}{6.145}$$

$$= 8,790.95 \text{ baht}$$

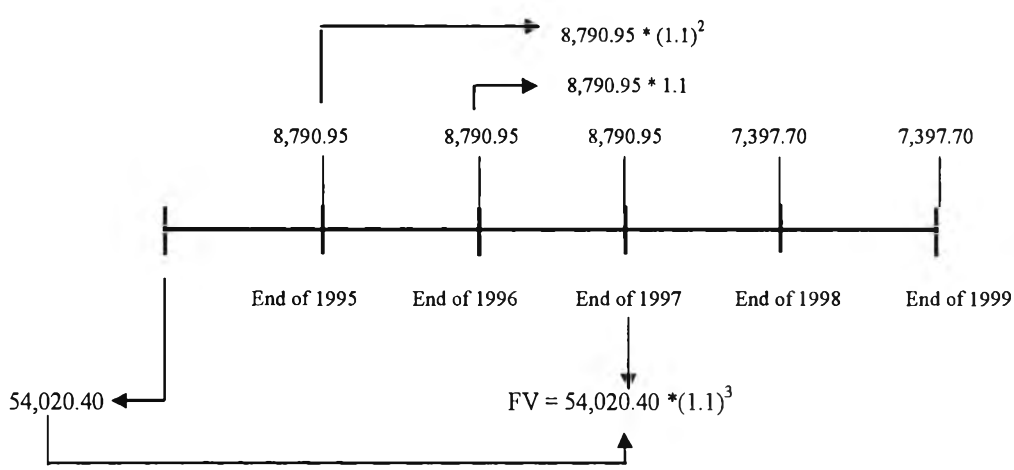
$$C_{k2} = 54,020.40*(1.1)^3 - [8,790.95*(1.1)^2 + 8,790.95*(1.1) + 8,790.95]$$

$$= 42,803.11$$

Then, $$C_b = \frac{42,803.11}{5.786}$$

$$= 7,397.70$$

Figure 3.4: Future value of capital cost calculation



The other capital costs of input items of this program were also calculated by using this method.

3.9.2 Calculation of recurrent cost

The recurrent costs of this study were classified into 2 categories, the labor cost and material cost, the labor costs were collected from the monthly salaries of personnel who worked for this program and the material costs were calculated from costs of material incurred for the students participated in this program.

3.9.3 Cost allocation

Both annual capital costs and recurrent costs for the period of study were allocated on the basis of available data. The cost allocation criteria were explained as follow:

Cost of dental equipment: these equipments were employed not only for students in this study, but they were also used for the other groups of school children, then these costs were shared to this program by using time allocation criteria. The annual capital cost of dental equipment was allocated to the students in this study on the basis of proportion or percentage of the time used of these equipments, which were shown below:

$$\text{Percentage of time used} = \frac{\text{Time used for students in this program}}{\text{Total time used of equipments}} \times 100$$

Allocated dental equipment cost to this program =Equipment cost x Percentage of time used of this equipment to this program

For example, these equipments were occupied by this program equal to x % of the whole time used of these equipments, so these capital costs were allocated to this program x % of all this costs.

Cost of vehicles: two vans were used to this program; these costs were also allocated on the basis of proportion or percentage of time occupied by these vans.

Cost of school facilities: in fact, this program did not pay for school facilities, but for calculate economic costs; these costs should be calculated because if this program is applied in others, costs of this program will include the rent. So, this study calculated school facilities by using percentage of space or area and time used to this program as allocation basis.

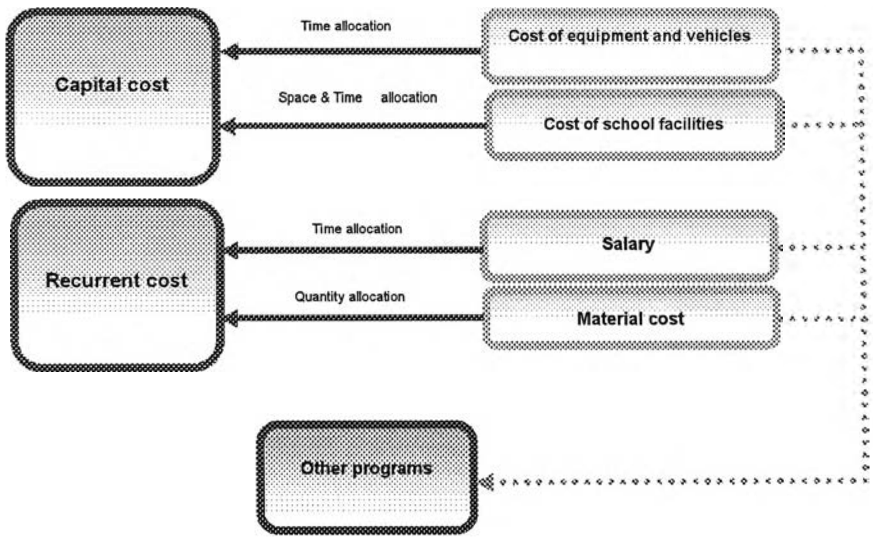
Labor cost: some staffs in this program also worked for other groups of school children, and then the monthly salaries of these staffs should be shared by using costs allocated criteria in terms of percentage of time employed to this program. Actually this program, dental students did not receive the salary because this subject is for educating them but this study will calculate both actual cost and also use salary rate of dental nurse* in community hospital (Thailand) to calculate the salary of dental students. Besides, this program did not pay for school teachers supervised children in these schools but opportunity cost of these teachers also be calculated.

(**Note**: *oral preventive services in community hospitals are the responsibility of dental nurse).

Material cost: material costs were also allocated by proportion of material consumed by this program as allocation basis.

Capital cost and recurrent cost were allocated to this program as figure 3.5 follow:

Figure 3.5: Cost allocation



3.10 Outcome measurement

3.10.1 Identify and measure outcome of two groups of school children:

Outcomes of the two groups, one implementing the oral health preventive program, the other not implementing the program will be measured by DMFT index per person both before and after implemented program.
Prevalence of students suffering from dental caries is the percentage of students suffering from this disease.

Primary outcome = mean DMFT / person (both two groups)

Secondary outcome = mean DMFT prevented / person

= mean DMFT / person of control group minus mean DMFT / person of experimental group

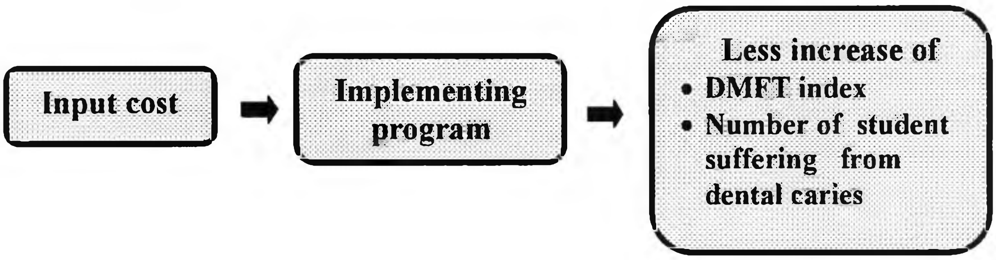
= $DMFT_{control} - DMFT_{exp.}$

3.10.2 Outcome prediction

School-based oral health preventive program reduces DMFT index and also reduces the number of students suffering from new dental caries as compared to the control.

The predicted outcomes of the group of school children implemented program were shown in the following figure:

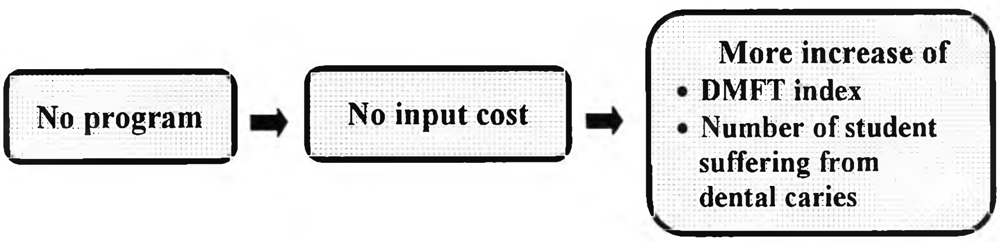
Figure 3.6: Predicted outcome of children with program



Not implementing the school-based oral health preventive program were initiate DMFT index and number of children suffering from dental caries increase.

The predicted outcomes for the group of school children not implemented program were shown in the following figure:

Figure 3.7: Predicted outcome of children without program



3.11 Hypothesis testing

The Z-test was used for testing the DMFT index between two groups of children.

1. Formulate the null hypothesis (H_0) in statistical terms.
2. Formulate the alternative hypothesis (H_1) in statistical terms.
3. Set the level of significance
4. Collect the data and calculate the statistic
5. If the calculated statistics fall in the rejection area H_0 will be rejected according to the rejection rule in favor of H_1. If calculated statistics fall outside of rejection area H_0 will be accepted.

Before testing the DMFT index between two groups of children after implemented the school-based oral health preventive program, the mean DMFT of both groups before implemented should be tested whether they were different.

$$H_0: \mu_{1B} = \mu_{2B}$$

$$H_1: \mu_{1B} \neq \mu_{2B}$$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right)}}$$

Rejection rule : if $Z > Z_{\alpha/2}$

or $Z < -Z_{\alpha/2}$

Then H_0 will be rejected.

Where $\overline{X}_1$ =mean DMFT for control group
$\overline{X}_2$ =mean DMFT for experimental group
S_1^2 =the variance of control group
S_2^2 =the variance of experimental Group
μ_{1B} = mean DMFT per person of control population before implemented program
μ_{2B} = mean DMFT per person of experimental population before implemented program
n_1 =sample size of control group
n_2 =sample size of experimental group

If $\mu_{1B} = \mu_{2B}$ then test the hypothesis, the DMFT index of children group not implemented program greater than that of the other children group implemented program.

$$H_0: \mu_{1A} = \mu_{2A}$$
$$H_1: \mu_{1A} > \mu_{2A}$$

Rejection rule : if $Z > Z_{\alpha}$
Then H_0 will be rejected.

Where μ_{1A} = mean DMFT per person of control population after implemented program
μ_{2A} = mean DMFT per person of experimental population after implemented program

Furthermore, the DMFT of experimental group, before and after implemented oral preventive program, should be tested for the occurrence of dental caries and DMFTw* which is DMFT weighted by number of permanent teeth at that time of experimental group should also be tested for the real occurrence of dental caries by using paired t-test.

$$H_0: \mu_{2B} = \mu_{2A}$$
$$H_1: \mu_{2B} > \mu_{2A}$$

$$t = \frac{\overline{D}}{S_D / \sqrt{n}}$$

$$\overline{D} = \frac{\sum_{i=1}^{n} D_i}{n}$$

D_i =differences between each pair of observations
=$DMFT_{Ai}$ - $DMFT_{Bi}$, i =1, 2, ..., n, or
=$DMFT_{Awi}$ - $DMFT_{Bwi}$, i =1, 2, ..., n

$$S_D^2 = \frac{\sum_{i=1}^{n} D_i^2 - [(\sum_{i=1}^{n} D_i)^2 / n]}{n-1}$$

Rejection rule: if p-value <0.05
Then H_0 will be rejected.

In addition, each component of DMFT index (D, M, F, Dw, Mw, and Fw) of experimental group, before and after implemented program, is also tested by using paired t-test in order to know which component will be affected to this program.

(**Note**: $DMFT_w$ * can be calculated from this formula

$$DMFT_{Aw}* = DMFT_A \times \frac{1}{\text{Number of tooth}}$$

Supposed DMFT score after implemented is 3 and there were 24 teeth in the mouth, then $DMFT_w$ is 3 x 1/24 =0.125).

Furthermore, the prevalence of dental caries in both two groups after implementing this program for five years would be tested the difference by using Z test for proportion as follows:

$H_0: P_1 = P_2$
$H_1: P_1 > P_2$

$$Z = \frac{(p_1 - p_2)}{\sqrt{(pq[(1/n_1) + (1/n_2)])}}$$

Rejection rule : if $Z > Z_\alpha$

Where	P_1	=	Prevalence of dental caries in control population
	P_2	=	Prevalence of dental caries in experimental population
	p_1	=	Prevalence of dental caries in control group
	p_2	=	Prevalence of dental caries in experimental group
	p	=	Prevalence of dental caries in sample size
	q	=	1 - p
	n_1	=	Number of sample size in control group
	n_2	=	Number of sample size in experimental group

3.12 Effectiveness measurement

Many dental studies usually used percentage of caries reduction to measure the effectiveness of dental program by comparing the difference of two program's outcome in DMFT scores per baseline (did not receive intervention) DMFT scores or used the caries increment and based the calculation on 100% program effectiveness (Burt, *et al* 1977, Donaldson, *et al* 1986, Rong, Brian,Wang, & Wang 2003).

In this study, the effectiveness is incremental mean DMFT between before and after implemented this program of each children group.

$$\text{Effectiveness} = DMFT_A - DMFT_B$$

$$\text{Net caries reduction} = E_1 - E_2$$

$$\text{\% caries reduction} = \frac{E_1 - E_2}{E_1} \times 100\%$$

Where
$DMFT_A$ = mean DMFT after implementing program
$DMFT_B$ = mean DMFT before implementing program
E_1 = Effectiveness of control group
E_2 = Effectiveness of experimental group

3.13 Cost-effectiveness analysis

At the end of program, the 5th year, cost-effectiveness ratio of experimental group will be calculated. The cumulative differences in costs of program per person were divided by effectiveness of experimental group as formula below:

$$\text{Cost-effectiveness} = \frac{\text{Cost of program / person}}{\text{Effectiveness of experimental group}}$$

Where; cost of program / person =Total cost divided by total children participated in program

3.14 Incremental cost effectiveness ratio (ICER)

An incremental cost-effectiveness ratio was conducted comparing children in the experimental group with children in the control group. The incremental cost-effectiveness ratio-that is, the additional costs divided by additional effectiveness between the experimental group compared to the control group expressed as a cost or savings per net caries reduction, was defined as:

$$\frac{C_1 - C_2}{E_1 - E_2} = \frac{\Delta C}{\Delta E}$$

Where C_1 =total cost associated with the school-based oral health preventive program per person
C_2 =total cost associated with this program of control group per person

The students in both two groups are assumed to have the same opportunities to receive dental services at other dental facilities; therefore the differentiated costs incurred between two groups were cost of this program. This paper considers the cost in provider perspective, and then costs of control group were equivalent to zero.

3.15 Sensitivity analysis

The outcomes of the program are influenced by the input costs. To test for uncertainty, the sensitivity of this study was tested in five issues.

3.15.1 Changing of the interest rate used to annualize the economic costs

The sensitivity of the cost-effectiveness ratio was tested by using different discount rates of input costs. In this study, sensitivity was tested by changing the discount rates at 0%, 3%, 5%, and 10% for one step calculation over five years period, not divided into two phases as primary analysis.

3.15.2 Increasing 20% of each capital cost

One of the objectives of this study was to analyze the impacts of input costs on the cost-effectiveness of this program. Input costs of this study comprised of capital costs and recurrent costs. The outcomes of the program were influenced by the input factors through the input costs. The capital costs were a majority part in the total costs of the program of establishment and operation. The alteration in the capital cost leads to the change of the total cost, average cost, cost-effectiveness ratio, and ICER.

Assume that, there is an increase of 20% of one item of capital costs but the other items, DMFT index, number of school children remain unchanged. What is the trend of total cost, average cost, incremental cost, cost-effectiveness ratio, and ICER?

3.15.3 Disregard costs in the last year

The oral health preventive programs usually spend a great deal of money for establishing and operating program at the beginning of program and the benefits will be happening in the future. So, costs in the last year of the school-based oral health preventive program in this study might not sacrifice for the benefit over 5 years of the study. The effectiveness over 5 years were most likely the effects from costs incurred only in the first four years of program, so, costs incurred at the last year of program should be disregard for calculating.

3.15.4 Excluding some cost items

This study tested the sensitivity on excluding the salaries of supervisor which were related to only the education of dental students. If this program is implemented in the other areas these costs should be excluded from total costs.

Moreover, the transportation costs are the one issue that the decision makers should consider, *where* should care be provided? (fixed vs. mobile clinics). The study was also tested the sensitivity on excluding the transportation costs.

3.15.5 Changing costs of dental equipments

As I mentioned above, the capital costs were a main part of total costs. If these costs decreased, the cost-effectiveness of program may be decreased. Then this study was tested the sensitivity by changing costs of some dental equipments in the new price at 2005 which are cheaper than the original costs used for calculation.

3.16 Assumptions

- Skill (both detecting dental caries and provide preventive care) of dental students have no effect on the outcome of the program.
- Consumptions of sugar drink and sweet of both two groups were not different.
- The opportunities to receive dental services at other dental facilities of subjects in both two groups were not different.
- The students withdrawing from schools during study period were assumed very few and have no effect on the outcome of the program.