# Chapter IV

# Data Analysis

This chapter presented the results in four parts; 1) Statistical technique to test the impacts of this program, 2) Analysis of costs to provider for establishing and operating this program, 3) Cost-effectiveness analysis of this program, and 4) Sensitivity analysis to analyze the impact of input costs on this program.

## 4.1 Statistical technique to test the impacts of this program

This study based on secondary data. The data of school children in experimental group were available consecutively for 5 years but data of control group were available only at the first and the last year of the study. Numbers of children of each group were shown below:

**Table 4.1: Number of children participated in this study, one implementing the oral health preventive program and the other not implementing the program**

| Group | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| Experimental group | 104 | 102 | 97 | 97 | 96 |
| Control group | 353 | n/a | n/a | n/a | 341 |

About 92.31% (96 out of 104) of children in the experimental group remained in the study in 1999-2000, compared with 96.60% (341 out of 353) of children in the control group. Moving out of schools was the prime reason for drop-outs.

### 4.1.1 Baseline examination and increment of DMFT index and its components

The caries experiences of both groups at baseline examination and increment of DMFT were presented in tables 4.2 and 4.3 and the difference of DMFT indices were shown in table 4.4.

**Table 4.2: Baseline and increment of DMFT of experimental group**

|  | Baseline exam | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|
| **Prevalence of dental caries** | 16.35% | 29.41% | 36.08% | 42.27% | 57.29% | 59.38% |
| **DT** (sd) | 0.22 (0.591) | 0.35 (0.684) | 0.49 (0.903) | 0.65 (1.109) | 1.07 (1.460) | 1.01 [a] (1.46) |
| **MT** (sd) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0.01 (0.102) | 0.01 [b] (0.102) |
| **FT** (sd) | 0.01 (0.098) | 0.15 (0.548) | 0.24 (0.704) | 0.40 (0.825) | 0.50 (0.962) | 0.58 [c] (1.033) |
| **DMFT** (sd) | 0.23 (0.611) | 0.51 (0.931) | 0.73 (1.123) | 1.04 (1.443) | 1.58 (1.833) | 1.60 [d] (1.821) |
| **Dw** (sd) | 0.022 (0.06) | 0.027 (0.055) | 0.029 (0.055) | 0.032 (0.053) | 0.045 (0.061) | 0.041 (0.058) |
| **Mw** (sd) | 0.00 (0.00) | 0.00 (0.00) | 0.00 (0.00) | 0.00 (0.00) | 0.0004 (0.0039) | 0.0004 (0.0036) |
| **Fw** (sd) | 0.001 (0.009) | 0.012 (0.041) | 0.013 (0.041) | 0.019 (0.039) | 0.021 (0.039) | 0.024 (0.043) |
| **DMFTw** (sd) | 0.023 (0.063) | 0.039 (0.073) | 0.046 (0.067) | 0.050 (0.072) | 0.065 (0.076) | 0.065 (0.075) |

According to the results shown in table 4.2 the prevalence of dental caries increased at decreasing rate for each year except the fourth year it increased at increasing rate. DMFTw also increased at decreasing rate for every year except the fourth and last year, it increased at increasing rate and it was constant respectively. Moreover, the D component was a majority part of DMFT in experimental group.

**Table 4.3: Baseline and increment of DMFT of control group**

|  | Baseline exam | 2000 |
|---|---|---|
| **Prevalence of dental caries** | 11.1% | 66% |
| **DT** | 0.2 | 1.422 [e] |
| **MT** | 0.0 | 0.052 [f] |
| **FT** | 0.0 | 0.519 [g] |
| **DMFT** (sd) | 0.2 (0.017) | 1.993 [h] (2.297) |

The results in table 4.3 indicated that the D component was the greatest part of DMFT in control group as in experimental group. It was responsible for 100% of DMFT at the baseline and decreased to 71.35% after 5 years of study. In contrary, the F component increased from 0% to 26.04% of DMFT.

**Table 4.4: Five-year program DMFT difference**

| Outcome \ Year | 1995 | 2000 |
|---|---|---|
| D | -0.02 | $0.412^i$ |
| M | 0 | $0.042^j$ |
| F | -0.01 | $-0.061^k$ |
| DMFT | -0.03 | $0.393^l$ |

(**Note**: [i, j, k] and [l] be calculated from [a, b, c] and [d] in table 4.3 and [e, f, g] and [h] in table 4.4)

As shown in tables 4.2, 4.3 and 4.4 the DMFT scores for children who participated in school-based oral health preventive program for 5 years. The mean score in 2000 is 1.60 compared to score of 1.993 for children who were of similar age when they entered the program. The difference of mean DMFT index is 0.393 which mostly influenced by D component.

**Figure 4.1: Average number of decayed (D), missing due to caries (M) and filled (F) permanent tooth from baseline examination to the fifth year of operation of the program**
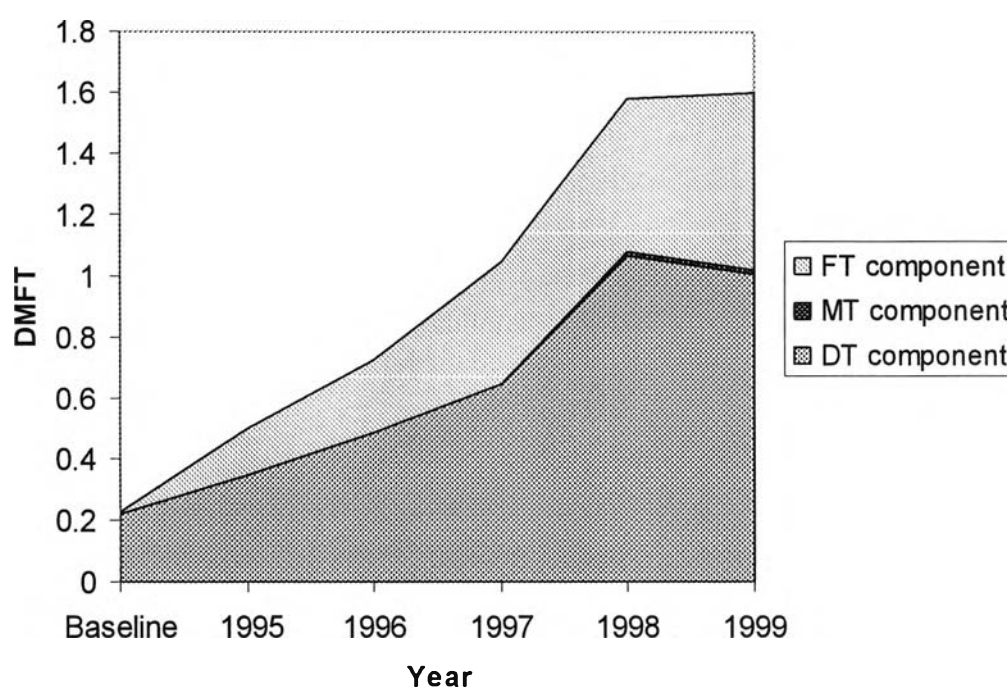


The results in figure 4.1 showed that "D" component was responsible for most of DMFT index at baseline examination (95.65%). After the program had been in operation for 5 years, the "D" component had decreased considerably (63.13%). In contrast, the "F" component was 4.35% of baseline DMFT score, and after the program had been in operation for 5 years, the "F" component had increased considerably to be 36.25% of DMFT score. The "M"component of the DMFT index was almost zero throughout the program.

### 4.1.2 Statistical technique to test the difference of DMFT index of two groups of school children

Before starting the program, all school children both experimental group and control group were tested the difference of caries experience by using Z test as follows:

Null hypothesis $\quad\quad H_0:\mu_{1B} = \mu_{2B}$

Alternative hypothesis $\quad H_1:\mu_{1B} \neq \mu_{2B}$

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left[\dfrac{S_1^2}{n_1} + \dfrac{S_2^2}{n_2}\right]}}$$

$$Z = \frac{(0.20 - 0.23)}{\sqrt{[(0.017^2/353) + (0.611^2/104)]}}$$

$$= -0.50$$

According to Z table, $H_0$ will be reject if $|Z|_{0.025} > 1.96$, therefore, the result (Z = -0.50) showed that the mean baseline of caries experience did not differ significantly between the group of school children implementing program and the other group of school children not implementing this program.

After implementing the program for five years, Z test were used for test the difference of DMFT index of two groups in 2000.

Null hypothesis $\quad\quad H_0:\mu_{1A} = \mu_{2A}$

Alternative hypothesis $\quad H_1:\mu_{1A} > \mu_{2A}$

$$Z = \frac{(1.993 - 1.60)}{\sqrt{[(2.297^2/341) + (1.821^2/96)]}}$$

$$= 1.76$$

According to Z table, $H_0$ will be reject if $Z > 1.645$, therefore, the result (Z = 1.76) showed that DMFT index of both groups, one implementing oral health preventive program and the other not implementing this program were statistically significantly different, that means DMFT index after implementing school-based oral health preventive program of the group of school children implementing this program is significantly less than the DMFT index of the group of school children not implementing this program.

In addition, each component of DMFT index (D, M, and F), DMFTw and each component of DMFTw (Dw, Mw, Fw) of experimental group, before and after implemented program, is also tested by using paired t-test.

Null hypothesis $\qquad$ $H_0: \mu_{2A} = \mu_{2B}$

Alternative hypothesis $\qquad$ $H_1: \mu_{2A} > \mu_{2B}$

**Table 4.5: The results of paired t-test of the difference of DMFTw, DMFT and its components of school children in the group implementing program**

| Year \\ Variable | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| $D_A - D_B$ | 0.13 | 0.14 | 0.16 | 0.42 | -0.06 |
| • p-value | 0.013* | 0.024* | 0.022* | 0.00* | 0.042* |
| $M_A - M_B$ | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| • p-value | n/a | n/a | n/a | 0.16* | n/a |
| $F_A - F_B$ | 0.14 | 0.09 | 0.16 | 0.1 | 0.08 |
| • p-value | 0.003* | 0.098 | 0.003* | 0.053 | 0.006* |
| $DMFT_A - DMFT_B$ | 0.28 | 0.22 | 0.31 | 0.54 | 0.02 |
| • p-value | 0.00* | 0.001* | 0.00* | 0.00* | 0.079 |
| $Dw_A - Dw_B$ | 0.005 | 0.002 | 0.003 | 0.013 | -0.004 |
| • p-value | 0.15 | 0.378 | 0.273 | 0.006* | 0.025* |
| $Mw_A - Mw_B$ | 0.00 | 0.00 | 0.00 | 0.0004 | 0.00 |
| • p-value | n/a | n/a | n/a | 0.16 | 0.16 |
| $Fw_A - Fw_B$ | 0.011 | 0.001 | 0.006 | 0.002 | 0.003 |
| • p-value | 0.004* | 0.302 | 0.064 | 0.29 | 0.008* |
| $DMFTw_A - DMFTw_B$ | 0.016 | 0.007 | 0.004 | 0.015 | 0.00 |
| • p-value | 0.00* | 0.247 | 0.054 | 0.003* | 0.46 |

(* = significant difference, then $H_0$ would be rejected)

$H_0$ will be rejected if p-value < 0.05. The results in table 4.5 showed that the DMFT indexes of school children in experimental group were significantly different in the first four years of study and it was not significantly different in the last year. The results of comparing DMFT weighted, showed that it was significantly different only in the first and the fourth year of the study.

For comparing D component, it was significantly different for each year; however, the Dw component was significantly different for the last two years.

Where; DMFT$_A$ = mean DMFT after implementing program

DMFT$_B$ = mean DMFT before implementing program

DMFTw$_A$ = mean DMFT weighted by number of teeth after implementing program

DMFTw$_B$ = mean DMFT weighted by number of teeth before implementing program

D$_A$ = Number of decayed tooth after implementing program

D$_B$ = Number of decayed tooth before implementing program

M$_A$ = Number of missing tooth due to caries after

|  |  |  |
|---|---|---|
|  |  | implementing program |
| $M_B$ | = | Number of missing tooth due to caries before implementing program |
| $F_A$ | = | Number of filled tooth after implementing program |
| $F_B$ | = | Number of filled tooth before implementing Program |
| $Dw_A$ | = | mean D weighted by number of teeth after implementing program |
| $Dw_B$ | = | mean D weighted by number of teeth before implementing program |
| $Mw_A$ | = | mean M weighted by number of teeth after implementing program |
| $Mw_B$ | = | mean M weighted by number of teeth before implementing program |
| $Fw_A$ | = | mean F weighted by number of teeth after implementing program |
| $Fw_B$ | = | mean F weighted by number of teeth before implementing program |

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

$$H_0 : P_1 = P_2$$

$$H_1 : P_1 > P_2$$

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

$$p = (225 + 57)/(341 + 96)$$

$$= 0.65$$

$$q = 1 - 0.65$$

$$= 0.35$$

So,

$$Z = \frac{0.66^* - 0.594^{**}}{\sqrt{((0.65)(0.35)[1/341 + 1/96])}}$$

$$= 1.20$$

According to Z table, $H_0$ will be reject if Z >1.645. Therefore, the result (Z = 1.20) showed that prevalence of dental caries of both two groups in 2000, were not statistically significantly different.

(**Note**: * and ** from tables 4.2 and 4.3 respectively)

### 4.1.3 Effectiveness measurement

The effectiveness in this study was measured from increment of mean DMFT index of school children between before and after implemented the school-based oral health preventive program for five years as formula below:

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

For two groups of school children, one implementing the program and the other not implementing the program, effectiveness of these groups after five years implementation can be calculated as

$$
\begin{aligned}
E_1 &= 1.993 - 0.2 \\
&= 1.793 \\[6pt]
E_2 &= 1.60 - 0.23 \\
&= 1.37 \\[6pt]
\text{Net caries reduction} &= 1.793 - 1.37 \\
&= 0.423 \\[6pt]
\% \text{ Caries reduction} &= \frac{0.423}{1.793} \times 100\% \\[6pt]
&= 23.59\%
\end{aligned}
$$

Furthermore, annual effectiveness of this program in experimental group can be calculated as table 4.6 below:

**Table 4.6: Annual effectiveness of this program in experimental group**

| Year | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| **Effectiveness** | $0.28^a$ | $0.5^b$ | $0.81^c$ | $1.35^d$ | $1.37^e$ |

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

(Note: [a] =0.51 - 0.23, [b] =0.73 - 0.23, [c] =1.04 - 0.23, [d] =1.58 - 0.23, [e] =1.60 - 0.23)

### 4.2 Analysis of costs to provider for establishing and operating this program

In this study cost analysis included both capital costs and recurrent costs to provider for establishing and operating the school-based oral health preventive program to school children in public primary schools in Bangkok. It calculated the annual costs and the total costs for five years both capital costs and recurrent costs incurred for this program during 1995 – 2000.

### 4.2.1 Cost calculation

This study analyzed the costs to provider of oral health preventive program and also identified the components of these costs for providing dental care. All costs for establishing and operating the school-based oral health preventive program in this study were calculated in Thai baht.

There were about 1,300 school children whom the dental students had to provide the oral health care in each year in the principle of community-based program. As a results in table 4.1, the average school children participated in this program was (104 +102 +97 +97 +96)/5 =99.2 students who were in these 1,300 school children. Then, the costs for 1,300 school children should be assigned to this program 7.63% (99.2/1,300*100%)

### 4.2.1.1 Capital cost calculation

Capital costs were calculated for each year of study period following annual cost formula as follows:

$$C_a = \frac{C_{k1}}{A_{f1}(n,r)}$$

$$C_b = \frac{C_{k2}}{A_{f2}(n,r)}$$

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 = the useful life of the equipment

r = interest rate

Capital costs utilized by this program were shared or allocated from the following basis:

**A. Dental equipments:** Allocated on the basis of proportion of time used

These dental equipments were used for the other school children. In the period of study, there were about 1,300 school children provided dental cares by using these equipments. The average number of school children in this study who used these equipments is (104 +102 +97 +97 +96)/5 =99.2 students.

Therefore, school children in this study used these equipments =(99.2/1,300)*100% = 7.63% of all time used of these costs, then, allocated dental equipments costs to this program equal to 7.63% of all these costs.

Some equipment (such as stainless tray and cotton pot) was bought for many years before 1995 and has been used more than estimated useful life. For calculating economic cost, these costs were assumed to purchase at 1995.

**B. Vehicles: Allocated on the basis of proportion of time served**

In this program there were two vans for transportation. One of the vans (van1) was used for other school children not participated in this program for transporting dental equipments and dental personnel similar to dental equipments. It occupied by this program 7.63%. However, van 1 had been bought for longer time than its estimated useful life, and then allocated van 1's costs were assumed to equivalent to allocated van 2's costs.

The other van (van2) was also used for other school children not participated in this program and used for the other programs. It was occupied by dental care for 1,300 school children at each year for 6.5 months and for half day at each visit. Then this van was employed by this program $=[(6.5/12)/2] * 7.63\% = 2.07\%$ of whole time used of this van.

Therefore, 2.07% of van 1 and van 2's costs were assigned into this program.

**C. School facilities:** Allocated on the basis of space and time used

The dental students provided services of this program in the school room at area 40 m$^2$ for 2 hours per visit.

Therefore, costs of school facilities were assigned to this program $=[(6.5/12)*2]/24*$ 7.63% of all time used of this room. Then these costs were assigned to this program equal to 0.34% of all this space. Capital inputs were presented in table 4.7

**Assumption:**
1. Each capital input was purchased at the beginning of year.
2. Each allocated capital cost was calculated at the end of year.

**Table 4.7: Capital items of school-based oral health preventive program at public primary schools in Bangkok[1]**

| Cost items | Number | Life time[2] (Year) | Buying (Year) | Prices (Baht/unit) | Total cost | Allocated Cost ($Ct_{0}$) |
|---|---|---|---|---|---|---|
| **1. Dental equipment** | | | | | | (7.63%) |
| **1.1 Dental mobile unit** | | | | | | |
| Dental mobile unit | 6 | 5 | 1995 | 118,000 | 708,000 | 56,640.00 |
| Mobile light | 6 | 5 | 1995 | 18,000 | 108,000 | 8,240.40 |
| Contra angle | 12 | 5 | 1995 | 4,000 | 48,000 | 3,662.40 |
| Aerotor | 12 | 5 | 1995 | 6,500 | 78,000 | 5,951.40 |
| Prophy | 12 | 5 | 1995 | 4,740 | 56,880 | 4,339.94 |
| | | | | | | |
| **1.2 Equipment for dental care** | | | | | | |
| Explorer | 300 | 10 | 1995 | 280 | 84,000 | 6,409.20 |
| Mouth mirror | 300 | 10 | 1995 | 150 | 45,000 | 3,433.50 |
| Cotton pliers | 300 | 10 | 1995 | 140 | 42,000 | 3,204.60 |
| Spoon(small) | 5 | 10 | 1995 | 335 | 1,675 | 127.80 |
| Spoon(medium) | 10 | 10 | 1995 | 335 | 3,350 | 255.61 |
| Plastic instrument | 10 | 10 | 1995 | 250 | 2,500 | 190.75 |
| Central forceps | 12 | 10 | 1995 | 150 | 1,800 | 137.34 |
| Forceps jar | 12 | 10 | 1995 | 250 | 3,000 | 228.90 |
| Examination tray | 80 | 10 | 1995 | 100 | 8,000 | 610.40 |
| Cotton sterilizing box | 8 | 10 | 1995 | 350 | 2,800 | 213.64 |
| Mouth gag | 3 | 10 | 1995 | 2,500 | 7,500 | 572.25 |
| Stainless tray | 6 | 10 | 1976 | 300 | *1,800* | *137.34* |
| Cotton pot 8" | 3 | 10 | 1975 | 600 | *1,800* | *137.34* |
| Cotton pot 10" x 14" | 3 | 10 | 1976 | 1,850 | *5,550* | *423.47* |
| | | | | | | |
| **1.3 Other instruments** | | | | | | |
| Compressor | 2 | 10 | 1995 | 48,150 | 96,300 | 7,347.69 |
| Curing light | 6 | 10 | 1995 | 17,000 | 102,000 | 7,782.60 |
| Autoclave | 1 | 10 | 1994 | 100,000 | 100,000 | 7,630.00 |
| Sealing machine | 1 | 10 | 1995 | 19,500 | 19,500 | 1,487.85 |
| Light guard | 6 | 5 | 1995 | 110 | 660 | 50.36 |
| | | | | | | |
| Subtotal | | | | | 1,528,115 (1,518,965)[a] | 116,595.17 (115,897.02)[a] |
| **2. Vehicles** | | | | | | (2.07%) |
| Van 1 | 1 | 10 | 1995 (1985) | 650,000[b] (200,000) | 650,000 | 13,455.00 |
| Van 2 | 1 | 10 | 1992 | 650,000 | 650,000 | 13,455.00 |
| | | | | | | |
| Subtotal | | | | | 1,300,000 (650,000)[c] | 26,910.00 (13,455)[c] |
| **3. School facilities** | | | | | | (0.34%) |
| | | | | | | |
| Subtotal | 40 m² | 20 | 1990 | 4,700[d] | 188,000 | 639.20 |
| **Total** | | | | | 2,566,115 (2,356,965)[e] | 144,144.37 (129,991.22)[e] |

[1]       =from the Department of Community Dentistry, Faculty of Dentistry, Mahidol University,

[2]       =from American Hospital Association (1978)

[a]       =Subtotal cost of dental equipments which did not include stainless tray and cotton pot

[b]       =Estimated costs of van 1 which equal to van 2's cost and assumed to purchase at 1995

[c]       =Subtotal cost of vehicle which did not include van 1

[d]       =Estimated cost of school building in Bangkok according to Department of land, Ministry of Interior

[e]       =Total cost of capital inputs which did not include stainless tray, cotton pot and van 1

The capital costs were calculated according to annual cost formula by using standard annualization factor presented in table 4.8 as below:

**Table 4.8: Annualization factor for calculating capital cost** (Drummond, *et al.* 1997)

| Useful lives | Interest rate | Annualization factor |
|---|---|---|
| 2 years | 5% | 1.859 |
| 4 years | 5% | 3.546 |
| 6 years | 5% | 5.076 |
| 7 years | 5% | 5.786 |
| 12 years | 5% | 8.863 |
| 5 years | 10% | 3.791 |
| 10 years | 10% | 6.145 |
| 20 years | 10% | 8.514 |

The calculated annual capital costs of this program were summarized in the tables 4.9-4.12

**Table 4.9: Summary of annual capital costs of school-based oral health preventive program at public primary schools in Bangkok in 1995 – 2000 at current price**

| Cost items | 1995-1996 | 1996-1997 | 1997-1998 | 1998 -1999 | 1999-2000 |
|---|---|---|---|---|---|
| **1. Dental equipment*** | 26,680.46 | 26,680.46 | 26,680.46 | 24,327.94 | 24,327.94 |
| **2.Vehicles** <br> • Van 1** <br> • Van 2 | 2,189.59 <br> 2,189.59 | 2,189.59 <br> 2,189.59 | 2,189.59 <br> 2,189.59 | 1,842.56 <br> 1,957.80 | 1,842.56 <br> 1,957.80 |
| **Subtotal** | **4,379.18** | **4,379.18** | **4,379.18** | **3,800.36** | **3,800.36** |
| **3. School facilities** | 75.08 | 75.08 | 75.08 | 57.73 | 57.73 |
| **Total** | **31,134.72** | **31,134.72** | **31,134.72** | **28,186.03** | **28,186.03** |

**Table 4.10: Summary of annual capital costs of school-based oral health preventive program at public primary schools in Bangkok in 1995 – 2000 at constant price**

| Cost items | 1995-1996 | 1996-1997 | 1997-1998 | 1998 -1999 | 1999-2000 |
|---|---|---|---|---|---|
| **1. Dental equipment*** | 35,592.40 | 32,356.73 | 29,415.21 | 25,544.34 | 24,327.94 |
| **2.Vehicles** <br> • Van 1** <br> • Van 2 | 2,920.97 <br> 2,920.97 | 2,655.43 <br> 2,655.43 | 2,414.02 <br> 2,414.02 | 1,934.69 <br> 2,055.69 | 1,842.56 <br> 1,957.80 |
| **Subtotal** | **5,841.94** | **5,310.86** | **4,828.04** | **3,990.38** | **3,800.36** |
| **3. School facilities** | 100.16 | 91.05 | 82.78 | 60.62 | 57.73 |
| **Total** | **41,534.49** | **37,758.63** | **34,326.03** | **29,595.33** | **28,186.03** |

(Note: 10% interest rate for calculating costs in 1995 – 1997 and 5% interest rate for calculating costs in 1998 – 1999

: * =7.63% of allocated dental equipment's costs which included stainless tray and cotton pot assumed to purchase in 1995

: ** =2.07% allocated van 1's costs assumed to purchase at the price 650,000 baht in 1995 and 2.07% of allocated van 2's costs )

As shown in tables 4.9 and 4.10, costs of dental equipment were the main part of capital costs while costs of school facilities were the least part of capital costs both in current and constant price scheme for calculation.

**Table 4.11: Summary of actual annual capital costs of school-based oral health preventive program at public primary schools in Bangkok in 1995 – 2000 at current price**

| Cost items | 1995-1996 | 1996-1997 | 1997-1998 | 1998 -1999 | 1999-2000 |
|---|---|---|---|---|---|
| 1. Dental equipment*** | 26,566.85 | 26,566.85 | 26,566.85 | 24,232.33 | 24,232.33 |
| 2. Vehicles**** | 2,189.59 | 2,189.59 | 2,189.59 | 1,957.80 | 1,957.80 |
| 3. School facilities | - | - | - | - | - |
| Total | 28,756.44 | 28,756.44 | 28,756.44 | 26,190.13 | 26,190.13 |

**Table 4.12: Summary of actual annual capital costs of school-based oral health preventive program at public primary schools in Bangkok in 1995 – 2000 at constant price**

| Cost items | 1995-1996 | 1996-1997 | 1997-1998 | 1998 -1999 | 1999-2000 |
|---|---|---|---|---|---|
| 1. Dental equipment*** | 35,440.84 | 32,218.95 | 29,289.95 | 25,443.95 | 24,232.33 |
| 2. Vehicles**** | 2,920.97 | 2,655.43 | 2,414.02 | 2,055.69 | 1,957.80 |
| 3. School facilities | - | - | - | - | - |
| Total | 38,361.81 | 34,874.38 | 31,703.97 | 27,499.64 | 26,190.13 |

(Note: 10% interest rate for calculating costs in 1995 – 1997 and 5% interest rate for calculating costs in 1998 – 1999

: *** =7.63% of allocated dental equipment's costs which not included stainless tray and cotton pot assumed to purchase in 1995

: **** =only 2.07% of allocated van 2's costs)

The results in tables 4.11 and 4.12 indicated that costs of dental equipment were the greatest part of actual capital costs as same as in tables 4.9 and 4.10.

### 4.2.1.2 Recurrent cost calculation

Besides capital inputs, the recurrent items to provider of this study were also identified and analyzed. Labor and material costs for providing oral care to school children are mainly components of recurrent cost of this program.

### 4.2.1.2.1 Labor cost calculation

Labor costs mean the salaries of supervisor, dental assistant, and van drivers who serving this program. Furthermore, they also included the opportunity cost of school teacher supervised school children and salaries of dental nurses for calculating opportunity cost of dental students. Labor costs were allocated to this program on the basis of proportion of time served.

### A. Salary of supervisor

The staffs of the Department of Community Dentistry, the Faculty of Dentistry, Mahidol University, supervised the fifth year dental students for providing oral care to 1,300 school children in public primary schools for 6.5 mouths per year and half of day per visit. The average number of school children in this study is about 99.2. Then the salaries of supervisor were shared by this program equal to $[(6.5/12)/2]*7.63\%$ of total monthly salary in each year of supervisor.

Allocated salaries of supervisor $= 2.07\%$ of total monthly salary in each year of supervisor

### B. Salary of dental assistant

As mentioned above, the dental students provided oral care for 1,300 school children for 6.5 months per year and half day per visit. Then allocated salary of dental assistants $=2.07\%$ of total monthly salaries in each year of dental assistants.

### C. Salary of van driver

Same as salaries of supervisor and dental assistants, allocated salaries of van drivers $=2.07\%$ of total monthly salaries in each year of van drivers.

### D. Salary of dental nurse

Allocated on the basis of proportion of time served, same as salaries of supervisor, therefore, allocated salaries of dental nurses $=2.07\%$ of total monthly salaries in each year of dental nurses.

### E. Opportunity costs of school teacher

The dental team provided oral care to school children at their schools for 2 hours per visit and 6.5 months per year. Then the opportunity costs of school teacher were

assigned to this program = [(6.5/12)/4]*7.63%, that is 1.03% of total monthly salaries of school teacher.

**Assumption:**

1. The number of students who withdraw from this program during period of the study is small.
2. The number of dental team (supervisor, dental students, dental assistants, and van drivers) and school teacher are unchanged during period of study.
3. The school teachers worked for 8 hours per day, then 2 hours for calculating opportunity cost of them is equal 1/4 of their salaries per day.
4. Monthly salaries of dental team and school teacher increased in the rate at which 5% of their own salaries for every year.
5. The time proportion of dental team and school teacher served by this program are unchanged during the period of study.
6. The prices of materials were unchanged during the period of study.

Annual labor costs over 5 years implementing program can be calculated from baseline of salaries of dental team and school teacher in 1995 presented in table 4.13.

**Table 4.13: Salaries of dental team and school teacher[1]**

| Salary / Personnel | Number | Monthly salary (1995) | Total monthly salary per year | % of salary | Annual cost allocated in 1995 |
|---|---|---|---|---|---|
| Supervisor | 1 | 10,080 | 120,960 | 2.07% | 2,503.87 |
| Dental nurse | 8 | 6,160 | 73,920 | 2.07% | 1,530.14 |
| Dental assistant | 2 | 6,700 | 80,400 | 2.07% | 1,664.28 |
| Van driver | 2 | 6,160 | 73,920 | 2.07% | 1,530.14 |
| School teacher | 1 | 6,160 | 73,920 | 1.03% | 761.38 |
| **Total** | **14** | **35,260** | **423,120** | - | **7,989.81** |

([1] = from the Department of Community Dentistry, Faculty of Dentistry, Mahidol University)

The annual labor costs of this program were summarized in tables 4.14 and 4.15 as below

**Table 4.14: Summary of annual labor costs of school-based oral health preventive program at public primary schools in Bangkok in 1995-2000**

| Year \ Personnel | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| Supervisor | 2,503.87 | 2,629.06 | 2,760.52 | 2,898.54 | 3,043.47 |
| Dental nurse | 1,530.14 | 1,606.65 | 1,686.98 | 1,771.33 | 1,859.89 |
| Dental assistant | 1,664.28 | 1,747.49 | 1,834.87 | 1,926.61 | 2,022.94 |
| Van driver | 1,530.14 | 1,606.65 | 1,686.98 | 1,771.33 | 1,859.89 |
| School teacher | 761.38 | 799.45 | 839.42 | 881.39 | 925.46 |
| Total<br>• Current price | **7,989.81** | **8,389.30** | **8,808.77** | **9,249.20** | **9,711.66** |
| • Constant price | **10,658.61** | **10,174.12** | **9,711.66** | **9,711.66** | **9,711.66** |

**Table 4.15: Summary of actual annual labor costs of school-based oral health preventive program at public primary schools in Bangkok in 1995-2000**

| Year \ Personnel | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| Supervisor | 2,503.87 | 2,629.06 | 2,760.52 | 2,898.54 | 3,043.47 |
| Dental nurse | - | - | - | - | - |
| Dental assistant | 1,664.28 | 1,747.49 | 1,834.87 | 1,926.61 | 2,022.94 |
| Van driver | 1,530.14 | 1,606.65 | 1,686.98 | 1,771.33 | 1,859.89 |
| School teacher | - | - | - | - | - |
| Total<br>• Current price | **5,698.29** | **5,983.20** | **6,282.37** | **6,596.48** | **6,926.31** |
| • Constant price | **7,601.66** | **7,256.13** | **6,926.31** | **6,926.31** | **6,926.31** |

According to tables 4.14 and 4.15, salaries of supervisor and school teacher were the most and the least part of labor costs respectively for each year. The annual labor costs were between 7,989.81 - 9,711.66 baths for economic cost calculation but they were only 5,698.29 - 6,926.31 baths for actual cost calculation.

### 4.2.1.2.2 Material cost calculation

Material costs mean costs of materials for doing sealant, PRR, fluoride, oral education, and other drugs and materials. Moreover, they also include costs of gasoline and

maintenance of capital costs and costs of school utilities (only electricity not includes water because this program did not use water supply at schools).

## A. Material for sealant, PRR, fluoride, oral education, and other drugs and materials

Material costs were allocated by proportion of material consumed by this program as allocation basis. As mentioned above, dental students provided oral care for 1,300 school children every year. Consequently, this study calculated total costs of material for 1,300 school children firstly and then shared these costs to this program. There are 4 steps to calculate costs of materials as follows:

1. Identified and classified the inputs of each activity (sealant, PRR, fluoride, oral education)
2. Allocated the input costs of material into each activity
3. Calculated unit cost of material of each activity for all school children provided by dental students by following formula:
   Unit cost = Total cost of material / Quantities of each activity
4. Calculated costs of each activity equal to unit cost multiplied by quantities served by this program

For material costs for sealant, PRR, fluoride, oral education, this study were calculated by using the following table:

**Table 4.16: Material items and prices**

| Input items | Price per unit |
|---|---|
| Alcohol | 100 |
| Antiseptic soap | 825 |
| Articulating paper | 190 |
| Bonding | 4,108.80 |
| Bur<br>- diamond bur<br>- steel bur<br>- stone bur | <br>136<br>19<br>27.50 |
| Composite material | 450 |
| Cotton | 55 |
| Dappen dish | 50 |
| Disclosing tablet | 2,700 |
| Disposable brush | 20 |
| Disposable brush tip | 5.60 |
| Disposable saliva ejector | 0.65 |
| Distrilled water | 14 |
| Etching | 266.67 |
| Fluoride mouthwash | 20 |
| Fluoride paste | 1,200 |
| Garbage can | 10 |
| Gauze | 520 |
| Glove | 1.5 |
| Glutaraldehyde | 99 |
| Hand piece bag | 1.9 |
| Mask | 1.5 |
| Medical cap | 0.80 |
| Napkin | 20 |
| Oral education poster | 20 |
| Plastic bag | 7 |
| Pumice | 110 |
| Rubber cup | 10.42 |
| Savlon 1:30 in alcohol 70% | 184 |
| Sealant | 3,766.40 |
| Sterilized tool kit<br>- 5.5 cm<br>- 7.5 cm<br>- 10 cm<br>- 30 cm | <br>580<br>610<br>850<br>4,922 |
| Towel | 20 |
| Zeta 5 | 1,200 |

## B. Gasoline and maintenance

It is mentioned earlier that vans were utilized for other school children and other programs, and then costs of gasoline and maintenance should be allocated to this program by proportion of time used of these vans same as costs of vans.

## C. School utility (electricity)

Allocated to this program on the basis of proportion of space and time occupied by this program same as school facilities.

The annual material costs of this program were summarized as in the following table.

**Table 4.17: Summary of annual material costs of school-based oral health preventive program at public primary school in Bangkok in 1995-2000[1]**

| Inputs | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| Material for Sealant | 4,390.64 | 2,071.64 | 1,886.12 | 2,133.48 | 3,493.96 |
| Material for PRR | 101.16 | 151.74 | 202.32 | 50.58 | 455.22 |
| Material for Fluoride | 241.86 | 170.41 | 128.74 | 158.84 | 232.98 |
| Material for Oral education | 282.31 | 282.31 | 282.31 | 282.31 | 282.31 |
| Other drugs and materials | 2,449.48 | 1,857.28 | 1,715.48 | 1,726.43 | 1,846.33 |
| Gasoline and maintenance | 1,135.32 | 1,096.92 | 1,095.00 | 1,095.00 | 1,107.00 |
| School utility | 381.45 | 319.04 | 306.56 | 306.56 | 319.04 |
| **Total**<br>• **Current price** | **8,982.22** | **5,949.34** | **5,616.53** | **5,753.20** | **7,736.84** |
| • **Constant price** | **11,982.51** | **7,215.06** | **6,192.22** | **6,040.86** | **7,736.84** |

([1] = from the Department of Community Dentistry, Faculty of Dentistry, Mahidol University)

**Table 4.18: Summary of actual annual material costs of school-based oral health preventive program at public primary school in Bangkok in 1995-2000**

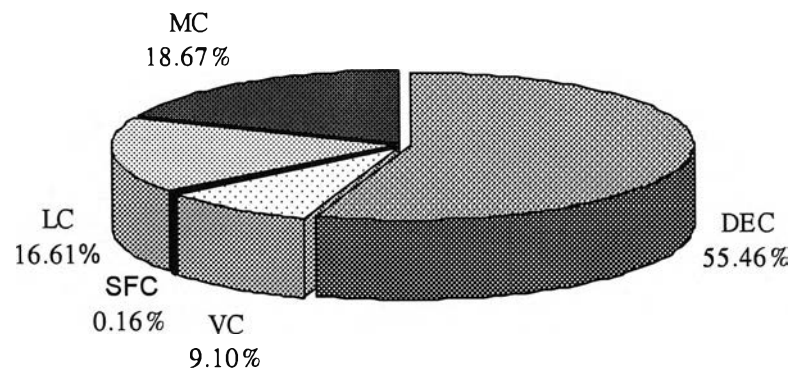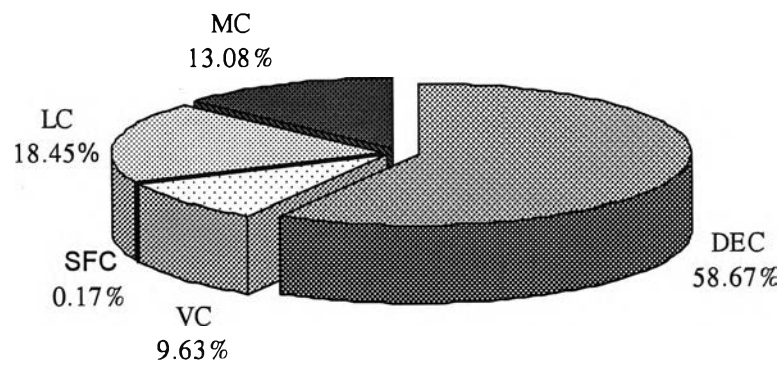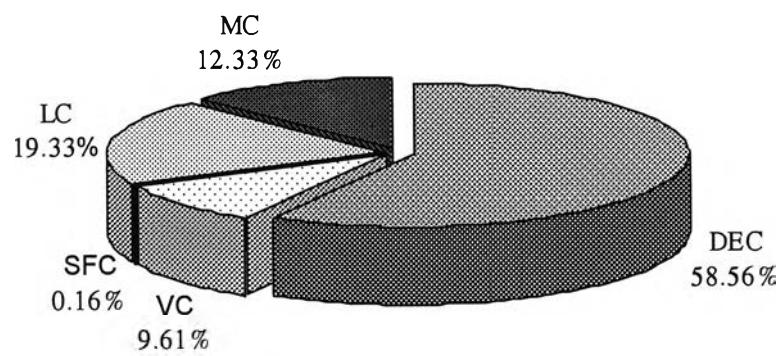| Inputs | 1995-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1999-2000 |
|---|---|---|---|---|---|
| **Material for Sealant** | 4,390.64 | 2,071.64 | 1,886.12 | 2,133.48 | 3,493.96 |
| **Material for PRR** | 101.16 | 151.74 | 202.32 | 50.58 | 455.22 |
| **Material for Fluoride** | 241.86 | 170.41 | 128.74 | 158.84 | 232.98 |
| **Material for Oral education** | 282.31 | 282.31 | 282.31 | 282.31 | 282.31 |
| **Other drugs and materials** | 2,449.48 | 1,857.28 | 1,715.48 | 1,726.43 | 1,846.33 |
| **Gasoline and maintenance** | 1,135.32 | 1,096.92 | 1,095.00 | 1,095.00 | 1,107.00 |
| **School utility** | - | - | - | - | - |
| **Total** <br> • **Current price** <br><br> • **Constant price** | **8,600.77** <br><br> **11,473.64** | **5,630.30** <br><br> **6,828.15** | **5,309.97** <br><br> **5,854.24** | **5,446.64** <br><br> **5,718.97** | **7,417.80** <br><br> **7,417.80** |

According to the results in tables 4.17 and 4.18, costs of materials for sealant are the most portions of annual material. It means that this program emphasized on providing dental sealant to school students.

### 4.2.1.1 Total cost calculation

Total cost of this program included capital costs and recurrent costs. They were calculated as formula below:

$$TC = CC + RC$$
$$CC = DEC + VC + SFC$$
$$RC = LC + MC$$

So, $$TC = DEC + VC + SFC + LC + MC$$

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

$$TAC = \frac{(AC_1 * n_1) + (AC_2 * n_2) + (AC_3 * n_3) + (AC_4 * n_4) + (AC_5 * n_5)}{\text{Average children participated in program}}$$

$$AAC = (AC_1 + AC_2 + AC_3 + AC_4 + AC_5) / 5$$

Where,

| | | |
|---|---|---|
| TC | = | Total cost |
| CC | = | Capital cost |
| RC | = | Recurrent cost |
| DEC | = | Cost of dental equipment |
| VC | = | Cost of vehicles |
| SFC | = | Cost of school facilities |
| AC | = | Average cost |

$AC_i$ = Average cost in 1995,..,1999

$n_i$ = Number of school children participated in this program in 1995,.., 1999

TAC = Total 5 years of average cost

AAC = Average 5 years of average cost

Average children participated in program = (104 +102 +97 +97 +96)/5
                                        = 99.2

Annual total costs of this program were presented in 4 patterns;
- annual total cost at current price
- annual total cost at constant price ( based on year 2000 value)
- annual actual total cost at current price
- annual actual total cost at constant price

Total costs were presented as tables 4.19 - 4.22 as follow:

Table 4.19: Annual total cost of school-based oral health preventive program at public primary schools in Bangkok in 1995-2000 at current price

| Cost items | 1995 - 1996 | 1996 - 1997 | 1997 - 1998 | 1998 - 1999 | 1999 - 2000 | Total 5 years | Average 5 year |
|---|---|---|---|---|---|---|---|
| Capital cost | | | | | | | |
| - Dental equipment | 26,680.46 | 26,680.46 | 26,680.46 | 24,327.94 | 24,327.94 | 128,697.26 | 25,739.45 |
| - Vehicles | 4,379.18 | 4,379.18 | 4,379.18 | 3,800.36 | 3,800.36 | 20,738.26 | 4,147.65 |
| - School facilities | 75.08 | 75.08 | 75.08 | 57.73 | 57.73 | 340.7 | 68.14 |
| Total (A) | 31,134.72 (64.72%) | 31,134.72 (68.47%) | 31,134.72 (68.34%) | 28,186.03 (65.26%) | 28,186.03 (61.76%) | 149,776.22 (65.70%) | 29,955.24 |
| Recurrent cost | | | | | | | |
| - Labor cost | 7,989.81 | 8,389.30 | 8,808.77 | 9,249.20 | 9,711.66 | 44,148.74 | 8,829.75 |
| - Material cost | 8,982.22 | 5,949.34 | 5,616.53 | 5,753.20 | 7,736.84 | 34,038.13 | 6,807.63 |
| Total (B) | 16,972.03 (35.28%) | 14,338.64 (31.53%) | 14,425.30 (31.66%) | 15,002.40 (34.74%) | 17,448.50 (38.24%) | 78,186.87 (34.30%) | 15,637.37 |
| Total cost (A +B) | 48,106.75 (100%) | 45,473.36 (100%) | 45,560.02 (100%) | 43,188.43 (100%) | 45,634.53 (100%) | 227,963.09 (100%) | 45,592.62 |
| Average cost | 462.56 | 445.82 | 469.69 | 445.24 | 475.36 | 2,298.02* | 459.73** |

(Note: * =TAC, ** =AAC)

**Table 4.20: Annual total cost of school-based oral health preventive program at public primary schools in Bangkok in 1995-2000 at constant price**
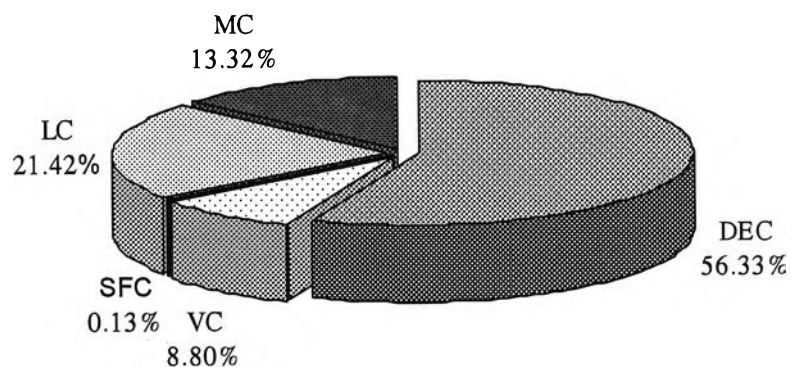
| Cost items | 1995 - 1996 | 1996 - 1997 | 1997 - 1998 | 1998 - 1999 | 1999 - 2000 | Total 5 years | Average 5 year |
|---|---|---|---|---|---|---|---|
| **Capital cost** | | | | | | | |
| - Dental equipment | 35,592.40 | 32,356.73 | 29,415.21 | 25,544.34 | 24,327.94 | 147,236.61 | 29,447.32 |
| - Vehicles | 5,841.94 | 5,310.85 | 4,828.05 | 3,990.38 | 3,800.36 | 23,771.57 | 4,754.31 |
| - School facilities | 100.16 | 91.05 | 82.78 | 60.62 | 57.73 | 392.33 | 78.47 |
| **Total (A)** | **41,534.49** (64.72%) | **37,758.63** (68.47%) | **34,326.03** (68.34%) | **29,595.33** (65.26%) | **28,186.03** (61.76%) | **171,400.52** (65.79%) | **34,280.10** |
| **Recurrent cost** | | | | | | | |
| - Labor cost | 10,658.61 | 10,174.12 | 9,711.67 | 9,711.66 | 9,711.66 | 49,967.72 | 9,993.54 |
| - Material cost | 11,982.51 | 7,215.06 | 6,192.22 | 6,040.86 | 7,736.84 | 39,167.49 | 7,833.50 |
| **Total (B)** | **22,641.11** (35.28%) | **17,389.19** (31.53%) | **15,903.89** (31.66%) | **15,752.52** (34.74%) | **17,448.50** (38.24%) | **89,135.21** (34.21%) | **17,827.04** |
| **Total cost (A +B)** | 64,175.60 (100%) | 55,147.82 (100%) | 50,229.92 (100%) | 45,347.85 (100%) | 45,634.53 (100%) | 260,535.73 (100%) | 52,107.15 |
| **Average cost** | 617.07 | 540.66 | 517.83 | 467.50 | 475.36 | 2,626.37 | 523.68 |

The results in tables 4.19 and 4.20 indicated that the capital cost was the greatest part of the total cost of this program; it was between 61.76% - 68.47% of total cost, which the cost of dental equipment was responsible for more than half of total cost. The recurrent cost was between 31.53% - 38.24% of total cost. The annual total cost was in the range 43,188.43 to 48,106.75. Total cost over 5 years program was 227,963.09 baths. The average cost for five year was 459.73 baths. The percentages of the component of this program were shown in the following figures 4.2 - 4.8.
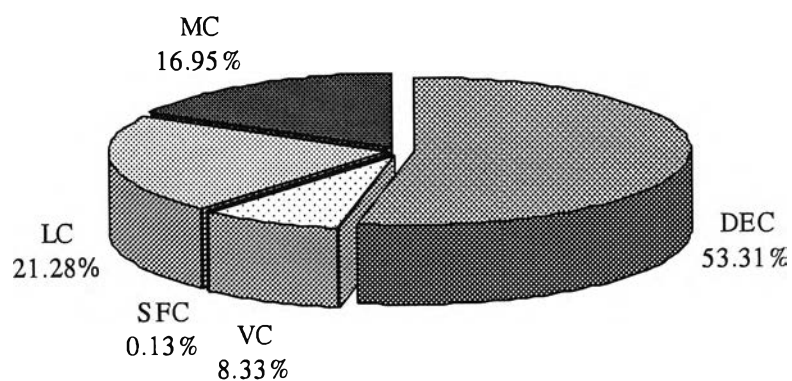
**Figure 4.2: Components of cost in 1995-1996**

MC
18.67%

LC
16.61%

SFC
0.16%

VC
9.10%

DEC
55.46%

**Figure 4.3: Components of cost in 1996-1997**

MC
13.08%

LC
18.45%

SFC
0.17%

VC
9.63%

DEC
58.67%

**Figure 4.4: Components of cost in 1997-1998**

MC
12.33%

LC
19.33%

SFC
0.16%

VC
9.61%

DEC
58.56%

**Figure 4.5: Components of cost in 1998-1999**

MC
13.32%

LC
21.42%

SFC
0.13%   VC
8.80%

DEC
56.33%

**Figure 4.6: Components of cost in 1999-2000**

MC
16.95%

LC
21.28%

SFC
0.13%   VC
8.33%

DEC
53.31%

**Figure 4.7: Components of cost for all 5 years at current price**

MC
14.93%

LC
19.37%

SFC
0.15%   VC
9.10%

DEC
56.46%
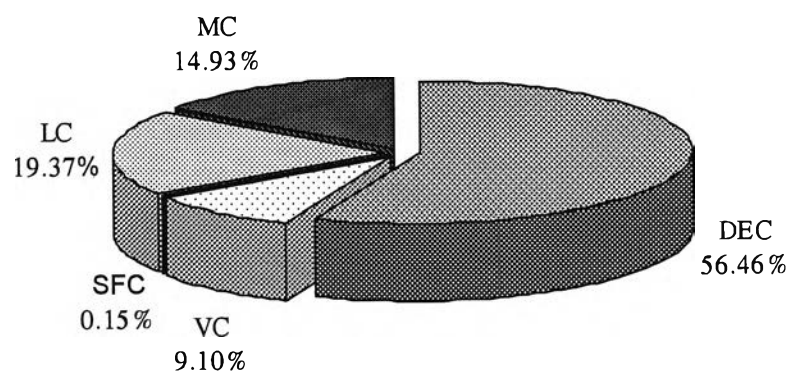
**Figure 4.8: Components of cost for all 5 years at constant price**
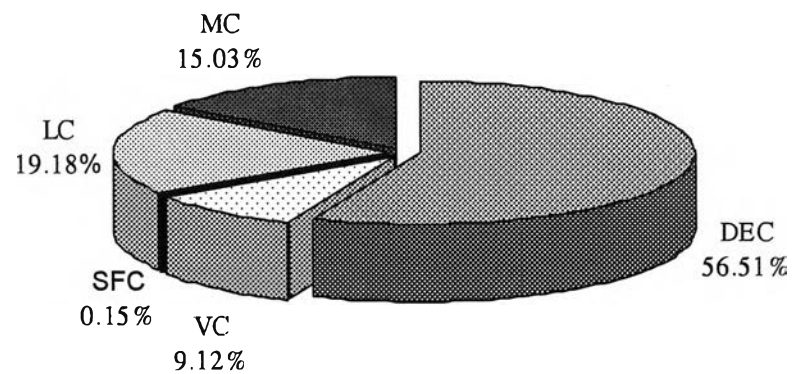


According to the figures 4.2 – 4.8, costs of dental equipments were the majority components of the total costs, which the labor costs and material costs were the second and the third most costs of annual total cost respectively except in 1995 the labor costs were less than the material costs.

Table 4.21: Actual annual total cost of school-based oral health preventive program at public primary schools in Bangkok in 1999-2000* at current price

| Cost items | 1995 - 1996 | 1996 - 1997 | 1997 - 1998 | 1998 - 1999 | 1999 - 2000 | Total 5 years | Average 5 year |
|---|---|---|---|---|---|---|---|
| **Capital cost** | | | | | | | |
| - Dental equipment | 26,566.85 | 26,566.85 | 26,566.85 | 24,232.33 | 24,232.33 | 128,165.21 | 25,633.04 |
| - Vehicles | 2,189.59 | 2,189.59 | 2,189.59 | 1,957.80 | 1,957.80 | 10,484.37 | 2,096.87 |
| - School facilities | - | - | - | - | - | - | - |
| Total (A) | **28,756.44** (66.79%) | **28,756.44** (71.23%) | **28,756.44** (71.27%) | **26,190.13** (68.50%) | **26,190.13** (64.61%) | **138,649.58** (68.45%) | **27,729.92** |
| **Recurrent cost** | | | | | | | |
| - Labor cost | 5,698.29 | 5,983.20 | 6,282.37 | 6,596.48 | 6,926.31 | 31,486.65 | 6,297.33 |
| - Material cost | 8,600.77 | 5,630.30 | 5,309.97 | 5,446.64 | 7,417.80 | 32,405.48 | 6,481.10 |
| Total (B) | **14,299.06** (33.21%) | **11,613.50** (28.77%) | **11,592.34** (28.73%) | **12,043.12** (31.50%) | **14,344.11** (35.39%) | **63,892.13** (31.55%) | **12,778.43** |
| Total cost (A +B) | 43,055.50 (100%) | 40,369.94 (100%) | 40,348.78 (100%) | 38,233.25 (100%) | 40,534.24 (100%) | 202,541.71 (100%) | 40,508.34 |
| Average cost | 414.00 | 395.78 | 415.97 | 394.16 | 422.23 | 2,041.75 | 408.43 |

(* =Costs incurred by this program which not included stainless tray and cotton pot's costs, van 1's costs, school facilities and utilities, salaries of dental nurses, and school teachers)

**Table 4.22: Actual annual total cost of school-based oral health preventive program at public primary schools in Bangkok in 1999-2000\* at constant price**

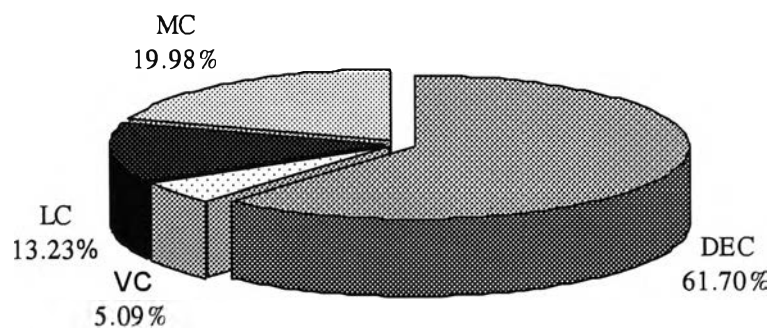| Cost items | 1995 - 1996 | 1996 - 1997 | 1997 - 1998 | 1998 - 1999 | 1999 - 2000 | Total 5 years | Average 5 year |
|---|---|---|---|---|---|---|---|
| **Capital cost** | | | | | | | |
| - Dental equipment | 35,440.84 | 32,218.95 | 29,289.95 | 25,443.95 | 24,232.33 | 146,626.02 | 29,325.20 |
| - Vehicles | 2,920.97 | 2,655.43 | 2,414.02 | 2,055.69 | 1,957.80 | 12,003.91 | 2,400.78 |
| -School facilities | - | - | - | - | - | - | - |
| Total (A) | 38,361.81 (66.79%) | 34,874.38 (71.23%) | 31,703.97 (71.27%) | 27,499.64 (68.50%) | 26,190.13 (64.61%) | 158,629.93 (68.51%) | 31,725.99 |
| **Recurrent cost** | | | | | | | |
| - Labor cost | 7,601.66 | 7,256.13 | 6,926.31 | 6,926.31 | 6,926.31 | 35,636.72 | 7,127.34 |
| - Material cost | 11,473.64 | 6,828.15 | 5,854.24 | 5,718.97 | 7,417.80 | 37,292.80 | 7,458.56 |
| Total (B) | 19,075.30 (33.21%) | 14,084.28 (28.77%) | 12,780.55 (28.73%) | 12,645.28 (31.50%) | 14,344.11 (35.39%) | 72,929.52 (31.49%) | 14,585.90 |
| Total cost (A+B) | 57,437.11 (100%) | 48,958.66 (100%) | 44,484.52 (100%) | 40,144.92 (100%) | 40,534.24 (100%) | 231,559.45 (100%) | 46,311.89 |
| Average cost | 552.28 | 479.99 | 458.60 | 413.87 | 422.23 | 2,334.27 | 465.39 |

(\* =Costs incurred by this program which not included stainless tray and cotton pot's costs, van 1's costs, school facilities and utilities, salaries of dental nurses, and school teachers)

The results in tables 4.21 and 4.22 denoted that the capital cost was the most section of the total cost for actual cost calculation as same as in the tables 4.19 and 4.20. It was between 64.61% - 71.27% of total cost. The recurrent cost was between 28.73% - 35.39% of total cost. The annual actual total cost was in the range 38,233.25 and 43,055.50 and the actual total cost over 5 years program0 was 202,541.71 baths. The actual average cost for five year was 408.43 baths. The percentages of the components of this program were shown in the figures 4.9 - 4.15 as follow:

**Figure 4.9: Components of actual cost in 1995-1996**



MC
19.98%

LC
13.23%

VC
5.09%

DEC
61.70%

**Figure 4.10: Components of actual cost in 1996-1997**



MC
13.95%

LC
14.82%

VC
5.42%

DEC
65.81%
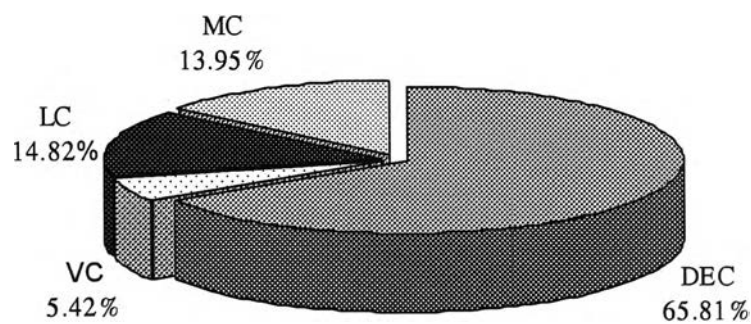
**Figure 4.11: Components of actual cost in 1997-1998**



MC
13.16%

LC
15.57%

VC
5.43%

DEC
65.84%
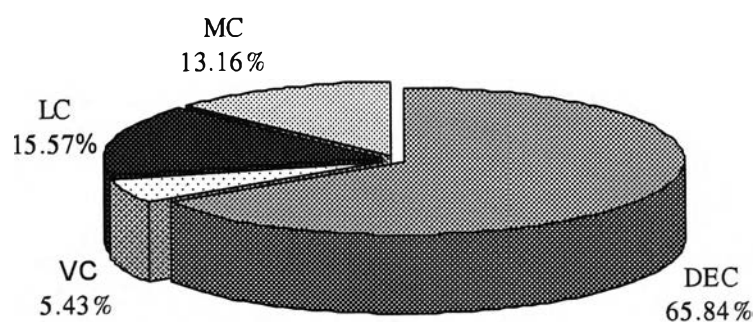
**Figure 4.12: Components of actual cost in 1998-1999**
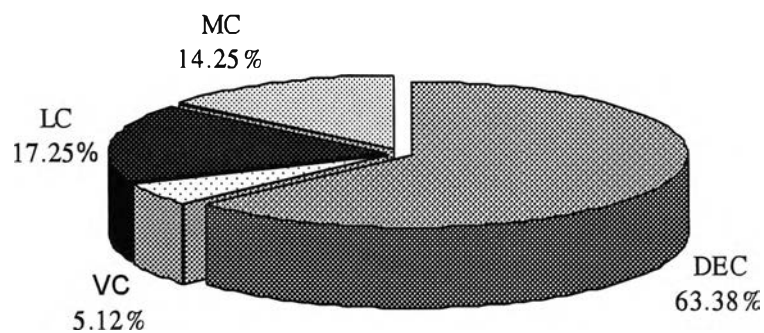


**Figure 4.13: Components of actual cost in 1999-2000**
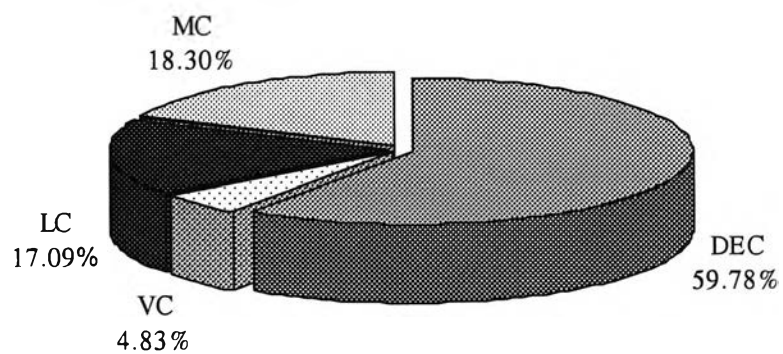


**Figure 4.14: Components of actual cost for all 5 years at current price**
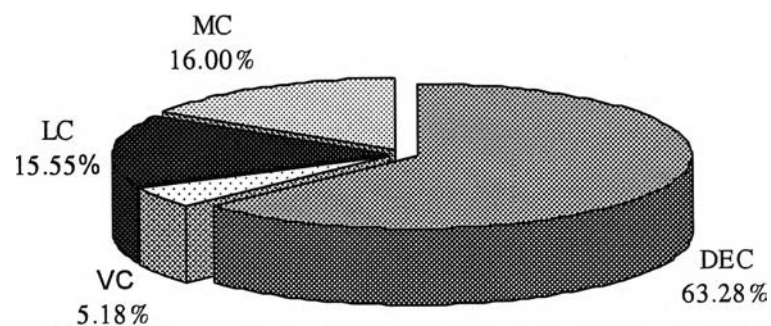
**Figure 4.15: Components of actual cost for all 5 years at constant price**
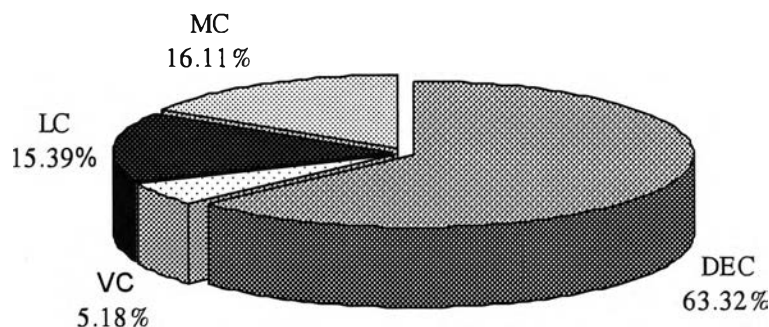


According to figures 4.9 – 4.15, the costs of dental equipments were responsible for more than half of the total costs, which the labor costs and material costs were the second and the third most cost of annual total costs respectively except in 1995 and 1999. For the constant price scheme calculation, the labor costs were less than the material costs.

As indicated in figures 4.16 and 4.17 for actual cost calculation both at current and constant price and economic cost calculation at constant price, total costs and average costs of the program tended to decrease year by year during the period of study except the last year, they slightly increased. The increased costs were attributed by providing more preventive program to school children in the last year. Not only this program aimed to provide dental care for the younger students and provide less for older students, but this program also emphasized to provide dental care for the sixth grade students; the oldest grade students of this program. Once they graduated from primary schools, there is no free dental care for them any more. But for economic cost at current price calculation, total costs increased and decreased every year.

**Figure 4.16: Total cost of this program**



Legend:
- ☒ Annual total cost at current price
- ⊞ Annual total cost at constant price
- ☒ Actual annual total cost at current price
- ☒ Actual annual total cost at constant price

**Figure 4.17: Average cost of this program**



Legend:
- ☒ Annual average cost at current price
- ⊞ Annual average cost at constant price
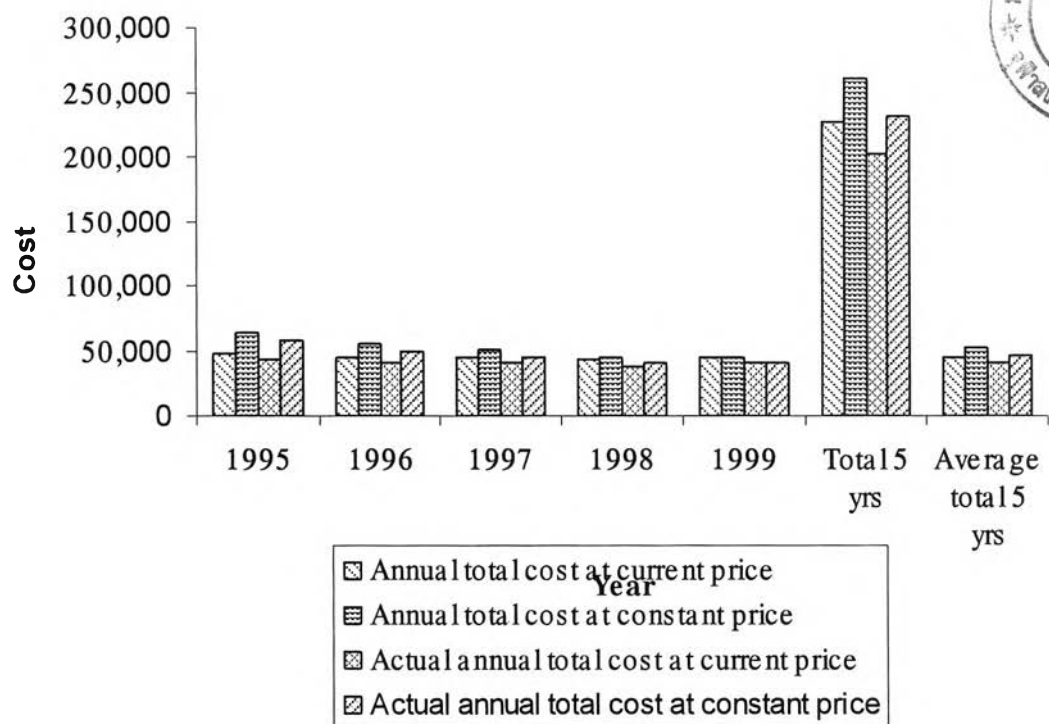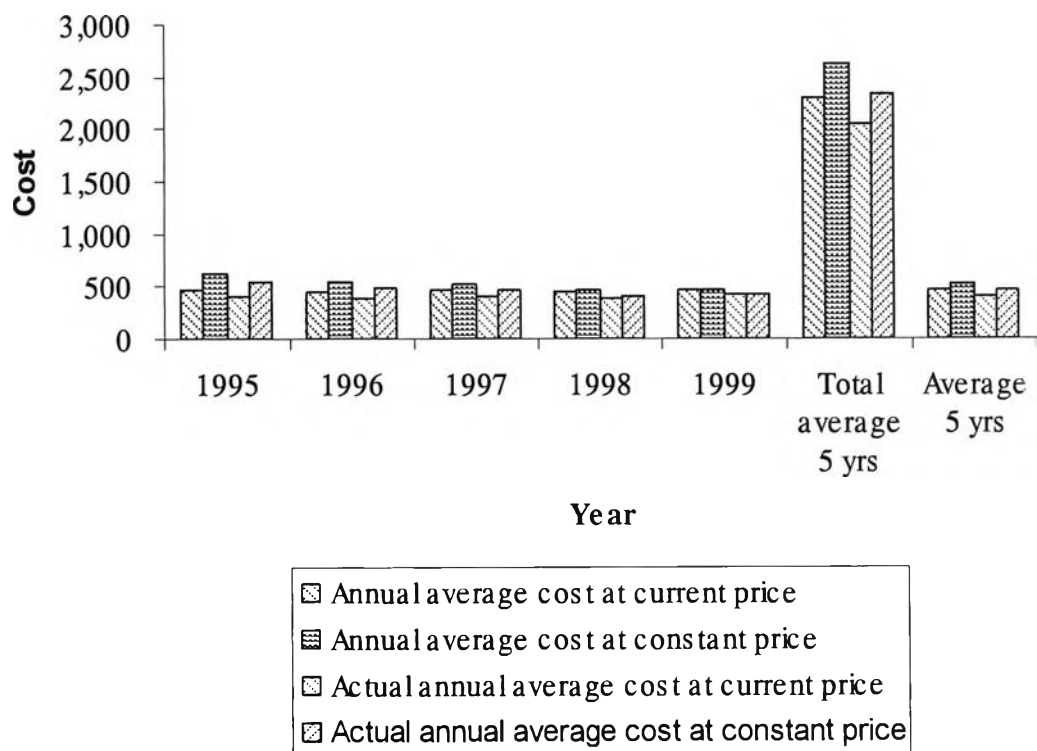- ☒ Actual annual average cost at current price
- ☒ Actual annual average cost at constant price

## 4.3 Cost-effectiveness analysis of school-based oral health preventive program

Since 1995 dental students provided oral health preventive program to school children at public primary schools in Bangkok for 5 years, then the cost-effectiveness of this program were calculated as follows:

$$\text{Cost-effectiveness (Current price)} = \frac{227{,}963.09^a / 99.2}{1.37}$$

$$= \frac{2{,}298.02}{1.37}$$

$$= 1{,}677.38$$

$$\text{Or, Cost-effectiveness (Constant price)} = \frac{260{,}535.73^b / 99.2}{1.37}$$

$$= 1{,}917.06$$

$$\text{Or, Cost-effectiveness (Actual current price)} = \frac{202{,}541.71^c / 99.2}{1.37}$$

$$= 1{,}490.33$$

$$\text{Or, Cost-effectiveness (Actual constant price)} = \frac{231{,}559.45^d / 99.2}{1.37}$$

$$= 1{,}703.85$$

$$\text{ICER (Current price)} = (227{,}963.09^a/99.2) / (1.793 - 1.37)^e$$
$$= 5{,}432.66$$

$$\text{Or, ICER (Constant price)} = (260{,}535.73^b / 99.2) / (1.793 - 1.37)^e$$
$$= 6{,}208.91$$

$$\text{Or, ICER (Actual Current price)} = (202{,}541.71^c/99.2) / (1.793 - 1.37)^e$$
$$= 4{,}826.83$$

$$\text{Or, ICER (Actual Constant price)} = (231{,}559.45^d / 99.2 / (1.793 - 1.37)^e$$
$$= 5{,}518.37$$

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

Cost of program / person = Total cost divided by average children participated in program

ICER = Incremental cost effectiveness ratio

$$= \frac{C_1 - C_2}{E_1 - E_2}$$

$$= \frac{\Delta C}{\Delta E}$$

$C_1$ = 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

(**Note**: [a]; from table 4.19, [b]; from table 4.20, [c]; from table 4.21; [d] from table 4.22; [e] from section 4.1.3)

Annual cost-effectiveness of this program can be calculated in 4 patterns; cost-effectiveness at current price and constant price and cost-effectiveness at actual current price and constant price. It substantially decreased for every year except the last year it slightly increased. As I mentions earlier that these increased costs were the consequences of providing more this program to the sixth grade students in the last year of study including the last dental examination were soon with the fifth dental examination then the effectiveness was changed a little. Therefore, the cost-effectiveness of this program at the last year would be increased from that of the fourth year. Annual cost-effectiveness of this program was summarized in table 4.23 below:

**Table 4.23: Cost – effectiveness of this program**

| Year \ Item | 1995 - 1996 | 1996 - 1997 | 1997 - 1998 | 1998 - 1999 | 1999 - 2000 | Total 5 years |
|---|---|---|---|---|---|---|
| C/E at current price[1] | 1,652.00 | 891.64 | 579.86 | 329.81 | 346.98 | 1,677.38* |
| C/E at constant price[2] | 2,203.82 | 1,081.32 | 639.30 | 346.30 | 346.98 | 1,917.06* |
| C/E at actual current price[3] | 1,478.57 | 791.56 | 513.54 | 291.97 | 308.20 | 1,490.33* |
| C/E at actual constant price[4] | 1,972.43 | 959.98 | 566.17 | 306.57 | 308.20 | 1,703.85* |

(**Note**: [1,2,3] and [4] can be calculated from average cost in tables 4.19, 4.20, 4.21 and 4.22 respectively and annual effectiveness calculated in table 4.6, and * from 4.3)

## 4.4 Sensitivity analysis to analyze the impact of input costs on this program

In this study the costing of school-based oral health preventive program was based on many variables and values of which might suffer from uncertainty. Therefore, to incorporate uncertainty into the estimates in order that decision makers can apply the results of this program in their judgments, sensitivity analysis was carried out. Many of the assumptions used in the primary analysis are subject to a degree of uncertainty. A

one-way sensitivity modifying key assumptions in relation to costs was undertaken. The sensitivity of this study was tested in five issues.

- Changing of the interest rate used to annualize the economic costs
- Increasing 20% of each capital cost
- Disregard costs in the last year
- Excluding some cost items
- Changing costs of dental equipments

### 4.4.1 Changing of the interest rate used to annualize the economic costs

The interest rate is one of the variables which influenced to the results. Primary analysis used 10% and 5% interest rate to calculate the costs in two phases but the additional analyses varied the assumptions on interest rate. Sensitivity was tested by changing the interest rates at 0%, 3%, 5%, and 10% for costing in one phase over all five years period of study. The following tables showed how total cost, average cost, cost-effectiveness, and ICER changed with changing of the interest rate. In addition, the tables presented the percentage changed of cost-effectiveness of this program compared with cost-effectiveness of this program in primary analysis at current price scheme for calculation shown in table 4.23 previously.

**Table 4.24: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for interest rate 0%**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 38,981.00 | 374.82 | - | 1,338.63 | -18.97% |
| 1996-1997 | 36,347.61 | 356.35 | - | 712.70 | -20.07% |
| 1997-1998 | 36,434.27 | 375.61 | - | 463.72 | -20.03% |
| 1998-1999 | 37,011.37 | 381.56 | - | 282.64 | -14.30% |
| 1999-2000 | 39,457.47 | 411.02 | - | 300.01 | -13.54% |
| Total 5 yrs | 188,231.71[a] | 1,897.50[b] | 4,485.81[c] | 1,385.04[d] | -17.43% |
| Average 5 yrs | 37,646.34[e] | 379.87[d] | - | - | - |

(**Note**: [a] $=\sum TC$, [b] $=(\sum TC)/99.2$, [c] $=(\sum TC/99.2)/(1.793-1.37)$, [d] $=[(\sum TC)/99.2]/1.37$ , [e] $=(\sum TC)/5$, [f] $=(\sum AC)/5$
   : % changed of C/E compared with C/E at current price in primary as shown in table 4.23)

**Table 4.25: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for interest rate 3%**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 41,549.52 | 399.51 | - | 1,426.84 | -13.63% |
| 1996-1997 | 38,916.13 | 381.53 | - | 763.06 | -14.42% |
| 1997-1998 | 39,002.79 | 402.09 | - | 496.41 | -14.39% |
| 1998-1999 | 39,579.89 | 408.04 | - | 302.25 | -8.36% |
| 1999-2000 | 42,025.99 | 437.77 | - | 319.54 | -7.91% |
| Total 5 yrs | 201,074.32 | 2,026.96 | 4,791.86 | 1,479.53 | -11.80% |
| Average 5 yrs | 40,214.86 | 405.79 | - | - | - |

**Table 4.26: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for interest rate 5%**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 43,348.16 | 416.81 | - | 1,488.60 | -9.89% |
| 1996-1997 | 40,714.77 | 399.16 | - | 798.33 | -10.47% |
| 1997-1998 | 40,801.43 | 420.63 | - | 519.30 | -10.44% |
| 1998-1999 | 41,378.53 | 426.58 | - | 315.99 | -4.19% |
| 1999-2000 | 43,824.63 | 456.51 | - | 333.22 | -3.97% |
| Total 5 yrs | 210,067.50 | 2,117.62 | 5,006.19 | 1,545.71 | -7.85% |
| Average 5 yrs | 42,013.50 | 423.94 | - | - | - |

**Table 4.27: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for interest rate 10%**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 48,106.74 | 462.56 | - | 1,652.02 | 0.00% |
| 1996-1997 | 45,473.35 | 445.82 | - | 891.63 | 0.00% |
| 1997-1998 | 45,560.01 | 469.69 | - | 579.87 | 0.00% |
| 1998-1999 | 46,137.11 | 475.64 | - | 352.33 | 6.83% |
| 1999-2000 | 48,583.21 | 506.08 | - | 369.40 | 6.46% |
| Total 5 yrs | 233,860.41 | 2,357.46 | 5,573.19 | 1,720.78 | 2.59% |
| Average 5 yrs | 46,772.08 | 471.96 | - | - | - |

From the results in tables 4.24 – 4.27, the percentage changed of cost-effectiveness of this program over 5 years were between -17.43% to 2.59% depending on the assumption used for calculation. For comparing primary analysis (economic cost at current price scheme for calculation) with 5% interest rate (lower margin), and 10% interest rate (upper margin) the cost-effectiveness of this program in primary analysis was tended to close by that of 10% interest rate for costing more than that of 5% interest rate (2.59% and -7.85%). Moreover, total costs, average cost, ICER in primary analysis were also closer by that of 10% interest rate for costing than that of 5% interest rate.

**Figure 4.18: Total cost of program at interest rate 0%, 3%, 5%, 10% and 1° analysis**
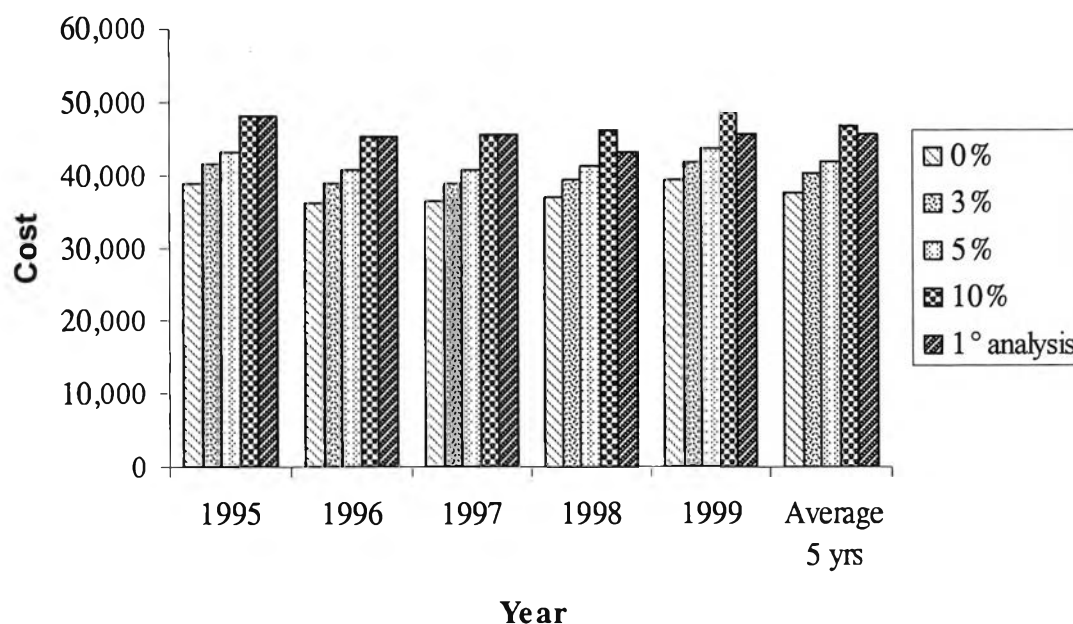


**Figure 4.19: Average cost of program at interest rate 0%, 3%, 5%, 10% and 1° analysis**
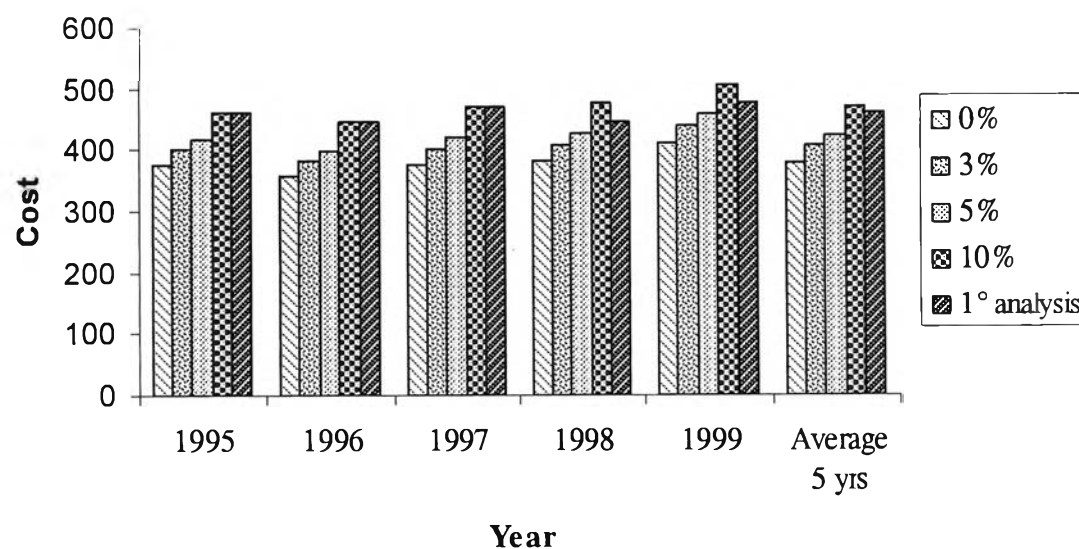
The figures 4.18 and 4.19 presented the annual total costs and average costs of program on sensitivity analysis by varying the interest rate at 0%, 3%, 5%, 10% and primary analysis. From these results, the total costs and average costs of this program are highly sensitive to the interest rate used to annualized capital costs.

### 4.4.2 Increasing 20% of each capital cost

Sensitivity analysis was also tested by varying the assumptions on capital costs, the great majority of total costs of this program. Sensitivity was tested by alteration in the capital cost. Assume that, there is an increase of 20% of one item of capital costs such as cost of dental equipment, vehicle and school facilities but the other items; DMFT index, number of school children remain unchanged. The following tables showed how total cost, average cost, cost-effectiveness, and ICER changed with increasing 20% of each capital cost

**Table 4.28: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for increasing 20% of dental equipment cost**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 53,442.83 | 513.87 | - | 1,835.26 | 11.09% |
| 1996-1997 | 50,809.44 | 498.13 | - | 996.26 | 11.73% |
| 1997-1998 | 50,896.10 | 524.70 | - | 647.78 | 11.71% |
| 1998-1999 | 49,711.76 | 512.49 | - | 379.62 | 15.10% |
| 1999-2000 | 50,500.12 | 526.04 | - | 383.97 | 10.66% |
| Total 5 yrs | 255,360.25 | 2,574.20 | 6,085.58 | 1,878.98 | 12.02% |
| Average 5 yrs | 51,072.05 | 515.05 | - | - | - |

**Table 4.29: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for increasing 20% of vehicle cost**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 48,982.57 | 470.99 | - | 1,682.09 | 1.82% |
| 1996-1997 | 46,349.18 | 454.40 | - | 908.81 | 1.93% |
| 1997-1998 | 46,435.84 | 478.72 | - | 591.01 | 1.92% |
| 1998-1999 | 43,948.51 | 453.08 | - | 335.61 | 1.76% |
| 1999-2000 | 46,394.61 | 483.28 | - | 352.76 | 1.66% |
| Total 5 yrs | 232,110.71 | 2,339.83 | 5,531.51 | 1,707.90 | 1.82% |
| Average 5 yrs | 46,422.14 | 468.09 | - | - | - |

**Table 4.30: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for increasing 20% of school facility cost**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 48,121.75 | 462.71 | - | 1,652.53 | 0.03% |
| 1996-1997 | 45,488.36 | 445.96 | - | 891.93 | 0.03% |
| 1997-1998 | 45,575.02 | 469.85 | - | 580.06 | 0.03% |
| 1998-1999 | 43,199.98 | 445.36 | - | 329.90 | 0.03% |
| 1999-2000 | 45,646.08 | 475.48 | - | 347.07 | 0.02% |
| Total 5 yrs | 228,031.19 | 2,298.70 | 5,434.28 | 1,677.88 | 0.03% |
| Average 5 yrs | 45,606.23 | 459.87 | - | - | - |

As indicated in tables 4.28 – 4.30 the percentage changed of cost-effectiveness of this program was tested by varying the assumption on 20% increasing of each capital costs; dental equipment, vehicle and school facility compared with primary analysis (economic costs at current price scheme for calculation). Among these costs, the percentage changed of increasing dental equipment's costs over all five years of implementing program are the highest (12.02%), that is, the cost-effectiveness of this program highly sensitive to dental equipment's costs.

**Figure 4.20: Total cost of program for increasing 20% of cost of dental equipment, or cost of vehicle, or cost of school facilities and 1° analysis**
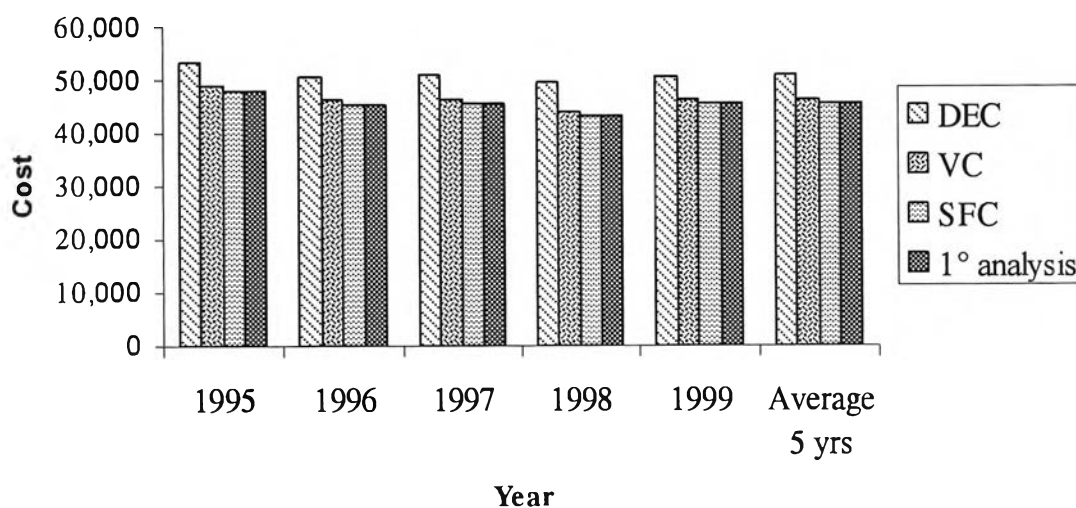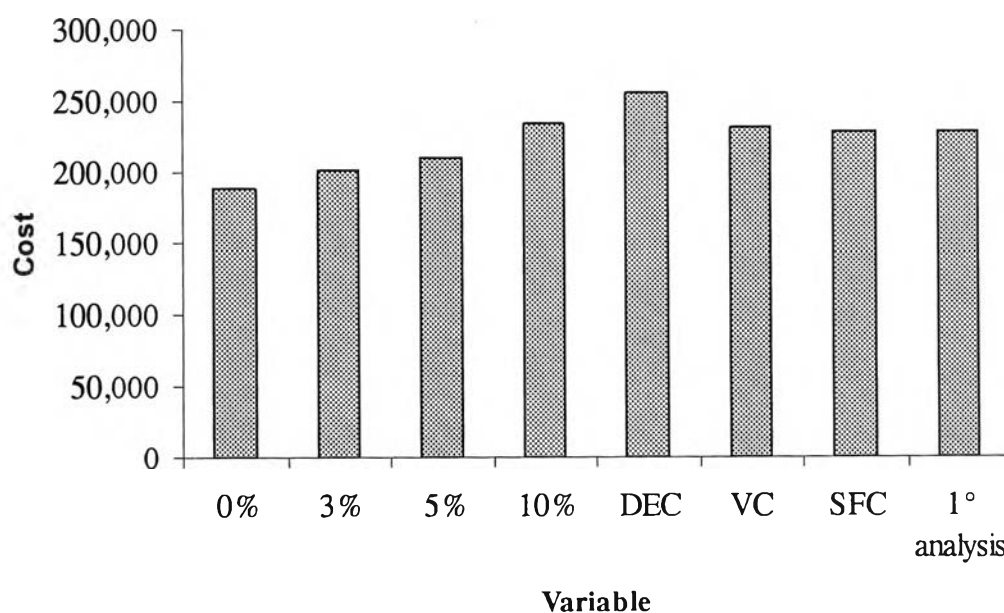
**Figure 4.21: Average cost of program for increasing 20% of cost of dental equipment, or cost of vehicle, or cost of school facilities and 1° analysis**
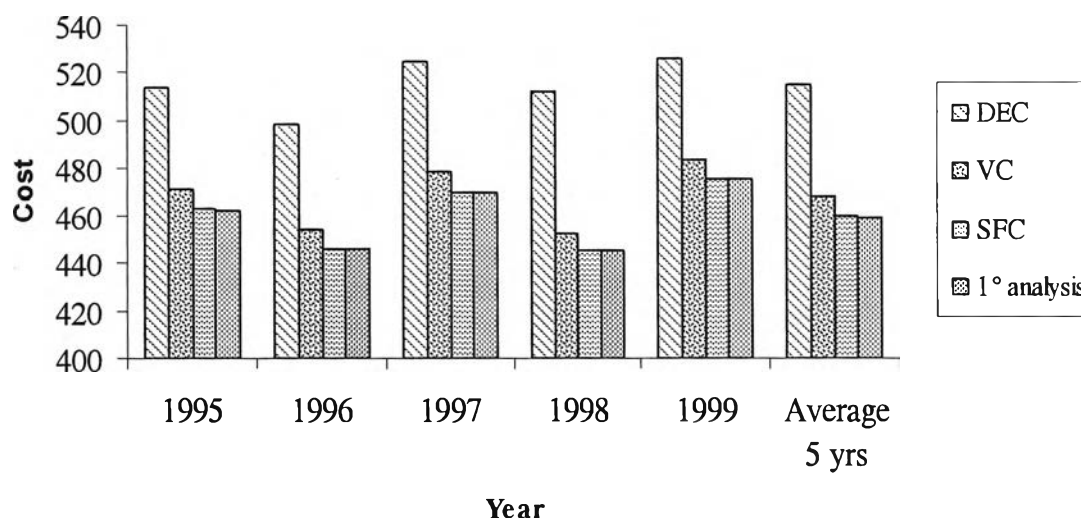


According to the figures 4.20 and 4.21, the changing of any item of capital costs could lead to the change of both total cost and average cost. Among these capital costs, dental equipment's costs are the most important portion of total costs. Both total costs and average costs are very highly sensitive to the change of dental equipment's costs.

For summarized total cost over 5 years implementing program, ICER and cost-effectiveness of this program on sensitivity analysis by varying the interest rate and increasing each capital cost, they were presented in figures 4.22 – 4.24 as follow:

**Figure 4.22: All total cost of this program over 5 years implementation for sensitivity analysis by varying the interest rate 0%, 3%, 5%, 10%, increasing 20% of cost of dental equipment, or cost of vehicle, or cost of school facilities and 1° analysis**

**Figure 4.23: ICER of this program over 5 years implementation for sensitivity analysis by varying the interest rate 0%, 3%, 5%, 10%, increasing 20% of cost of dental equipment, or cost of vehicle, or cost of school facilities and 1° analysis**
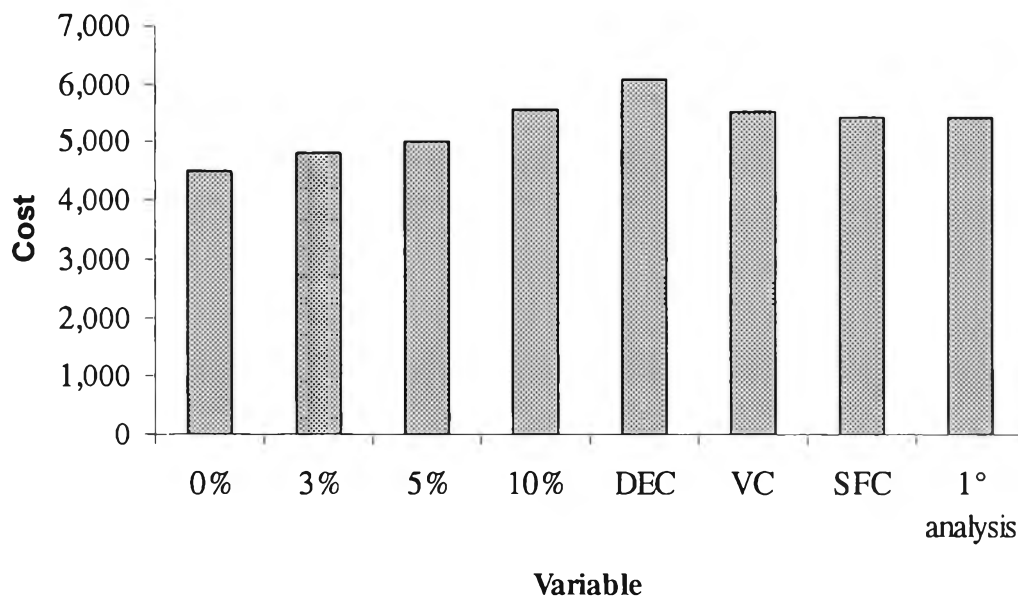


**Figure 4.24: C/E of this program over 5 years implementation for sensitivity analysis by varying the interest rate 0%, 3%, 5%, 10%, increasing 20% of cost of dental equipment, or cost of vehicle, or cost of school facilities and 1° analysis**
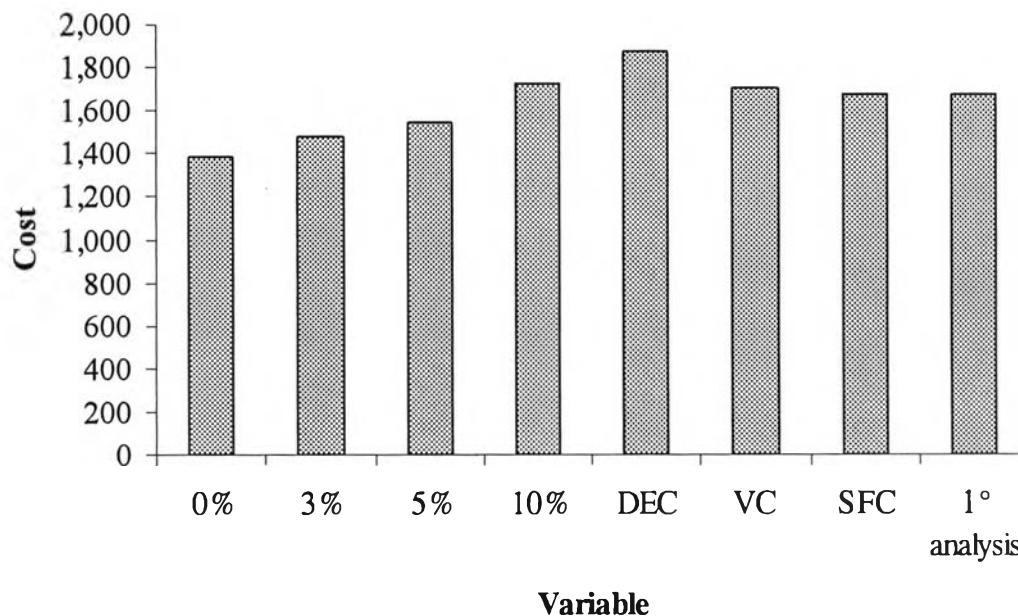
### 4.4.3   Disregard costs in the last year of program

This program was expected in preventive benefit of dental care which costs extremely incurred at the beginning of program and the benefits usually occur in the long-run future. The effectiveness occurring in the last year of program might be not the results of costs at the last year. So, costs incurred at the last year of program should be disregard for calculating only costs affected to the effectiveness over 5 years of program. The following table presented the total cost, average cost, cost-effectiveness, ICER, and percentage changed of cost-effectiveness of this program over 5 years implementing program.

**Table 4.31: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for disregard costs in the last year of program**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|------|-----|-----|------|-----|------------------|
| Total 5 yrs | 182,328.56 | 1,837.99 | 4,345.13 | 1,341.60 | -20.02% |
| Average 5 yrs | 36,465.71 | 364.66 | - | - | - |

From the results in table 4.31, the total cost, average cost, ICER and cost-effectiveness of this program substantially decreased from the primary analysis. Especially cost-effectiveness ratio decreased 20.02%.

### 4.4.4   Excluding some cost items

As mentioned earlier, this program was based on teaching and training the dental students in the principle of oral preventive care in community-based program of Faculty of Dentistry, Mahidol University. Some costs in this study might incur for education these students. For example, salaries of supervisor are not necessary for initiating this program in the other schools or areas provided by dental nurses.

In some countries, there were dental nurses working for school-based oral health program at primary schools which did not require transportation of dental team. Somewhere dental nurses worked at public dental health services which required transportation in order to provide this program to school children under their responsibilities.

So, the following tables showed how total cost, average cost, ICER and cost-effectiveness changed when either salaries of supervisor, or transportation costs of dental team (cost of vehicles, salaries of van drivers and gasoline & van's maintenance cost) were excluded, and exclude these costs were excluded simultaneously.

**Table 4.32: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for excluding salaries of supervisor**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|------|-----|-----|------|-----|------------------|
| 1995-1996 | 45,602.88 | 438.49 | - | 1,566.03 | -5.20% |
| 1996-1997 | 42,844.30 | 420.04 | - | 840.08 | -5.78% |
| 1997-1998 | 42,799.50 | 441.23 | - | 544.73 | -6.06% |
| 1998-1999 | 40,289.89 | 415.36 | - | 307.67 | -6.71% |
| 1999-2000 | 42,591.06 | 443.66 | - | 323.84 | -6.67% |
| Total 5 yrs | 214,127.63 171,536.57* | 2,158.54 1,729.20* | 5,102.93 4,087.94* | 1,575.58 1,262.19* | -6.07% -24.75%* |
| Average 5 yrs | 42,825.53 34,307.31* | 431.76 343.02* | - | - | - |

(* =disregard for the last year of program)

**Table 4.33: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for excluding transportation cost of dental team (cost of vehicles, salaries of van drivers and gasoline & van's maintenance cost)**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|------|-----|-----|------|-----|------------------|
| 1995-1996 | 45,441.29 | 436.94 | - | 1,560.48 | -5.54% |
| 1996-1997 | 42,769.79 | 419.31 | - | 838.62 | -5.95% |
| 1997-1998 | 42,778.04 | 441.01 | - | 544.46 | -6.11% |
| 1998-1999 | 40,322.10 | 415.69 | - | 307.92 | -6.64% |
| 1999-2000 | 42,667.64 | 439.87 | - | 321.07 | -7.47% |
| Total 5 yrs | 213,978.86 171,311.22* | 2,157.04 1,726.93* | 5,099.39 4,082.58* | 1,574.49 1,260.53* | -6.13% -24.85%* |
| Average 5 yrs | 42,795.77 34,262.24* | 430.56 342.59* | - | - | - |

(* =disregard for the last year of program)

**Table 4.34: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for excluding both salaries of supervisor and transportation cost of dental team (van's cost and gasoline & van's maintenance cost)**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 38,558.24 | 370.75 | - | 1,324.12 | -19.85% |
| 1996-1997 | 35,761.55 | 350.60 | - | 701.21 | -21.36% |
| 1997-1998 | 35,638.34 | 367.41 | - | 453.59 | -21.78% |
| 1998-1999 | 33,623.20 | 346.63 | - | 256.76 | -22.15% |
| 1999-2000 | 35,823.81 | 373.16 | - | 272.38 | -21.50% |
| Total 5 yrs | 179,405.14<br>143,581.33* | 1,808.52<br>1,447.39* | 4,275.46<br>3,421.73* | 1,320.09<br>1,056.49* | -21.30%<br>-37.02%* |
| Average 5 yrs | 35,881.03<br>28,716.27* | 361.71<br>287.08* | - | - | - |

(* =disregard for the last year of program)

As indicated in tables 4.32-4.34, the total cost, average cost, ICER and cost-effectiveness of program were less than primary analysis considerably. Including cutting off costs at the last year, cost-effectiveness ratio was extremely changed in sensitivity analysis on excluding both salaries of supervisor and transportation costs of dental team. It means that if the dental team provided this program at public dental health centers, cost-effectiveness of this program in provider perspective was 1,056.49 baths over 5 years of implementation.

### 4.4.5 Changing costs of dental equipments

As a result of this primary analysis, the cost-effectiveness of this program was likely high. One of these problems was expensive dental equipment's costs such as dental mobile unit. Therefore, this study was also tested sensitivity by changing costs of dental mobile unit which including dental mobile unit, compressor, curing light, and some handpieces. Costs of this dental mobile unit were 222,000 baths in 2005. Then, sensitivity analysis converted these costs into 1995 values.

**Table 4.35: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for changing costs of dental equipments**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 44,978.75 | 432.49 | - | 1,544.60 | -6.50% |
| 1996-1997 | 42,345.36 | 415.15 | - | 830.30 | -6.88% |
| 1997-1998 | 42,432.02 | 437.44 | - | 540.05 | -6.86% |
| 1998-1999 | 40,494.80 | 417.47 | - | 309.24 | -6.24% |
| 1999-2000 | 42,940.90 | 447.30 | - | 326.50 | -5.90% |
| Total 5 yrs | 213,191.83 170,250.93* | 2,149.11 1,716.24* | 5,080.64 4,057.30* | 1,568.69 1,252.73* | -6.48% -25.32%* |
| Average 5 yrs | 42,638.36 34,050.19* | 429.97 340.51* | - | - | - |

($^a$ = 10% interest rate at 1995-1997, 5% at 1997-2001, and 3% at 2001-2005 (BOT 2005)
\* =disregard for the last year of program)

According to table 4.35, the total cost, average cost, ICER and cost-effectiveness of this program were changed a little when changing new equipment costs for calculation. Cost-effectiveness was decreased only 6.48%.

**Table 4.36: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for excluding salaries of supervisor, and changing costs of dental equipments**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 39,041.41 | 375.40 | - | 1,340.71 | -18.84% |
| 1996-1997 | 41,674.80 | 408.58 | - | 817.15 | -8.35% |
| 1997-1998 | 41,588.14 | 428.74 | - | 529.31 | -8.72% |
| 1998-1999 | 35,982.40 | 370.95 | - | 274.78 | -16.69% |
| 1999-2000 | 33,536.30 | 349.34 | - | 254.99 | -26.51% |
| Total 5 yrs | 191,823.05 158,286.75* | 1,933.70 1,595.63* | 4,571.39 3,772.17* | 1,411.46 1,164.69* | -15.85% -30.56%* |
| Average 5 yrs | 38,364.61 31,657.35* | 386.60 316.73* | - | - | - |

(\* =disregard for the last year of program)

**Table 4.37: Sensitivity analysis of the total cost, average cost, cost-effectiveness, and ICER for excluding both salaries of supervisor and transportation cost of dental team (van's cost and gasoline & van's maintenance cost), and changing costs of dental equipments**

| Year | TC | AC | ICER | C/E | % changed of C/E |
|---|---|---|---|---|---|
| 1995-1996 | 31,996.77 | 307.66 | - | 1,098.79 | -33.49% |
| 1996-1997 | 34,592.05 | 339.14 | - | 678.28 | -23.93% |
| 1997-1998 | 34,426.98 | 354.92 | - | 438.17 | -24.44% |
| 1998-1999 | 29,315.71 | 302.22 | - | 223.87 | -32.12% |
| 1999-2000 | 26,769.05 | 278.84 | - | 203.54 | -41.34% |
| Total 5 yrs | 157,100.56 130,331.51* | 1,583.68 1,313.83* | 3,743.92 3,105.98* | 1,155.97 959.00* | -31.08% -42.83%* |
| Average 5 yrs | 38,364.61 26,066.30* | 316.56 260.79* | - | - | - |

(* =disregard for the last year of program)

The results in tables 4.36 and 4.37 showed that if the dental nurse provided this program at schools not for education of dental students by introducing new dental equipments at lower price, the cost-effectiveness of this program decreased 15.85%. Furthermore, if the dental team provided this program at the public dental health center (fixed clinic), the cost-effectiveness of this program substantially decreased 31.08%.