



## Chapter I

### Introduction

#### 1.1 Background and Rationale

Oral health is defined as a general state of well-being as a result of healthy and functioning mucosa, gingival and dentition. Despite an increasing incidence of oral cancer in adult and static levels of periodontal disease in children, a marked improvement has been observed in general oral health (experiences of periodontal disease, caries and tooth loss in adults, and caries in children) over the last decade.

Despite great global achievement in the oral health of populations, problems still remain in many communities around the world. This is particularly among underprivileged groups in both developing and developed countries. Poor oral health may have a profound effect on general health, and several oral diseases are related to chronic diseases (World Health Organization [WHO] 2003). The experience of pain, problems with eating, chewing, smiling and communication due to missing, discolored or damaged teeth have a major impact on people's daily lives and well-being. Furthermore, oral diseases restrict activities at school, at work and at home causing millions of school and work hours to be lost each year throughout the world.

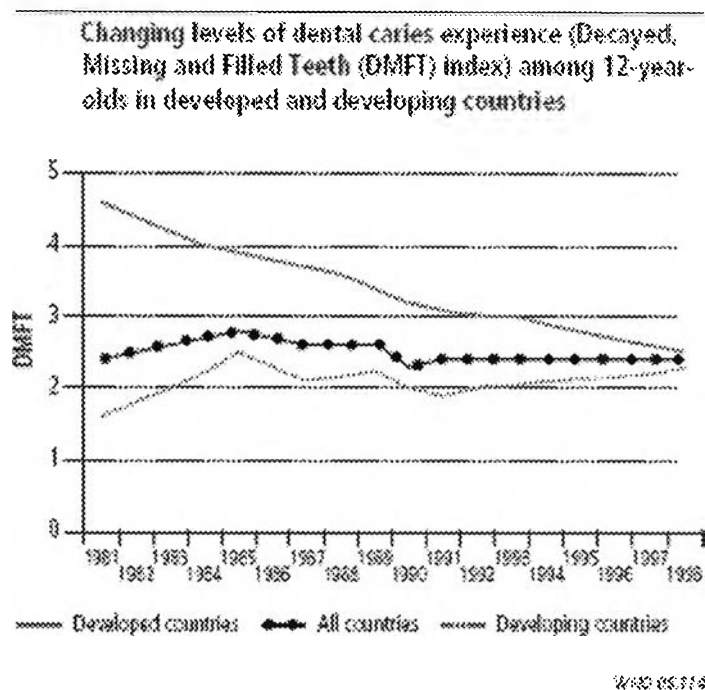
The DMFT index is a measure of cumulative caries experience in the permanent dentition of children. Caries occurrence has been described in terms of the numbers decayed, missing and filled teeth (DMFT) or tooth surface (DMFS) and correspondingly in the primary teeth below the age of six years (dmft) or (dmfs). These indices are still widely used as measures of the outcome of dental program (Klein *et al* 1938 cited by Institute of Dentistry, University of Oulu 2002).

Dental caries and periodontal disease have historically been considered the most important global oral health burdens. Dental caries is still a major health problem in most industrialized countries as it affects 60–90% of school-aged children and the vast majority of adults (Petersen 2005a).

According to the Global Oral Health Databank (WHO 2004), the distribution and severity of dental caries vary in different parts of the world and within the same region or country. Dental caries experience in children is relatively high in the Americas (DMFT =3.0) and in the European Region (DMFT =2.6) whereas the index is lower in most African countries (DMFT =1.7). Figure 1.1 illustrates the time trends in dental caries experience of 12-year-olds children in developing and developed countries. In most developing countries, the levels of dental caries were low until recent years but prevalence rates of dental caries and dental caries experience are now tending to increase. This is largely due to the increasing consumption of sugars and inadequate exposure to fluorides. In contrast, a decline in caries has been observed in most industrialized countries over the past 20 years or so. This pattern was the result of a number of public health measures, including effective use of fluorides, together with changing living conditions, lifestyles and improved self-care practices. However, it

must be emphasized that dental caries as a disease of children has not been eradicated, but only controlled to a certain degree.

**Figure 1.1:** Trend of DMFT among 12-year-olds in developed and developing countries



In analysis of the severity of dental caries in primary dentition, WHO has suggested to use the dmft of 6-year-olds children as the standard value for analysis and comparison as it has the highest occurrence of carious lesions in primary dentition. In permanent dentition, the DMFT of 12-year-olds children is set as the standard value as it is the time where all permanent teeth, excluding the third molars, are present in the oral cavity.

A joint working group composed of the Federation Dentaire Internationale (FDI), the International Association for Dental Research (IADR), and WHO developed new goals for oral health by the year 2020 as follows (Hobdell, *et al* 2003):

### Goals

1. To minimize the impact of diseases of oral and craniofacial origin on health and psychosocial development, giving emphasis to promoting oral health and reducing oral disease among populations with the greatest burden of such conditions and diseases.
2. To minimize the impact of diseases of oral and craniofacial manifestations of systemic diseases on individuals and society, and to use these manifestations for early diagnosis, preventions and effective management of systemic diseases.

**Targets:** By the year 2020 the following will have been achieved over baseline: (out of the 16 targets, some are presented here)

### 9. Dental caries

1. To increase the proportion of caries free 6-year-olds by X%
2. To reduce the DMFT index particularly the D component at age 12-year-olds by X%, with special attention to high-risk groups within populations, utilizing both distributions and means
3. To reduce the number of tooth extracted due to dental caries at ages 18, 35-44, and 65-74 years by X%.

### 14. Tooth loss

1. To reduce the number of edentulous persons by X% at ages 35-44, and 65-74 years
2. To increase the number of natural teeth persons by X% at ages 18, 35-44, and 65-74 years
3. To increase the number of individuals with functional dentitions (21 or more natural teeth) by X% at ages 18, 35-44, and 65-74 years.

The present goals are differ significantly from those of 1981 in a number of ways, for instance; they are general because their purpose is to facilitate regional, national, local oral health policy development and activities; no absolute values are given, as these have to be established on the basis of local circumstances.

According to the 5<sup>th</sup> Thailand National Oral Health Survey (Dental Health Division 2001), Thai oral health statuses compared with goals are in table 1.1 as below

**Table 1.1: National Oral Health Survey of Thailand compared with Global Goal and National Goal of Thailand in 2000**

Age	Goal	Global Goal 2000	National Goal 2000	Survey			
				1984	1989	1994	2000-01
5-6 yrs.	% caries free	50	30	25.6	17.2	14.7	12.5
12 yrs.	DMFT $\leq$	3	1.5	1.5	1.5	1.6	1.6
18 yrs.	% who retain all their teeth $\geq$ 28 teeth	85	75	65.0	79.0	66.5	71.4
35-44 yrs.	% who retain all their teeth $\geq$ 20 teeth	-	95	92.7	91.7	91.9	92.3

From the report of WHO Oral Health Databank (WHO 2002) in 1980, DMFT values were available for 107 of 173 countries, of these, 51% had 3 DMFT or less, while the remaining 49% had the higher values. In the year 2000, data were available for 184

countries as record in WHO oral health Country/Area Profile Program, of these, 68% had less than 3 DMFT.

According to the data of the Global Oral Databank, DMFT for 12 year-olds of some countries in SEARO (WHO 2004) are in the table 1.2 as below

**Table 1.2:** DMFT for 12 year-olds in SEARO countries

Country	DMFT	Year
Bangladesh	1.5	1981
	1.4	1984
	1.0	2000
Bhutan	1.4	1985
India	0.86	1993
Indonesia	0.7	1970
	2.3	1980
	2.7	1990
	2.2	1995
Korea, Democratic P R of	3.0	1991
Maldives	2.1	1984
Mongolia	1.4	1976
	2.6	1990
	1.9	1997
Myanmar	1.1	1991
	1.1	1993
Nepal	0.5-2.1	1984-86
	1.2	1994
	1.1	1999-00
Sri Lanka	1.9	1983-84
	1.4	1994-95
Thailand	0.4	1960
	2.9	1977
	1.5	1989
	1.6	1994
	1.6	2000-01

From Thailand National Oral Health Survey and data available in Dental Health Division ( Dental Health Division 2001) and WHO, oral disease prevalence in Thailand is as follow:

**Table 1.3:** dmft and DMFT index and their components in each age group of Thai

Age group	% affected	dmft	d	m	f	Year
3 years	65.7	3.61	3.49	0.07	0.05	2000-01
5-6 years	87.4	5.97	5.53	0.30	0.14	2000-01

Age group	% affected	DMFT	D	M	F	Year
12 years	57.3	1.64	1.14	0.07	0.43	2000-01
15 years	62.1	2.11	1.45	0.13	0.54	2000-01
18 years	63.7	2.4	1.4	0.4	0.6	1994
35-44years	85.6	6.13	1.89	3.55	0.69	2000-01
60-74 years	85.6	14.37	2.08	12.20	0.09	2000-01
65+years	95.0	15.8	1.8	13.9	0.1	1994

The results from Thailand National Oral Health Survey showed that dental caries distribution and severity among children were still high. At age 3, and 5-6 years, the decayed component (d) of 3.49, and 5.53 are 96.68, and 92.63 percentage of the total dmft respectively. At age 12 years, the decayed component (D) of 1.14 is 69.51 percentage of the total DMFT. In conclusion, the decayed components of children were a majority part of DMFT (dmft).

Dental care for Thai youth has during the past decades been based on and directed towards prevention. In previous years, dental caries was a dominating problem for children. Both children and adolescents have suffered from advanced caries disease. Caries can be viewed as an infectious disease and mutans streptococci are considered to be important bacteria for its development. The time of contamination is of a certain importance, as the later child is infected, the less caries lesions develop in early childhood and later on. Dietary habits have shown to be of importance for caries development, but the frequency of tooth brushing was more related to caries than were dietary in some studies.

Most oral diseases are closely related to unhealthy environments, lifestyles that include diets rich in sugars, widespread use of tobacco, and consumption of alcohol and are also dependent on clean water, adequate sanitation, proper oral hygiene and appropriate exposure to fluorides. Oral disease control and public health need to take integrated approaches to health promotion and disease prevention based on common risk factors. Mandates which are particularly important for WHO and the work of the Oral Health Program are: Global Strategy on Prevention and Control of Non-communicable Diseases; Global Strategy on Diet, Physical Activity and Health; Health Promotion and Healthy Lifestyles; Cancer Prevention and Control; International Plan of Action on Ageing, and Promotion of healthy lifestyles. These World Health Assembly Resolutions provide a supporting framework for Resolutions specific to Oral Health.

National programs which include measures at individual, professional and community levels are effective in preventing most oral diseases (Cohen & Gift 1995 cited by Peterson, Estupinan-Day & Ndiaye 2005). Worldwide emphasis on health promotion and primary prevention of oral diseases is insufficient in developing countries and those with economies and health systems in transition face considerable challenges to provide universally accessible or affordable intervention and care (Peterson, Estupinan-Day & Ndiaye 2005).

WHO has identified priority action areas for countries to consider when initiating or strengthening national oral health program as follows:

- effective use of fluorides for prevention of dental caries: the goal is to implement appropriate means of maintaining a constant low level of fluoride in as many mouths as possible through fluoridated drinking-water, salt, milk or affordable toothpaste (Petersen & Lennon 2004 quoted in Petersen, Estupinan-Day & Ndiaye 2005)
- oral health promotion and prevention of oral disease through a healthy diet, i.e. advocacy for reduced consumption of sugars and increased intake of fruits and vegetables (Moynihan & Petersen 2004 quoted in Petersen, Estupinan-Day & Ndiaye 2005)
- control of tobacco-related oral disease by involving oral health professionals in tobacco cessation and preventing children and youth from adopting the tobacco habit (Petersen 2003 quoted in Petersen, Estupinan-Day & Ndiaye 2005)
- oral health through health-promoting schools (WHO 2003 quoted in Petersen, Estupinan-Day & Ndiaye 2005), based on the WHO School Health Initiative
- oral health improvement among elderly people (Petersen & Yamamoto 2005 quoted in Petersen, Estupinan-Day & Ndiaye 2005) through health promotion and aged-friendly primary health care
- integration of oral health into national and community health programs based on oral health– general health–quality of life interrelationships
- development of oral health systems and orientation of services towards prevention and health promotion
- strengthening the prevention of HIV/AIDS-related oral disease, particularly in developing countries (Petersen 2004 quoted in Petersen, Estupinan-Day & Ndiaye 2005 )
- development of oral health information systems: evidence for oral health policy, formulation of goals and targets (Hobdell *et al.* 2003, WHO 1999 quoted in Petersen, Estupinan-Day & Ndiaye 2005) and measuring progress (Peterson & Kwan 2004 quoted in Petersen, Estupinan-Day & Ndiaye 2005)
- research for oral health, oriented towards bridging the gaps in research between developed and developing countries (Peterson 2005 quoted in Petersen, Estupinan-Day & Ndiaye 2005)

The guiding principles for oral health promotion and disease prevention are implemented through WHO regional offices and country programs. The Pan American Health Organization (PAHO) Oral Health Program has used information on dental caries to classify countries and to tailor its regional strategy to three groups: “emergent” (most needy), “growth” and “consolidation”, with programs for each. The PAHO strategy and action plan for oral health 2005–2015 stresses development of policies in oral health services and stronger coordination with WHO’s work for primary health care and accomplishment of the Millennium Development Goals.

Although dental caries is not a life-threatening disease; they can relate to other diseases, for instance; cardiovascular disease (bacterial endocarditis), diabetes mellitus, osteoporosis, chronic obstructive pulmonary disease (COPD), and nasocomial pneumonia. Everyone should therefore aware of and protect themselves from this disease. The high prevalence of carious lesions in chewing (occlusal) surfaces and proximal (smooth) surfaces of both primary and permanent teeth has been documented

in many reports. Fluoride is particularly effective in reducing the incidence of dental caries in the smooth surfaces of teeth but less effective on chewing surface. Pit and fissure sealant is a suitable preventive program to protect occlusal caries surfaces; it is less effective in smooth surfaces. Therefore, the combined uses of fluoride and pit and fissure sealant are significant advances in preventive dentistry.

The high and ever-rising costs of health care in Thailand and throughout the nations of the world are justifiably of great concern. Clearly, if optimal preventive care is going to reach as many people as possible, the cost-effectiveness of individual preventive procedures must be addressed.

In 2004, there are 8,070 dentists in Thailand or 1: 7,811 (number of dentist per population) (Thai Dental Council 2004). The supply projection of dentist in 2010 is 8,840 but the requirement for dentist projected by population ratio (1:5000) in 2010 is 9,054 (Punyasingh , Udompanich , & Lexomboon 1997). It is impossible for the dental profession to do the tremendous task of oral health problems. Consequently, oral preventive cares were needed.

In times of scarce resources within the health care sector, it will be of great importance to select the best preventive strategy with the fewest resources needed. The preventive program is suitable for young-aged group; all children should participate in the preventive program and obtain primary prevention of dental caries. In Thailand, caries prevention has focused on oral hygiene and different forms of administration of preventive programs.

Primary prevention protects individuals against disease, often by placing barriers between the etiological agent and the host. It is aimed at keeping a population healthy to minimize the risk of disease or injury. In the context of this guideline, primary prevention is about keeping children's teeth free from dental caries.

Not only supervise the clinical dental practice to dental students, the Faculty of Dentistry, Mahidol University is also required to train their students in the principles of oral preventive care and expose them to community-based programs where the principles can be applied. Therefore, Department of Community Dentistry, Mahidol University set one subject "DTCM 501 Dental Clinic Practice: Community Dentistry" in order to offer knowledge and skill for solving oral problem; dental caries and gum disease of school-children as well as the dental students can plan and practice in oral health promotion in school suitably. For this purpose, Mahidol University acquired schools in Bangkok around the Faculty of Dentistry, where dental students could be exposed to these programs.

The preventive oral health program, subject DTCM 501, is offered to the fifth year dental students of Mahidol University. This program provides preventive oral health cares to the students at public primary schools in Bangkok that their parents allow taking part in this program. The oral preventive cares in this program consist of oral health education, pit and fissure sealant, fluoride application, and preventive resin restoration.

This study mainly analyzes the total cost in provider perspective and effectiveness associated with a school-based oral health preventive program to a group of children in

public schools in Bangkok. It is hoped that this study will provide the baseline data and recommendations that might be useful for decision makers for establishing similar programs in other areas.

## **1.2 Research Questions**

### **1.2.1 Primary Research Question**

What is the cost-effectiveness of a school-based oral health preventive program at public primary schools in Bangkok?

### **1.2.2 Secondary Research Questions**

1.2.2.1 Does the school-based oral health preventive program reduce the dental caries?

1.2.2.2 What is the additional cost per additional mean DMFT prevented of school-based oral health preventive program, compared with control group?

1.2.2.3 What are the impacts of input costs on the cost-effectiveness of this program?

## **1.3 Research Objectives**

### **1.3.1 General objective**

To analyze cost-effectiveness of a school-based oral health preventive program at public primary schools in Bangkok

### **1.3.2 Specific objectives**

1.3.2.1 To compare mean DMFT between the group of children participating in the school-based oral health preventive program and the other group of children not participating in this program

1.3.2.2 To analyze the additional cost per additional mean DMFT prevented of oral health preventive program at public primary schools in Bangkok

1.3.2.3 To analyze the impacts of input costs on the cost-effectiveness of this program

## **1.4 Scope of the study**

It is a case study of some public primary schools in Bangkok for cost-effectiveness analysis of an oral health preventive program implemented by dental students of the Faculty of Dentistry, Mahidol University in 1995-2000. Cost and outcome data for implementing this program are secondary data which were collected from patient's records and list of faculty's cost. This study was limited to examining the costs to providers in establishing and operating oral health preventive program.

Furthermore, this study has also determined the additional cost per additional mean DMFT prevented and the incremental cost effectiveness ratio of this program. It tried to



compare the outcome between the group of children participating in the program and the group of children not participating in the oral health preventive program. Besides, it also tried to analyze the impact of input costs on the cost-effectiveness of this program.

### **1.5 Research Hypothesis**

The mean DMFT of children not implemented the school-based oral health preventive program is greater than that of the children implemented this program at 5% level of statistical significance.

### **1.6 Expected Benefit**

This study provides baseline data and information about economic costs of a school-based oral health preventive program at public primary schools and cost-effectiveness analysis of this program in provider perspective. It informs decision maker of other dental schools to do similar community-based program to their dental students. Furthermore, it also informs decision makers of dental health services on the value of introducing a similar program into the public primary school in Bangkok or in rural areas if adapt some factors and know how much does it cost to reduce dental caries to achieve the target.

Similarly, school systems, public officials, parents, and practitioners can use the recommendation for school-based oral health preventive programs as one factor in their decision to start, expand, or modify existing programs in their school districts taken into accounts.

Moreover, the results of the economic evaluations can also be used to help decision makers determine whether school-based oral health preventive program is affordable and wise expenditure that provide the worthwhile benefits of avoiding the often underestimated health consequences of dental caries.