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Preventive Dentistry in Mongolia

Battsetseg Tseveenjav

Academic dissertation

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Abstract

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The current study investigated preventive dentistry in Mongolia by assessing future and practicing dentists' professional preventive practice and knowledge and the oral health outcomes dental professionals achieved for themselves and dentists for their children.

The study was based on a questionnaire survey with cross-sectional and longitudinal designs. Two types of questionnaires were piloted and delivered to the target population: all actively practicing dentists in the capital city, and all clinical-year dental students in 2000 and 2002. In total, 245 dentists (98%), plus 79 students in 2000 (100%) and 73 students in 2002 (96%) responded. In addition, data on 208 children aged 3 to 13 years were reported by their dentist parents. Cross-sectional comparisons of the students' data assessed differences due to time, whereas longitudinal comparisons revealed changes due to professional training in different aspects of prevention.

The respondents' oral hygiene and dietary behaviour as well as utilization of oral health services were assessed by close-ended questions with several alternative answers. Preventive practice, competency, orientation, and knowledge as well as attendance at, self-perceived competency in, and attitude towards continuing education were measured by means of a four- or five-point scale or dichotomy. Dental health was self-reported by tooth in the dentigram provided.

Better knowledge of or more competent self-perception in preventive care was a significant determinant for Mongolian dental professionals' making use of preventive dentistry for themselves, their own children, and patients, and for those Mongolian dentists' engaging in continuing education activity. Dental professionals and dentists' children enjoyed better dental health than did their population counterparts. As regards preventive practice of the dental students concerning their patients, and of the dentists concerning their own children, recommendations or advice on individual-active measures were more frequently given than were professional-active measures. The dental professionals were quite knowledgeable in traditional caries-preventive measures. Minor variation in preventive practice and knowledge occurred in relation to dental professionals' background variables.

It can thus be concluded that preventive dentistry in Mongolia seems to be in its developmental phase. Mongolian dental professionals need to make full use of preventive dentistry in order to benefit themselves, their own children, and patients. This would potentially be reflected as improvement in the oral health of the Mongolian population. For this task, the preventive knowledge that dental professionals possess needs to be improved, especially concerning modern measures of caries prevention. The learning environment should support the use of preventive measures. Behavioural science subjects should be integrated into the basic dental curriculum and continuing education programme, emphasizing social and environmental determinants of oral health behaviour and outcome. The practice of preventive dentistry should be supported at both the administrative and dental educational level to gain more widespread appreciation and adoption of preventive measures at the individual, professional, and community level.

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List of publications

This thesis is based on the following articles referred to in the text by their Roman numerals. In addition, the thesis includes some unpublished data.

- I Tseveenjav B, Vehkalahti M, Murtomaa H. Preventive practice of Mongolian dental students. *European Journal of Dental Education* 2002; 6: 74-78.
- II Tseveenjav B, Vehkalahti M, Murtomaa H. Time and cohort changes in preventive practice among Mongolian dental students. *European Journal of Dental Education* 2003; 7: 177-181.
- III Tseveenjav B, Vehkalahti M, Murtomaa H. Caries-preventive measures applied by Mongolian dentists to their own children. *Oral Health and Preventive Dentistry* 2004; (accepted for publication).
- IV Tseveenjav B, Vehkalahti M, Murtomaa H. Attendance at and self-perceived need for continuing education among Mongolian dentists. *European Journal of Dental Education* 2003; 7: 130-135.
- V Tseveenjav B, Vehkalahti M, Murtomaa H. Oral health and its determinants among Mongolian dentists. *Acta Odontologica Scandinavica* 2004; 62: 1-6.
- VI Tseveenjav B, Vehkalahti M, Murtomaa H. Dental health of dentists' children in Mongolia. *International Journal of Paediatric Dentistry* 2003; 13: 240-245.

Abbreviations

CPM	Caries-preventive measure
CPMs	Caries-preventive measures
CI	Confidence interval
DMFT	Number of decayed, missing, and filled permanent teeth
dmft	Number of decayed, missing, and filled primary teeth
DMFT+dmft	Total number of decayed, missing, and filled permanent and primary teeth
DT	Number of decayed permanent teeth
dt	Number of decayed primary teeth
DT+dt	Total number of decayed permanent and primary teeth
FT	Number of filled permanent teeth
ft	Number of filled primary teeth
FT+ft	Total number of filled permanent and primary teeth
FTP	Fluoridated toothpaste
GDP	General Dental Practitioner
MT	Number of missing permanent teeth
mt	Number of missing primary teeth
MT+mt	Total number of missing permanent and primary teeth
MNMU	Mongolian National Medical University (recently renamed as Health Sciences University of Mongolia)
NHP	National Health Policy
NOHP	National Oral Health Policy
NOHS	National Oral Health Survey
OR	Odds ratio
ROSC	Recommended oral self-care

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1. Introduction

The most common oral problems, caries and periodontal disease, are bacterial in origin, exacerbated by dietary sugars, ineffective plaque removal, and less than optimal fluoride availability (Blinkhorn, 1998). Dental caries afflicts humans of all ages and in all regions of the world and is a disease of the complex interplay of social, behavioural, cultural, dietary, and biological risk factors that are associated with its initiation and progression (Ismail et al., 1997). Regardless of the fact that caries is preventable, its prevalence is high and still increasing in some developing countries, especially among urban children, while its decline has been reported in many industrialised countries during the last three decades (Petersen, 2003). The increase seems to be mainly a consequence of increasing consumption of sugar-containing snacks and soft drinks due to urbanization, combined with insufficient use of fluoride (Sheiham, 1984; Cirino et al., 1998) and inadequate oral hygiene (Bjarnason, 1998).

Dental diseases are not directly life-threatening, but have a detrimental effect on quality of life: having an impact on normal social roles, self-esteem, nutrition, communication, and general health, and causing pain, discomfort, and loss of function. At a society level, treating dental diseases is very costly for health care systems. The costs account for 5% to 10% of total health care expenditure in industrialized countries, exceeding that for treating cardiovascular disease, cancer, and osteoporosis (Sheiham, 2001). Because in developing countries, the cost of traditional curative care of dental diseases would probably exceed the available resources for health care, preventive strategies are clearly more affordable and sustainable (WHO, 2003).

The caries-preventive methods ranked by experts as effective for the caries decline in the industrialised countries are the use of fluoride in various forms, improved oral hygiene, and sensible sugar consumption (Bratthall, 1996). Changes in diagnostic criteria and preventive and curative efforts by dental health services have certainly been parallel factors for the caries decline (Petersen & Torres, 1999). Scandinavian countries, having the highest DMF scores in the world in the 1970s, directed long-standing, highly developed, and generously funded public health programs to control dental caries among children (Burt, 1998) resulting in the lowest scores nowadays.

Mongolia, situated in northern Asia, is completely landlocked between two large neighbours – the Russian Federation and the Republic of China. The country covers 1,566 million square kilometres with a population of 2.7 million (World Fact Book, 2003). Mongolia is ranked by the World Bank (2003) as a low-income country according to gross national income per capita and as moderately indebted based on levels of external debt. The country, after the Mongolian Empire under Chinggis Khan, followed by several powerful states during the 13th to 14th centuries, had been under Chinese rule for centuries and took its independence in 1921 with Soviet assistance. The communist regime ruled until the ex-communist party gradually yielded its monopoly of almost 70 years in power to the Democratic Union Coalition. Since then, a number of reforms were put forward to modernize the economy and democratize the political system. The main economic reforms were liberalised price controls and domestic and

foreign trade, restructuring of the banking and energy systems, and privatisation programs, and the fostering of foreign investment. At the same time, economic pressures due to discontinuation of developmental aid provided by the former Soviet Union, which accounted for 35% of the governmental annual budget, affected various sectors of the society.

Due to the socio-economic reforms since 1990, people's traditional way of living started to change into a new way of living—the “western lifestyle”—especially in urban areas. Consumption of sugar-containing food and soft drinks, and alcohol and smoking increased tremendously, with their negative effects on the population's general and oral health. The unemployment rate reached 20%, and the population living below the poverty line 36% (World Fact Book, 2003).

Previously, the country had a well-structured and staffed health care system, based on centralized specialist clinics accessible to most inhabitants, with some great achievements especially in childhood diseases (Manaseki, 1993). The National Health Policy of Mongolia (NHP) was drafted in the middle of the 1990s, emphasizing the responsibility of individuals for their own health, public and preventive actions for health promotion, management improvement of public health services, and expansion of privatization within the health care system. One of the health care reforms is the establishment of a family doctor system giving priority to the primary health care of the population (Hindle, 1999). The National Oral Health Policy (NOHP, 1997) followed the same priorities set by the NHP and suggested new strategies to promote the oral health of the population.

The health care system and educational system are intimately linked like the pedal and wheels of a bicycle, since trained health care personnel must be competent to perform the defined activities within health services in order to achieve the goals of the health care system (WHO, 1984). Changing socio-economic circumstances and the needs and demands of the Mongolian population require dental professionals to broaden their focus towards a community level, contrasting with their previous practice which had its focus only at an individual level. They need to understand a multitude of socio-economic and behavioural determinants of oral health. This challenge requires the Mongolian dental educational system to put more emphasis than earlier on dental public health, which is defined as the science and practice of preventing oral diseases, promoting oral health, and improving quality of life through the organized efforts of society (Daly et al., 2002). On the other hand, dental schools are in a position significantly to influence professional, public, institutional, and individual adoption of caries-preventive policies. Thus, for Mongolian dental education, there is a challenge to set new goals and strategies in accordance with those stated by the NOHP in order to meet changing needs and demands of the population in changing circumstances.

The present study aimed at determining the role and characteristics of preventive dentistry in Mongolia to provide a constructive contribution to development of preventively orientated oral public health care service, with the ultimate objective of improving the oral health of the population.

2. Literature review

2.1. Preventive dentistry

2.1.1. Prevention and its levels

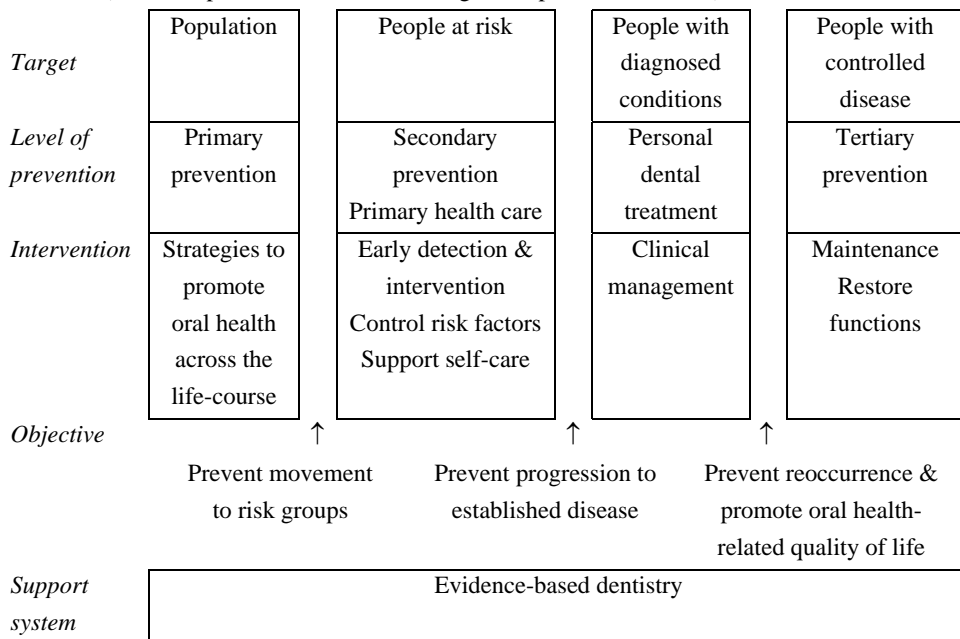
Dentistry as a profession has been relying on a curative approach for nearly a century (Hjorting-Hansen, 1996). Following the obvious decline in caries occurrence in many western industrialized (Downer, 1996; Bratthall et al., 1996; Marthaler, 1996; Petersson & Bratthall, 1996) and Nordic countries (von der Fehr, 1994) and in the USA (Burt, 1994), more knowledge has emerged as to methods of preventing caries lesions (Stookey, 1998; Rozier, 2001).

Dental prevention has been given preference in many countries by legislation (Chen, 1990; Brennan et al., 1998) with substantial resources allocated for it (Wang, 1998), although random use of preventive measures (Telivuo & Murtomaa, 1988; Kärkkäinen et al., 2001), inadequate focusing on prevention (Vehkalahti et al., 1991; Varsio et al., 1999), and predominance of the curative approach (Kelly et al., 2000) have still been reported.

An integrated model for the opportunities for prevention, developed for Australia's chronic disease strategy and adapted to oral health (Figure 1), summarizes levels of prevention and target populations and specific interventions at every level of the approach.

Figure 1: An integrated model of opportunities for prevention of oral diseases

(Source: Spencer, 2003, with S. Karger AG permission, Basel)



Primary prevention refers to actions taken before onset of disease, preventing people from moving into groups at risk. Secondary prevention includes interventions to identify the early onset of disease and to reduce risk factors (Schwarz, 1998). Primary and secondary preventive actions are of the utmost importance for the approach, because they are more affordable than interventions at other levels, and the population, or a significant part of it, benefits (Spencer, 2003). Other levels, with their target populations being people with diagnosed conditions and controlled disease, are also part of the approach: to prevent reoccurrence of disease and promote the oral health-related quality of life. The interventions of the last two levels are relatively expensive.

2.1.2. Strategies in preventive dentistry

Dental prevention, as part of oral health promotion, has an important focus at both the individual and community level (Riordan & Widström, 1984; Walsh, 2000). Preventive strategies are divided into two distinct groups: strategies aimed at the whole population and those aimed at people or individuals at risk (Rose, 1985). A population strategy in dental prevention, which attempts to promote health and control the causes of the incidence of dental disease, seems to be feasible when the prevalence of oral diseases in a population is high (Sheiham & Joffe, 1991). A targeting strategy of people or individuals at risk is advocated in countries with decreased prevalence and skewed distribution of dental caries (Fejerskov, 1995; Pienihäkkinen & Jokela, 2002). The targeting, however, seems to work most efficiently for particular geographic localities rather than individuals, perhaps being something between a population strategy and selection of individuals at risk (Burt, 1998). Targeting individuals at risk seems to fail even in some countries with a skewed distribution of caries, thus suggesting basic prevention for all children (Hausen et al., 2000; Batchelor & Sheiham, 2002). However, total substitution of one strategy by another is not appropriate (Sheiham & Joffe, 1991). Instead, every strategy has its place in public health programs, and efficiency in dental prevention will best be preserved with a mix of all approaches (Burt, 1998).

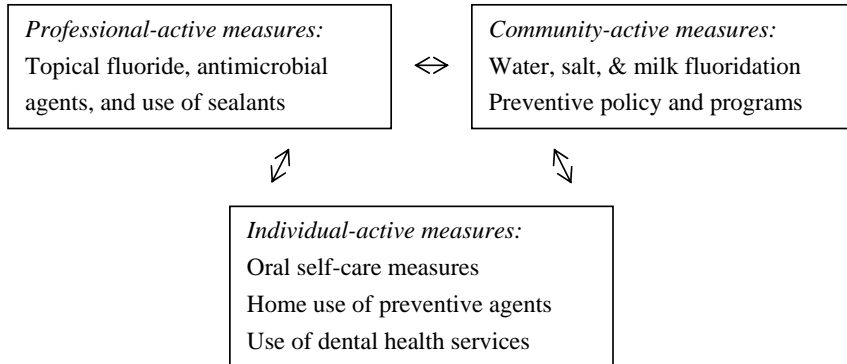
2.1.3. Community-, dental professional-, and individual-active measures

Effective preventive measures in dentistry have been developed and refined (Rozier, 2001), some of them emphasising the role of community and dental professionals and others the patients' own responsibility in managing oral diseases. Based on the role and responsibility of the main decision-maker to carry out preventive measures, these can be called community-, dental professional-, or individual-active (Figure 2).

Community-active measures need approval to be adopted at a nationwide level, to be endorsed (e.g., health policies), and to be funded and carried out (e.g., preventive programmes in different settings such as school-based tooth-brushing and rinsing programmes). For example, water, salt, and milk fluoridation need recommendation by professional organisations and approval by states to be adopted. Therefore, the main decision-maker is a person or organisation that may or may not be affiliated with the dental profession, but holds a position of power. Nevertheless, the dental community and professionals play an important role in bringing to the main decision-maker their

knowledge and evidence of available, efficient, and effective community-active preventive measures.

Figure 2: Preventive measures, based on the main decision-maker, to be applied



Dental professional-active measures are those applied by dentists, hygienists, and dental assistants to individuals on a one-to-one basis, e.g., application of fluoridated (varnish, gels, and rinses) and antimicrobial (chlorhexidine) compounds and placement of sealants, based on an assessment of each individual’s risk, taking into consideration his or her current fluoride exposure. A decision-maker may have standards on how and when to use available preventive measures. Mostly, in any dental team, a dentist is the main decision-maker within the confines of his or her professional license. Individuals and patients are passive recipients of the measures.

Individual-active measures are any kind of oral hygiene measures such as tooth-brushing and interdental cleaning performed by individuals, the home use of fluoridated toothpaste, fluoride compounds, antimicrobial agents, and xylitol, and adoption of sensible use of sugary food. Dental professionals are responsible for providing information on healthy habits for dental well-being and for instructing and motivating individuals in order to modify detrimental behaviours and lifestyles toward oral health and to encourage healthy ones. They thus provide necessary knowledge to facilitate recipients’ making healthy decisions and choices for the benefit of their oral health. Because these measures, however, always require an active role and responsibility from individuals, the main decision-maker here is an individual. In addition, other factors have a strong impact on the individual’s likelihood of practising these measures, factors related to the individual, such as his or her age, gender, or socio-economic class.

Despite the fact that there is one main decision-maker for each set of preventive measures, they require, to some extent, the participation of and interaction between other levels of decision-making. A dental professional is the main promoter of those preventive measures to be adopted at different levels. For example, individuals decide on their own sugar consumption, yet dental professionals should actively provide the necessary knowledge on harmful effects of sugar on the teeth and motivate and instruct

individuals in its sensible use. In addition, if an individual is a child, he or she is subject to the sugar-consumption pattern within his or her family. At the community level, state, government, and international organizations may make regulations concerning sugar policy, may organize or sponsor educational campaigns to increase public knowledge, and may regulate people's choice, making healthy choices easier. At this level, the dental professional's role is to help decision-makers in making an informed decision. Thus, there are factors beyond the individual who is the main decision-maker regarding his or her consumption, and these are in the hands of other decision-makers. This multilevel decision making occurs for each of the preventive measures. Thus, successful prevention needs the active involvement of individuals, families, professionals, communities, and societies as well as international organizations, as does any other oral health promotion activity (Reisine, 1993).

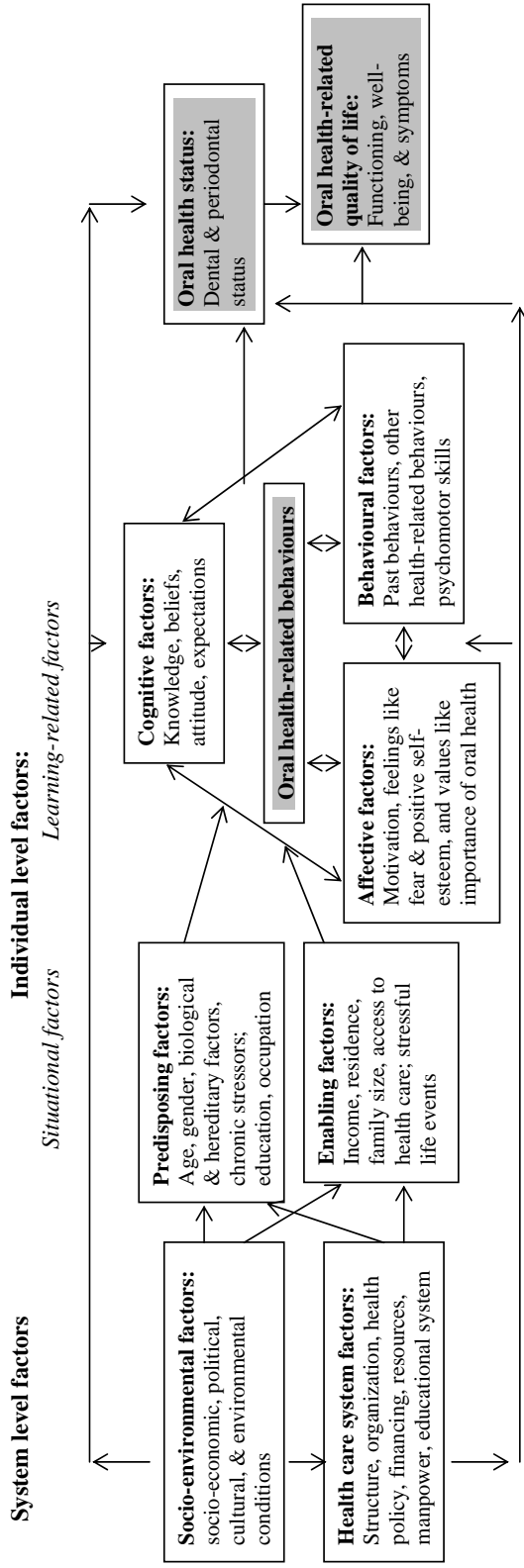
2.1.4. Behavioural aspects of oral diseases

It is well known nowadays that the main oral diseases are strongly related to each individual's lifestyle and oral health-related behaviour. Several theories and models have been developed to explain human behaviour (see for theories & models, Sjøgaard, 1993). Based on previous approaches (Inglehart & Tedesco, 1995; Chen et al., 1997) it can be summarised that oral health-related behaviours and outcomes of individuals are influenced by multiple system- and individual-level factors (Figure 3).

System-level factors are divided into socio-economic and health care-system factors (Chen et al., 1997). These factors, to a great extent, determine the individuals' lifestyle and oral health-related behaviours and outcomes (Petersen, 1990; Locker, 2000; Gillcrist et al., 2001; Diehnelt & Kiyak, 2001; Hjern et al., 2001). Therefore, any exploration of human behaviour needs to take into account the influence of system-level factors (Daly et al., 2002).

At an individual level are situational and learning-related factors (Figure 3) which are to a great extent related to the individual's likelihood of practising health behaviour. The importance of individual-level factors for health behaviour and status is emphasized by numerous studies showing differences in oral health behaviour and status by age, racial and ethnic group, socio-economic status, and education, as well as by gender (Milen et al., 1985; Whittle & Whittle, 1998; Sakki et al., 1998; Irigoyen et al., 1999; Tickle et al., 2000; Paulander et al., 2003). Many theories of human behaviour explain adoption of a new behaviour (see for review Sjøgaard, 1986) and suggest that proper oral health habits are developed through the traditional K-A-B (knowledge-attitude-behaviour) chain. They emphasize that possessing scientifically supported knowledge and understanding is the common cardinal first step in behaviour change (Park et al., 2004). On the other hand, components of this chain are in continuous interaction with each other. Therefore, learning-related factors such as cognitive, affective, and behavioural aspects of human behaviour and their interaction need to be seen as a product of an ongoing process rather than a reflection of fixed internal entities and considered in any oral health promotion activity (Sjøgaard, 1986; Inglehart & Tedesco, 1995).

Figure 3: Theoretical model explaining oral health-related behaviours and oral health status based on the Second International Collaborative Study model (Chen et al., 1997) and a New Century Model of Oral Health Promotion (Inglehart & Tedesco, 1995)



Children's health-related attitude and behaviours are taught and adopted at home and are modelled on the parental and family example. This process is called primary socialization. Later, these attitude and behaviours are influenced by their teachers, friends, and peers, and shaped and formalized in a community-based network when children become socialized; this process is called secondary socialization (Honkala, 1993). When a child's adopted norms within a family differ greatly from those adopted in a school, he or she faces difficulty, resulting in what is called "cultural clash" (Freeman, 1999). An example of this cultural clash has been reported among dentists' children during secondary socialization. In adulthood, psycho-social factors serve to sustain pressure on individuals which affects their dental health. This process, called tertiary socialization, does not necessarily occur in the order of things, but may be imposed upon the individual by outside agencies. Freeman (1999) proposed that three aspects of tertiary socialization exist: 1) influence of dental health education, 2) process of professionalization, and 3) influence of social norms. For instance, change in the oral health-related attitude and behaviour of preclinical dental students compared to those in later years.

Four distinct oral health behaviours: use of fluoridated toothpaste, oral hygiene practices, dietary habits, and utilization of oral health services, are of value in controlling oral diseases (Honkala, 1993). Fluoridated toothpaste has been considered by experts as the main reason for the caries decline seen in industrialized countries (Bratthall et al., 1996) and as the entire reason for the continuous decrease in caries in many non-fluoridated areas of Europe (König, 1993). Unless in combination with the use of fluoridated toothpaste, from a public health perspective, mechanical removal of dental plaque alone is not of significant value in reducing dental caries on a population basis (Frazier, 1980), but is highly effective against gingivitis. However, in the sense that plaque removal is necessary to yield the optimum effect from fluoride, improved oral hygiene and fluoride have a synergistic effect against tooth decay (Rólla et al., 1991). After the caries decline in developed countries, a number of studies have reported little, weak or no correlation between caries experience and total amount of sugar intake (Burt et al., 1988; Klock et al., 1989; Lachapelle et al., 1990; Woodward & Walker, 1994), explaining that where people are exposed to various forms of fluoride, sugar is ceasing to be the most important determinant. A review of longitudinal studies concluded, however, that the correlation is still evident in societies that make use of prevention (Marthaler, 1990). In those countries where fluoride use is not widespread, in the absence of proper oral health promotion, an increase in sugar consumption has a significant detrimental effect on dental health (Irigoyen & Szpunar, 1994; Woodward & Walker, 1994; Ismail et al., 1997). Utilization of oral health services does not become an automatic behaviour, as the other three behaviours do. However, the custom of regular dental check-ups can be established (Honkala, 1993), based on dental professionals' recommendations: every six months or two years (Sheiham, 1984; Elderton, 1985) or an interval adjusted to the needs of the individual patient (National Board Health, 1985).

2.2. Evidence of effectiveness of prevention

2.2.1. Evidence of effectiveness of caries-preventive measures

2.2.1.1. Community-active measures

Since the 1940s, optimizing fluoride levels in the water supply has become an ideal population-based measure in many ways because it is effective and relatively inexpensive, and does not require conscious daily cooperation from individuals (American Association of Paediatric Dentistry, 2001). The effectiveness of *water fluoridation* has been documented by observational and interventional studies for over 50 years (Lamberg et al., 1997). In the 1940s, water fluoridation produced about 60% of the caries reduction in children compared to caries in those living in non-fluoridated communities. Later, caries reduction of 40% to 49% for the primary dentition and 50% to 59% for the permanent dentition was reported, based on 113 studies from 23 countries, as an effect of water fluoridation (Murray, 1993). Thus, caries reduction due to water fluoridation is not any greater than that observed in the 1940s, in those countries where people are exposed sufficiently to various other forms of fluoride. Even fluoridation discontinuation has no dramatic effects on the dental health of children and adolescents (Forss, 1999; Seppä et al., 2000). In the USA, children being continuously exposed to fluoridated water had mean DMFS scores about 18% lower than those who had never lived in fluoridated communities (Brunelle & Carlos, 1990). *Salt fluoridation* was evaluated as equivalent to water fluoridation, based on existing evidence, producing caries reductions of 36% to 79% (Künzel, 1993; Hescot et al., 1995; Stephen et al., 1999). Salt fluoridation is authorized in Switzerland (1955), France (1986), Costa Rica (1987), Jamaica (1987), and Germany (1991) on a nationwide scale (Brambilla, 2001; Marthaler, 2003). *Milk fluoridation* is another possible community-based and effective vehicle of fluoride for caries prevention (Künzel, 1993; Brambilla, 2001) and is experimented in Scotland, Chile, Hungary, China, and Bulgaria with caries reductions of 18% to 63%. But it is not considered as good a measure as fluoridated water and salt, because of problems of consistent delivery (Davies, 2003). Reduction in caries prevalence in the permanent dentition was reported as 37% among Hungarian children after 10 years of fluoridated milk consumption (Gyurkovics et al., 1992). In the primary dentition, a lower caries increment was seen among test children than among controls after 21 months of fluoridated milk consumption in China (Bian et al., 2003). The main advantage of salt and milk fluoridation is that they give individuals the freedom of consumer's choice. Fluoridation of sugar and beverages, as well as fluoride-rich mineral water are likely to be of limited importance for caries prevention on a population basis, but may be effective on an individual basis (Künzel, 1993; Mulyani & McIntyre, 2002).

2.2.1.2. Dental professional-active measures

Fluoride varnishes are widely adopted as a caries preventive measure in Europe, and their use is increasing worldwide (Donly, 2003). Fluoride varnishes effectively inhibit demineralization, resulting in a caries reduction of 50% to 70% in fissures and 24% in proximal surfaces (Seppä et al., 1995; Beltran-Aguilar et al., 2000). Fluoride varnish may be optimal in the respect that it prolongs the duration of fluoride intake in the enamel, being equally effective for both the permanent and primary dentition (Table 1).

Table 1: Evidence of dental professional-active measures (summarized from: Davies, 2003)

Preventive measures	Recommendation	Effectiveness in caries reduction	Strength of evidence
Fluoride varnish	Twice yearly application for children and adolescents at high caries risk	33% in primary and 35% in permanent dentition	Cochrane review and meta-analysis of RCTs
	Application for adults at high risk	Lower root caries increment	RCT
Fluoride gels	Gel containing 12 300 ppm fluoride for 5 minutes up to four times a year for individuals at high caries risk	22% - 28% in permanent dentition of children and adolescents; Reduced new root caries in adults	Meta-analysis from 17 studies and Cochrane review; No evidence for primary dentition
Chlorhexidine	Gels	47% for gels	Meta-analysis
Fissure sealant	Occlusal caries of the permanent molars for children at high risk	71% for autopolymerizing & 46% for light-cured resin	Traditional & systematic reviews, a meta-analysis

The caries-preventive effect of acidulated phosphate *fluoride gel* has been clinically documented (Wei & Yiu, 1993), and its effectiveness for caries reduction is reported as 33% for the primary and 35% for the permanent dentition (Table 1). Marinho et al. (2003) estimated the magnitude of the effect as a 21% (95% CI 14-28) reduction in DMFS, based on a review of 14 placebo-controlled trials. Evidence of effectiveness of the use of professionally applied topical fluorides at an individual level is strong (Schuller & Kalsbeek, 2003).

Antimicrobial agents such as chlorhexidine have been shown to be effective for caries-susceptible subjects and expectant mothers, with heavily colonized mutans streptococci (Marsh, 1993; Jokela, 1997; Thorild et al., 2003). Chlorhexidine gels had a 47% caries-reduction effect, as shown in a recent review (Table 1). Topical iodine is approved by the Federal Drug Administration in the USA for skin and mucosal application in children. Its use in the prevention of early childhood caries showed that 91% of those who received treatment were disease-free compared to controls (Lopez et al., 2002). *Pit and fissure sealants* are safe and effective (Simonsen, 2002) but expensive; targeting children at moderate or high risk is emerging as the desirable strategy for such programmes (Kumar & Wadhawan, 2002). However, the cost of sealant delivery varies

by community and by setting, and its cost effectiveness is influenced by annual caries increment, sealant failure rate, annual filling failure rate, and sensitivity and specificity of screening to predict future caries development of individuals for the sealant program (Griffin et al., 2002). Davies (2003) (Table 1) reported 71% and Ripa (1993) 66% of teeth treated with pit and fissure sealants of the second generation (auto-polymerized) being fully protected from dental decay, although a recent review concluded that there remains a need for further studies of high quality regarding their effectiveness, particularly in child populations with a low and a high-caries risk, (Mej re et al., 2003). The evidence as to the effectiveness of dental professional-active measures for caries prevention in children and adolescents also seems relatively strong, but few studies have been conducted in adults and the elderly (Davies, 2003), their indication being directed mostly to individuals with moderate or high caries activity.

2.2.1.3. Individual-active measures

The use of *fluoridated toothpaste* (FTP) should be recommended as a primary preventive measure for children, and its effect has long ago been established (Marthaler, 1971), although long-term studies in age groups other than children and adolescents are still lacking (Twetman et al., 2003). According to the review by Davies (2003), evidence is strong on FTP and other individual-active measures as effective for the permanent dentition of children and adolescents (Table 2). The use of FTP is close to an ideal public health measure, since its use is convenient, inexpensive, culturally approved, and widespread (Burt, 1998).

Fluoride supplements, a systemic administration of fluoride, became very popular in Europe in the 1950s and 60s. But from the 1980s onwards, fluoride supplements gradually lost their importance due to increasing evidence of the topical effect of fluoride on tooth surfaces being the most important (Zimmer et al., 2003). Nowadays, most of the European dental associations no longer recommend the use of fluoridated supplements as a standard procedure, but its use may be recommended at an individual level where people are not exposed to various forms of fluoride. Fluoride supplements are effective for the primary and permanent dentition of children and adolescents as well as for root caries (Stephen, 1993). The effectiveness of fluoride supplements seems to depend on and vary according to the compliance rates of both parents and children. Delivery of the supplements via schools has produced benefits as low as 20% to 24% and as high as over 80% (Stephen, 1993).

The cariostatic efficacy of *fluoride rinses* with neutral sodium fluoride solutions has been clearly demonstrated, especially in supervised school-based programmes (Petersson, 1993). The average efficacy of fluoride rinses in caries reduction has been reported as between 20% and 50% (FDI Commission, 2002a) and as 30% (Table 2). Despite the cost-benefit effect of fluoride rinses being questionable in populations with low caries prevalence, with rinsing programmes being gradually replaced by more individual fluoride therapy (Petersson, 1993), they are highly effective as a population strategy when the prevalence of caries is high (Burt, 1998).

Table 2: Evidence on fluoridated toothpaste and other individual-active measures for caries prevention (summarized from: Davies, 2003)

Caries preventive measures	Recommendation	Effectiveness in caries reduction	Strength of evidence
Fluoridated toothpaste:			
<i>Frequency of use</i>	Brushing twice a day with fluoridated toothpaste	24% in permanent dentition of children and adolescents	Cochrane review
		37% in primary dentition	Limited to one study
<i>Fluoride concentration</i>	Advice based on child's caries risk, other sources of fluoride, and age.	6% reduction for every increase of 500 ppm	Numerous clinical trials in children
	Adults at high risk use toothpaste containing 1500 ppm fluoride or more		Few studies in adults
<i>Rinsing behaviour</i>	Not to rinse with a large volume of water		Few clinical trials
<i>Time of day</i>	Brush with fluoridated toothpaste as last thing in the evening & one other occasion		Few studies
Fluoride supplements	If compliance can be assured, appropriate for children at high risk		Traditional & systematic reviews and several follow-ups
Fluoride rinses	Daily use of 0.05% (230 ppm) sodium fluoride and weekly use of 0.2% (920 ppm) for children over 6 years at high caries risk and for adults	30% in permanent dentition of children and adolescents	Traditional review and clinical trials
Chlorhexidine	Rinses and gels	46% for rinses & gels	Systematic review

The effectiveness of *chlorhexidine* rinses and gels for individual-active use is reported to be similar to that for professional-active use (Table 2). *Slow-release fluoride devices* were developed to supply fluoride intra-orally over a period of at least one year. Use of these devices is recommended for those at high-caries risk and for notoriously bad dental attendees with very poor oral hygiene and motivation (Toumba, 2001).

Restriction of sugar consumption is another individual-active measure for caries prevention. A wealth of evidence from various types of studies in vivo and in vitro shows the aetiological role of dietary sugar in initiation and progression of dental caries; universally, its role is accepted (Gustafsson et al., 1954; Scheinin et al., 1976, Burt & Szpunar, 1994; WHO, 2003). The frequency of sugar intake between main meals seems to be more important than the total amount consumed, according to some interventional and longitudinal studies (Gustafsson et al., 1954; Holt, 1991; Holbrook et al., 1995), though the evidence is not very strong. This seems to be due to a limited number of studies because of difficulties of placing groups of people on rigid dietary regimes for a long period of time. In addition, frequency versus total amount of sugar is difficult to evaluate since there is a direct relationship between these two variables (Sheiham, 2001). Based upon available evidence, recommendations concerning sugar consumption are to reduce frequency and amount and to consume it during mealtimes when possible (Daly et al., 2002).

The Turku Sugar Study in Finland (Scheinin et al., 1976) has shown that the total dietary substitution of sucrose with sugar substitute (xylitol) resulted in a 85% reduction in dental caries over a 2-year period. *Xylitol*, a naturally occurring sugar substitute, has anticariogenic properties and reduces *Streptococcus mutans* levels in saliva and plaque (Lynch & Milgrom, 2003) and transmission of *Streptococcus mutans* from mothers to children (Peldyak & Mäkinen, 2002). There is a lowered cariogenic challenge among Finnish and Swiss children due in part to the widespread use of sugar substitutes such as xylitol (Isokangas, 1987; Imfeld, 1993), although its use is limited due to its low versatility and high cost (Burt, 1993) among others. A review which included studies from 1966 to 2001 on sugar substitutes found consistent reduction of 30% to 60% in caries among subjects using substitutes compared to controls (Hayes, 2001), though another recent review suggested that evidence for the use of sorbitol or xylitol in chewing gum, or for the use of invert sugar (hydrolysed sucrose), is inconclusive (Lingström et al., 2003). Intense or non-caloric sweeteners are widespread, and their main commercial success is based on weight control and by those with diabetes (Imfeld, 1993).

2.2.2. Evidence of effectiveness of preventive measures of periodontal diseases

Periodontal diseases are initiated by bacteria in dental plaque and its metabolic products, although an individual's susceptibility to periodontal diseases is influenced by a number of genetic, environmental, and behavioural factors. Gingivitis may be widespread among populations, and moderate levels of attachment loss are prevalent among the middle-aged and elderly. Severe forms of periodontal disease occur in a few teeth in 8% to 15% of the population in any given age cohort, increasing with age

(Locker et al, 1998). They are not, however, the major cause of tooth loss after age 40, as was previously believed (Burt, 1994; Pilot, 1998).

Periodontal disease can be minimized by effective plaque control, the most important aetiological factor for periodontal health. Evidence exists as to mechanical, chemical, and professional preventive measures in reducing and controlling dental plaque.

2.2.2.1. Community-active measures

Traditionally, dental professionals concentrated on a high-risk preventive strategy that is very expensive, but the most significant means of preventing periodontal disease will be *community-active preventive measures* aimed at providing and increasing public knowledge of periodontal diseases and their prevention and reducing overall plaque and smoking rates (Daly et al., 2002). Such activities could be educational campaigns through the mass and print media as well as school-based and supervised tooth-brushing programs, encouragement of smoking-free public places, and taxation policy for importing and selling cigarette and tobacco products. People are more informed than earlier through the mass media on the importance of oral health. For example, the print media (84%), followed by private dental practitioners (65%), was the most highly rated source of information for preventive behaviours among Australians (Roberts-Thomson & Spencer, 1999).

2.2.2.2. Dental professional-active measures

Professional active-preventive measures against periodontal diseases can be achieved through mechanical and chemical control. *Debridement or scaling*, professional mechanical removal of plaque, calculus, and other deposits, effectively prevents the occurrence of gingivitis, reduces probing pocket depth and improves the clinical attachment level (Van der Weijden & Timmerman, 2002). This procedure is offered to individuals in dental settings and requires skilled personnel, and therefore it is inherently time-consuming, difficult, and expensive (Davies, 2003). In an extensive review of relevant clinical trials on effectiveness of professional debridement, average reductions in pocket depth were 0.03 to 2.2 mm, with 0.34 to 1.2 mm in non-molar sites, yet these studies were conducted by highly proficient clinicians with no time constraints (Table 3). A systematic review (Tunkel et al., 2002) of the data available on controlled clinical trials suggests that there is no difference between ultrasonic or sonic and manual debridement in the treatment of chronic periodontitis for single-rooted teeth, though the evidence was not very strong. Another review on the effect of periodic subgingival scaling compared with supragingival prophylaxis with respect to clinical outcomes showed that, as non-surgical treatment, these measures were comparable at 12 months (Heasman et al., 2002).

Table 3: Evidence on preventive measures of periodontal disease (summarized from: Davies, 2003)

Preventive measures for periodontal disease	Recommendation	Strength of evidence
Oral hygiene measures		
<i>Frequency of brushing</i>	Brushing twice a day to maintain gingival health	Traditional reviews of the literature
<i>Brushing duration and technique</i>	No particular method better than any other. Emphasize systematic approach to reach all tooth surfaces to maximize plaque control	Several RCTs
<i>Manual toothbrush</i>	Use a small-headed brush with soft, round-ended filaments, a compact, angled arrangement of long and short filaments, and comfortable handle	Traditional and Cochrane reviews
<i>Powered toothbrushes</i>	Use ones with oscillating/rotating movement	Traditional review and expert opinion
<i>Interdental aids (floss/tape, interdental brushes and toothpicks)</i>	Use based on size of interproximal spaces, tooth position and alignment, gingival contour and pocket depth and patient's ability and motivation	
Chemical measures		
<i>Toothpaste</i>	Toothpaste containing broad-spectrum anti-bacterial agent triclosan and copolymer for individuals at high risk	RCTs
<i>Mouthrinses</i>	10 ml of 0.2% or 15 ml of 0.12% chlorhexidine for supragingival plaque control	Traditional reviews of clinical trials
<i>Professional removal of subgingival plaque & deposits</i>	Subgingival scaling for adolescents at high risk and adults at both low and high risk for periodontal disease. Frequency based on individual needs.	Clinical trials

Antimicrobial agents are demonstrated to have lasting efficacy, and they access hard-to-reach areas and reduce supragingival plaque and gingivitis (Sreenivasan & Gaffar, 2002; Santos, 2003). The use of antimicrobial agents associated with mechanical tooth

cleaning is shown to be more beneficial than is the utilization of the agents alone (FDI Commission, 2002b). Antibacterial agent-containing toothpaste seems effective for individuals at high risk of developing periodontal disease (Table 3). Locally delivered, controlled release of an antimicrobial agent such as subgingival chlorhexidine chips is reported to be a clinically safe and effective treatment option, reducing probing depth for long-term management of chronic periodontitis and improving the amount of bone gain during guided tissue regeneration procedures (Reddy et al., 2003; Soskolne et al., 2003).

Evidence shows that smoking contributes to development of periodontal disease (Reibel, 2003). Dental professionals seem to have the willingness to give advice on *smoking* and on the importance of smoking cessation as regards oral health for their patients. Over two-thirds of EU dentists (Allard, 2000) and 89% of British dentists in the Oxford region (John et al., 2003) reported that dentists should encourage their patients to quit smoking. However, the practice of advice-giving on smoking differed between dentists: current activity regarding smoking was reported by most dentists in Australia (Clover et al., 1999), but by only 37% of the British dentists (John et al., 1997). Among Finnish dentists, 4% always advised and 15% often advised their patients about smoking, and 62% occasionally did so (Telivuo et al., 1991); Finnish periodontists enquired about and advised on smoking significantly more frequently than did the other Finnish dentists (Telivuo et al., 1992). Dentists identified a number of difficulties involved in helping patients to quit smoking (Clover et al., 1999), with lack of time and reimbursement mechanisms being the most often-mentioned difficulties for EU dentists. Dentists confident about their smoking-cessation knowledge frequently advised patients to quit and spent more time counselling on smoking cessation (Albert et al., 2002). A population survey in Finland on smoking found that smokers have less favourable health behaviours and attitudes towards oral health than do non-smokers. Fewer daily smokers than non-smokers considered smoking to have harmful effects on oral health, although the majority of daily smokers wanted to quit. On the other hand, only 8% of daily smokers reported that they had been advised by their dentists to quit.

2.2.2.3. *Individual-active measures*

The most important *individual-active preventive measure of periodontal disease*, plaque control at the individual level, can be achieved through a combination of mechanical and chemical means such as tooth-brushing, interdental cleaning, and rinsing with antimicrobial agents (Ciancio, 2003; Ower, 2003). These, as individual-active measures, require constant advice and reinforcement from dental professionals. Axelsson et al. (1991) concluded from their 15-year longitudinal study in adults that self-performed oral hygiene and professional tooth cleaning, when needed, effectively prevents recurrence of periodontal disease. *Tooth-brushing* is the oldest, most effective, and most commonly accepted means of mechanical removal of dental plaque. The recommended frequency is twice a day, preferably after breakfast and before bed. From the periodontal point of view, powered brushes that worked with a rotation oscillation action remove more plaque than do manual brushes in the short and long term, yet manual ones are more affordable (Table 3; Heanue et al., 2003). Length of time spent on

brushing has been shown to be more closely related to effectiveness of plaque removal than is frequency (Honkala et al., 1986). Because tooth-brushing does not, however, clean proximal surfaces effectively, *interdental cleaning* is needed, with various devices as toothpicks, dental floss/tape, and interdental brushes. Although they are recommended by WHO (1987b) and the American Dental Association (1988) at least once a day, the practice is rare and differs between countries, perhaps due to differing cultural norms (Kuusela et al., 1997). Moreover, use of interdental devices is technically more difficult than use of brushes, and demands psychomotor dexterity (Honkala, 1993).

2.3. Prevention among professionals and lay populations

The existing preventive measures have no value unless used appropriately by the public and by the dental profession (Kim, 1998).

2.3.1. Preventive dentistry among professional dental communities

Knowledge on, attitude towards, and practice of preventive dentistry and different preventive measures among dentists and dental auxiliaries have been assessed in several studies (Eijkman & de With, 1980; Bader et al., 1987; Gonzales et al., 1988; Chen, 1990; Chovanec et al., 1990; Gonzales et al., 1991; Lewis & Main, 1996; Main et al., 1997; Moon et al., 1998a). Use and choice of preventive measures by dental practitioners can differ between countries and among individual dentists, with the ultimate common goal of improving oral health. The differences are, perhaps, due to oral health care legislation, acceptance and appreciation of preventive approaches by patients and by the dental community, availability of preventive agents, and work load of restorative care, as well as dentists' location of practice, years in practice, age, and income (Chen, 1990; Helminen et al., 1999; Källestål et al., 1999; Helminen & Vehkalahti, 2003). A gap seems, however, to exist between what is known about preventing oral diseases and what is provided in private practice, public clinics, dental schools, and community-based programs in many countries (Horowitz, 1995).

The role of knowledge has gained recognition, and accurate knowledge is power because it enables individuals, groups, communities, and government agencies to make informed decisions regarding health and prevention of disease. Dental professionals are the ones who transfer the knowledge based on scientific evidence to the public and to the decision-makers of a society (Eijkman & de With, 1980). In general, dentists seem to be knowledgeable in preventive matters (Gonzalez et al., 1988) though some studies have reported their knowledge to be poorer than expected (Eijkman & de With, 1980; Lewis & Main, 1996; Moon et al., 1998b). A large variation exists in dentists' knowledge explained by their socio-demographic characteristics, as well as by age, school of graduation, amount of continuing education, and level of professional reading. Dentists are more knowledgeable in oral hygiene-related measures, but not in use of fluorides (Moon et al., 1998b) and sealants (Lewis & Main, 1996). Among Dutch dentists in the Netherlands, preventive knowledge differs by their year of graduation—with those graduated earlier having less knowledge in preventive matters than do their

more recently graduated counterparts—but not by their type of practice (Eijkman & de With, 1980). Whereas among Korean dentists, the same trend has been evident by year of graduation, public health dentists in Korea are more knowledgeable than are private practitioners (Moon et al., 1998b). In Texas, in the USA, among recently graduated dentists, those who had attended more professional meetings and those with a lower patient-load practised more preventive measures (Chen, 1990). Good knowledge is associated with better practice, yet there also exists a gap between knowledge and practice in some aspects of prevention. For instance, among Ontario dentists in Canada, knowledge on the use of sealants is positively related to its use, but good knowledge about opportunities for the remineralization of enamel lesions with fluoride did not affect their practice, dentists tending to restore enamel lesions (Lewis & Main, 1996). A study evaluating the effects of three modes of education in selected groups of dentists in Michigan, in relation to their knowledge, attitudes, and use of pit and fissure sealants, showed that intervention had significantly enhanced their knowledge, but had little effect upon their attitude towards and use of such measures (Lang et al., 1991).

Prophylaxis and fluoride application are the main focus of prevention in the USA (Anusavice, 1995). Among Minnesota paediatric dentists (Gonzalez et al., 1988), oral hygiene measures are considered the most important and the first choice, the same being true for Texas general dental practitioners (GDP) and paediatric dentists (Chen, 1990), and for Danish and Icelandic practitioners (Wang, 1998). Oral hygiene measures and supplementary fluoride are equally important for Norwegian dentists (Wang, 1998).

Individual-active measures such as dietary advice are the first choice for Swedish dentists (Wang, 1998), while 61% of GDPs in Yorkshire, UK, are reported to practice them (Roshan et al., 2003). Systematic instruction in oral hygiene is given to schoolchildren up to the third grade (6- to 9-year-olds) in municipal dental services in Denmark (Petersen & Torres, 1999). Oral hygiene instruction was reported to be practised by 87% of Yorkshire GDPs.

Dental professional-active measures such as application of fluoride varnish is offered to most children in Sweden (Källestål et al., 1999) and in Denmark (Petersen & Torres, 1999). Topical fluoride was the most frequently used measure also in the Finnish public health care service during 1994 to 1996 (Helminen et al., 1999), but less frequently in general and paediatric practice in Texas during the 1980s (Chen, 1990). The vast majority of Ontario dentists believe in the effectiveness of topical fluoride, but are unaware of the importance of dental prophylaxis prior to the professional application of fluoride (Lewis & Main, 1996). They correctly believe in the cost-effectiveness of early fissure sealing of permanent molars, but incorrectly believe that early fissure sealing of primary molars is as cost-effective as that of permanent molars. Among Danish children under municipal services, permanent molars (91%) and premolars (31%) were the teeth most frequently sealed (Petersen & Torres, 1999). Sealant use was reported by 57% of Yorkshire GDPs (Roshan et al., 2003), 92% of Ohio dentists in the USA (Siegal et al., 1996), and all of the Minnesota dentists (Gonzalez et al., 1991).

Australian dentists provide preventive measures mainly to asymptomatic patients or to those with periodontal disease as part of routine care, with ones on emergency visits missing the benefits of prevention (Brennan & Spencer, 2003). In Texas, preventive dentistry is practised more in populated areas (Chen, 1990). Yorkshire GPs increased their preventive practice over a 10-year period from 1986 to 1996 (Roshan et al., 2003).

The information source on which the choice of preventive measures is based varies between dentists across countries. Danish and Norwegian dentists trust their chief dental officers; Icelandic dentists use their own knowledge from their dental education, while Swedish ones to a greater extent rely on information from courses and meetings (Wang, 1998). In Finland, preventive treatment instructions are given by national (National Board of Health, 1985) and local authorities, for example, the Helsinki City Health Department (1985) recommending individually customised prevention including self-care advice and topical application of fluoride at each check-up.

A wide variation in dental and dental hygiene students' attitude and behaviours towards dental health exists in cross-cultural comparisons between dental students in Japan, Australia, Finland, China, Hong Kong, the USA, Korea, and Greece, according to the 20-item Dental Behaviour Inventory (DBI) (Kawamura et al., 1997; 2000; 2001; 2002; Polychronopoulou et al., 2002). Comparison among freshman dental students in Japan, Hong Kong, and West China showed that their reported attitude and behaviour differed by 16 items out of the 20 (Kawamura et al., 2001). The mean score for DBI was higher for the first- to third-year and lower for the fifth- to sixth-year Finnish (Kawamura et al., 2000) and higher also for the first- to fourth-year Australian dental students than (Kawamura et al., 1997) was that for their Japanese counterparts in corresponding study-years. Of Finnish students, 2% went to a dentist when they had a toothache compared to 56% of their Japanese counterparts. Of Australian dental students, 8% reported a belief that they might eventually require dentures, whereas 37% of Japanese students did so. Of the US dental hygiene students, 1% reported gum bleeding while brushing, whereas 37% of Korean counterparts did so (Kawamura et al., 2002). Furthermore, 76% of the US students were told by their dentists that they were performing a high level of plaque control, contrasting with 19% of their Korean counterparts. Differences in dental behaviours by gender are not found among countries, except for Greek dental students (Polychronopoulou et al., 2002).

2.3.2. Preventive dentistry among lay populations

Public knowledge of oral diseases and their prevention is assessed in several studies, with a gap between the general public's and current scientific knowledge of the prevention of dental diseases (Horowitz, 1995; Kim, 1998). In general, people are aware of the importance of oral hygiene for prevention of oral diseases. A low level of knowledge of oral diseases and their prevention has been identified among elderly people and inhabitants in rural areas in Finland (Markkula et al., 1977), among racial and ethnic minorities in the USA (Gift et al., 1994) and the UK (Mikami et al., 1999), and among females and older adults in South Australia (Roberts-Thomson & Spencer, 1999). A lower educational level is consistently associated with a low level of

knowledge. Wrong beliefs and a high acceptance rate of myths concerning dental prevention are surprisingly common among females and even those with a good education. Low rating of the importance of scientifically efficacious measures is common across populations, as well. For example, a significantly lower percentage of Australians of a younger age, those with a home language other than English, and those with lower levels of education know the purpose of water fluoridation (Roberts-Thomson & Spencer, 1999). Less than half the interviewed mothers of schoolchildren in Wuhan, China, knew the caries-preventive effect of fluoride compared to 89% of school teachers (Petersen & Esheng, 1998), and less than half of both mothers and schoolteachers in Wuhan did not believe that tooth-brushing prevents gum bleeding. A study on caries-preventive knowledge and reported behaviour among Japanese parents resident in London showed their knowledge and behaviour to be generally lower than those reported by English parents (Mikami et al., 1999). This difference was also seen between British expatriates in Tokyo compared to the Japanese, the former knowing more about dental caries (Mikami et al., 2003).

A study among patients attending the School of Dental Hygiene of the Royal Dental Hospital in London revealed that patients' attitudes and knowledge do not predict their gingival health (Rayant, 1979). McCaul et al. (1985) found that oral hygiene behaviours such as brushing and flossing among college students are predicted by their expectations (both self-efficacy and outcome expectations) and environmental influences (barriers and the behaviours of significant others). But although knowledge and skills are unrelated to the levels of behaviours, yet behaviours predict oral health outcomes such as plaque index and gingival health. In contrast, Keogh & Linden (1991) found that clearer knowledge, more positive attitudes, and more appropriate behaviour are related to better dental health among adults of higher socio-economic status than of lower.

Okada et al. (2001) found that the gingival health of children could be significantly influenced by the oral health attitude of their mothers up to approximately ten years of age. They also found a positive relation between parents' oral health behaviour and children's oral health behaviour and health status (Okada et al., 2002). In a randomized controlled trial to assess the effect of educational intervention on caregivers in 22 nursing homes in the UK, their oral health care knowledge and attitude improved in parallel with their clients' oral health status, knowledge, and attitude score improvements (Frenkel et al., 2002). Among Wuhan children, 22% both of 6- and of 12-year-olds brushed their teeth twice daily, but 58% and 47%, respectively, never visited a dentist; the corresponding percentages for their mothers were 50% and 45%, respectively (Petersen & Esheng, 1998).

3. Aim of the study

3.1. General aim

The general aim of this study was to investigate preventive dentistry in Mongolia by assessing dental professionals' (practicing dentists and dental students) professional preventive practice and knowledge, oral self-care behaviours, and oral health outcomes.

3.2. Specific objectives

To achieve the aim, the following specific questions were asked:

1. How do the dental students practice preventive dentistry for their patients? (I)
2. Does any change occur in the dental students' preventive practice due to time and dental training? (II)
3. What do the dentists do for their own children to prevent dental caries? (III)
4. How knowledgeable are the dentists and dental students in preventive dentistry? (I, V)
5. How do the dentists keep their professional preventive knowledge and skills updated? (IV)
6. What do the dentists and dental students do to maintain and improve their own oral health? (V)
7. What oral health outcomes have the dentists and dental students achieved for themselves? (V)
8. What oral health outcomes have the dentists achieved for their own children? (VI)

3.3. Hypotheses

Those dental professionals with better knowledge of or with perceptions of themselves as more competent in preventive dentistry will practice appropriate oral self-care for themselves and enjoy good oral health. Consequently,

- a) Such dentists are more likely to practice appropriate preventive care for their own children, and potentially for their patients.
- b) Such dental students are more likely to provide appropriate preventive care to their patients.

4. Subjects and methods

4.1. Study background

The dental caries level in Mongolia has been classified by WHO as low for 12-year-olds (1993; 1996) and as moderate for 35- to 44-year-olds (Petersen, 2003). However, high caries experience has been reported among urban children (Boldyn, 1993) and a difference in oral health between urban and rural children, especially for those with primary dentition. For instance, the mean dmft for 6-year-olds in urban areas was 6.5 and in rural areas 0.9, the mean DMFT for 12-year-olds being 1.8 and 1.2, respectively (NOHP, 1997). Gum bleeding and calculus are frequently found in most children and adults, more in rural than urban populations. However, severe forms of periodontal disease are infrequent (Tseveenjav, 1996). Fluoride content in drinking water is low in most areas of the country except in some provinces in Gobi (Idesh, 2001).

In Mongolia, the oral health care system is based on specialist-based dental clinics with their main activity of providing curative care for the consequences of oral diseases. Current oral health manpower reflects the structure of the system. Thus, the most numerous oral health personnel in Mongolia are now dentists, followed by dental technicians. There were 375 dentists registered as active, 250 working in the capital city, 40 in the other two big cities, and 85 in the countryside. Of all dentists, 56% were working as GDPs and the rest as: therapeutic or paediatric dentists, orthodontists or maxillo-facial surgeons, most of them on-job or through short-term continuing education course-trained specialists. There were 56 laboratory dental technicians trained in the local Medical College (NOHP, 1997). Currently employed dental nurses are on-the-job trained; and their main role is working as chair-side assistants. There are neither dental hygienists nor training for them.

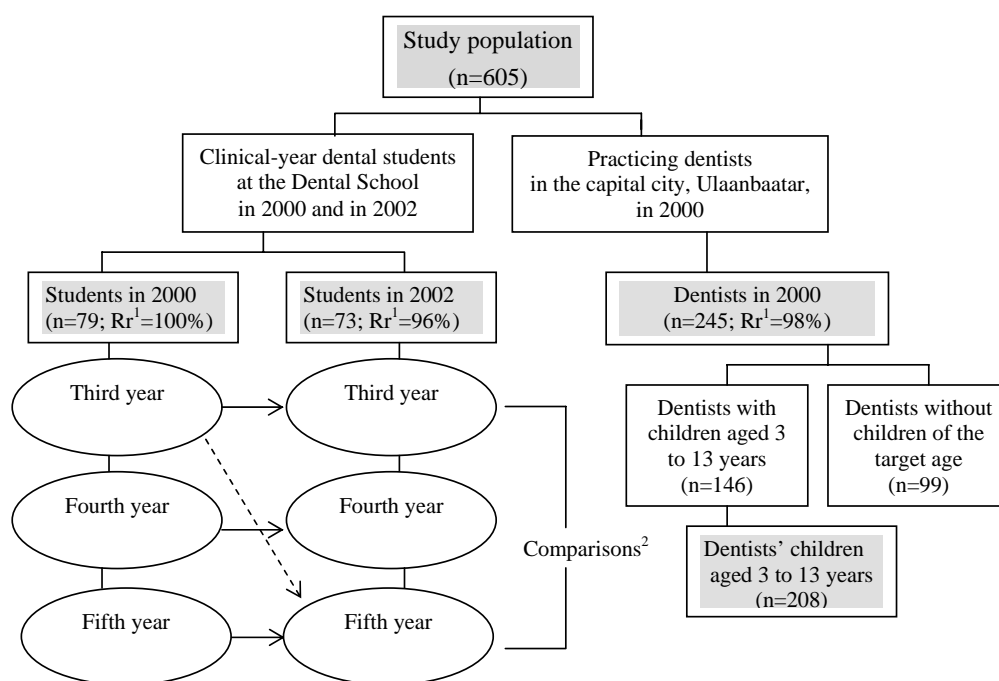
Dental education in Mongolia was established in 1961, taking the path of Stomatology which considers oral medicine equivalent with any other medical specialization. The Dental School of the Mongolian National Medical University (MNMU) has a five-year training programme with the main emphasis of the curriculum on curative approaches to oral diseases and their consequences. Teaching is heavily focused on procedures instead of on the scientific backgrounds of the procedures. Dental students therefore concentrate on and spend most of their time on gaining technical skills rather than focusing on outcomes (Tseveenjav, 1999). Teaching of preventive dentistry includes 10 hours of lectures and 20 hours of practical work. The extent as well as content of preventive teaching in the current dental curriculum has remained without any notable change since its introduction, even though a re-examination of preventive dentistry has been needed (Thomson, 1999). However, in the year 2000, there occurred some organizational changes within the Dental School, such as the establishment of the independent Department of Paediatric and Preventive Dentistry.

The NOHP set the fundamental strategies, such as focusing resources on cost-effective prevention, organizing public oral health care, and integrating public policies and activities with oral health in order to increase the role of individuals and the community and re-planning manpower and management of oral health care, all to achieve the new goals of the oral health system in Mongolia.

4.2. Study population

The study population comprised future dental professionals and practising dentists and their children (Figure 4). The future professionals were represented by dental students in their clinical years at the Dental School of the MNMU in 2000 (n=79) and in 2002 (n=73). The practising dentists were represented by registered active practitioners (n=245) in the capital city of Mongolia, Ulaanbaatar. Of all dentists, 146 reported data on their children aged 3 to 13 years (n=208).

Figure 4: Description of the study population and design



¹Response rate; ²Solid arrows for cross-sectional and dashed arrow for longitudinal comparisons

Mean age of the students was 23 years in both survey years (Table 4) and that of the dentists was 35 with a range of 23 to 60. Median and mean lengths of work experience of the dentists were 7 and 10 years. Females predominated among both the students and dentists (Tables 4 and 5). Of the dentists' children, 50% were girls (Table 6).

Table 4: Description of Mongolian students surveyed

	Study-year			Female n (%)	Age (years)		
	Third- n (%)	Fourth- n (%)	Fifth- n (%)		Mean (SD)	Median	Range
	Students in 2000	26 (33%)	26 (33%)		27 (34%)	72 (91%)	23 (2.7)
Students in 2002	25 (34%)	22 (30%)	26 (36%)	65 (89%)	23 (2.6)	22	20-31

Table 5: Description of Mongolian dentists surveyed according to background characteristics

Backgrounds	All dentists (n=245)		Dentists with children of the target age (n=146)	
	%	n	%	n
Gender				
Female	83	204	84	122
Male	17	41	16	24
Type of practice				
State Institution	58	141	57	83
Private sector	42	104	43	63
Working experience				
≤ 5 years	39	96	34	50
> 5 years	61	149	66	96
Field of practice				
General practitioner	60	147	64	93
Speciality field	40	98	36	53
Main patient group attending				
Adults and children	82	200	79	115
Adults only	14	36	15	23
Children only	4	9	6	8
Postgraduate degree				
Yes	37	90	40	58
No	63	155	60	88

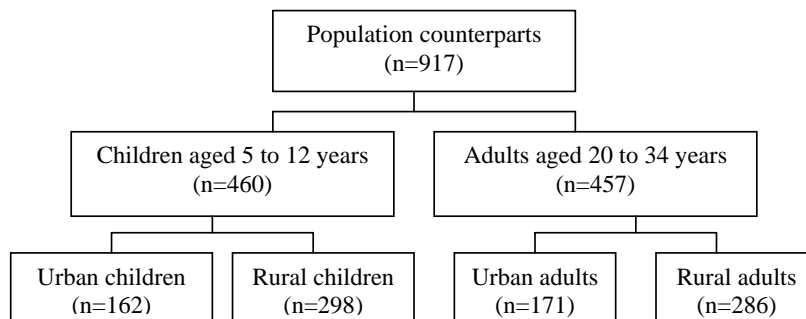
Table 6: Number of Mongolian dentists' children aged 3 to 13 years (n=208), by age and gender

Age group (years)	n	Gender	
		Boys (%)	Girls (%)
3-5	54	52	48
6	18	44	56
7-11	97	50	50
12	17	41	59
13	22	55	45
All	208	50	50

4.3. Reference group: population counterparts

The dental professionals' and dentists' oral health outcomes were compared with those of their population counterparts in Mongolia. The reference group (Figure 5) comprised urban and rural counterparts of the same ages as those in the present study.

Figure 5: Description of the reference group: population counterparts



The data came from the National Oral Health Survey (NOHS), 1996. NOHS was carried out to collect background data for drafting of a National Oral Health Policy. Subjects of the NOHS were randomly selected from the capital city and six provinces (out of 18) of Mongolia to well represent the general population in Mongolia. Of all 1242 subjects aged 2 to 76 years included in the NOHS, 917 were of the right target ages for comparison with the present study subjects. Clinical dental examinations of NOHS were carried out by four calibrated dentists using the WHO Oral Health Assessment method (1987) and recorded by tooth. Comparisons of the NOHS data with those of dental professionals and dentists' children were made separately by area of residence: urban or rural.

4.4. Pilot study

The Mongolian versions of the questionnaires were first pre-tested among ten Mongolian dentists of different ages and working experience in December 1999, and discussed with them. Revision of the questionnaires was carried out to obtain the final version of the questionnaires.

4.5. Data collection

Data collection was carried out on two occasions. One was in May 2000. The final version of the questionnaire was delivered by the author to all clinical-year students at the Dental School of Mongolian National Medical University in their classrooms and to dentists in their practicing locality as registered for the practice license by the author. The questionnaires for dentists were taken from door to door due to the difficulty of the

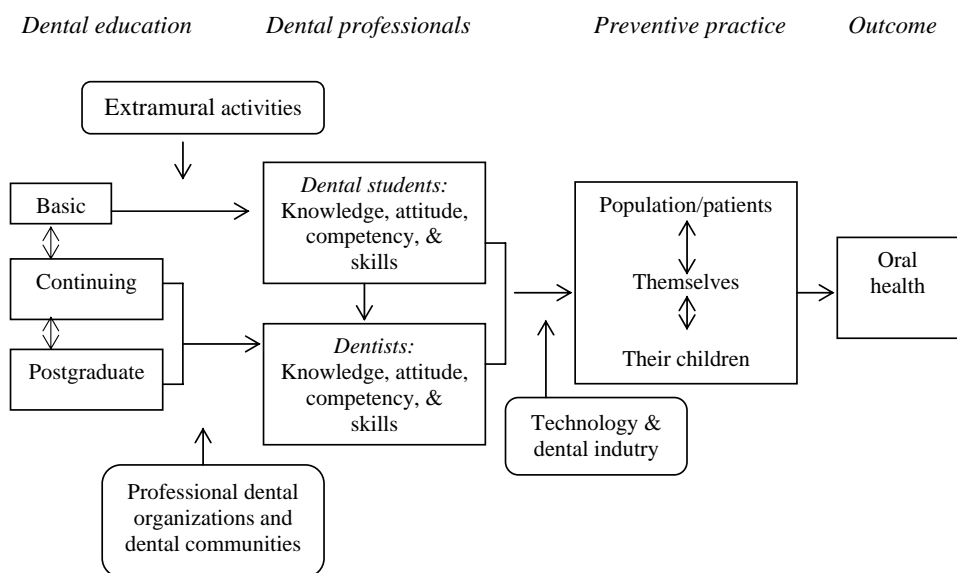
postal service related to insufficient infrastructure development in Mongolia. Returning the questionnaires was either by Dental School correspondence or by the author's collecting door to door, based on each dentist's preference. The collecting of these questionnaires was done at the second, fourth, and sixth week after delivery. The response rate was 100% for the students and 98% for the dentists within 5 weeks.

The second part of the data collection was carried out in April 2002, by the author's delivering the same questionnaire to all clinical-year students in 2002 at the Dental School. Response rate was 96% within 5 weeks from the delivery of the questionnaires.

4.6. Theoretical model

Design and analysis of this study were based on a theoretical model developed to explain determinants of the preventive practice of dental professionals. The assumption of this study was that dental professionals' professional preventive knowledge, attitudes, and competency, and the skills acquired from dental education are of the utmost importance for their further making use of preventive dentistry for the benefit of themselves and their own children and patients (Figure 6) in maintaining and improving their oral health. At the same time, it is assumed that these patterns are interrelated. The outcome of dental professionals' preventive practice was determined by assessing oral health-related behaviours and status among dental professionals themselves and among dentists' children.

Figure 6: Theoretical model explaining dental professionals' preventive practice



4.7. Study design

Cross-sectional and longitudinal designs were applied for this study (Figure 4, lower left side). Cross-sectional comparisons between cohorts, to assess changes in students' preventive practice and knowledge and oral self-care due to the time effect, were carried out among their counterparts in the same study year in 2000 and in 2002. Longitudinal comparisons, to determine the changes because of the effect of professional education, were carried out as within-cohort comparisons among the fifth-year students in 2002 with their third year of study in 2000. A cross-sectional design was also used for dentists and for their children.

4.8. Questionnaires

Two different types of questionnaires were designed and used for the data collection of the present study; one for dentists and another for dental students (A combined version of these two types of questionnaires is an appendix). The questionnaires were originally written in English and later translated into Mongolian, and included a cover letter explaining the voluntary and confidential nature of participation in the survey. Respondents answered the questionnaires anonymously.

The questionnaire for dentists collected their personal data, inquiring about gender, years of working experience, educational background, and characteristics related to current work. The following sections included questions on oral hygiene and dietary behaviour and utilization of dental services by respondents. A dental chart (dentigram) with ready-given codes for dental health and questions on periodontal status were provided in the next section. Code D meant decayed, M was for missing due to caries, F for filled, or S for sound teeth. The fourth and fifth sections assessed dentists' self-perceived competency in carrying out clinical and preventive measures and dentists' attitudes towards, attendance at, and self-perceived need for continuing education. The next section comprised statements on preventive matters to assess knowledge of and attitudes towards preventive dentistry measured by means of a five-point Likert scale. The final section asked dentists to fill in a dental chart on the dental health of their own children aged 3 to 13 years. The caries-preventive measures applied to these children were also asked for each child. In the last page of the dentists' questionnaire, a space was provided if they had any thoughts or suggestions about this study or issues related to preventive dentistry in Mongolia; 25% of the dentists gave free-formulated responses.

The questionnaire for dental students inquired about such personal data as gender and year of study in the Dental School. The second section assessed students' oral hygiene and dietary behaviour. Oral health was asked about in a similar way as in the questionnaire for dentists. The following two sections required information on students' practice of preventive measures for patients involving four different measures and self-

perceived competency in carrying out clinical and preventive measures. The sixth section assessed preventive knowledge of students, in a similar way as for dentists.

4.9. Questions and variables

4.9.1. Professional preventive practice

Professional preventive practice of dental students was assessed by means of a four-point scale of frequency: always or almost always, quite often, seldom, or not at all, as regards carrying out four different preventive measures: (a) recommending fluoride-containing toothpaste, (b) giving nutrition counselling, (c) applying topical fluoride, and (d) placing sealants. For a description of data, each four-point scale of frequency was reclassified into two levels of frequencies: the category at least quite often, which included “always or almost always” and “quite often”, and the seldom or not at all category, which included the final two categories. For further analysis, the original answers were given scores according to their reported frequency, the higher scores corresponding to more frequent practice. The sum of the given scores determined student’s reported preventive practice.

Preventive practice among dentists as applied to their own children was assessed by asking the frequencies of seven caries-preventive measures a) supervision of tooth-brushing, b) recommendation of the use of fluoridated toothpaste, c) restriction of sugar consumption, d) demonstration of tooth-brushing techniques, e) application of topical fluoride, f) regular preventive visits, and h) placing of pit and fissure sealant. Answers for measures a through c were given by means of a four-point scale: always or almost always, quite often, seldom, or not at all. In the analysis, scale was dichotomized into: “at least quite often” and “seldom or not at all”. The answers for measures d through h were given as “yes” or “no”. The preventive practice of a dentist was represented by the best practice of each measure if the dentist had more than one child of the target age, to estimate the best possible practice.

4.9.2. Professional preventive knowledge

Professional preventive knowledge of dental professionals was assessed by 14 statements related to the role of fluorides, frequency of sugar consumption, sugar-free chewing gum and xylitol, and use of sealant in preventive dental caries, and to the aetiology of gingivitis. All statements were measured by means of a five-point Likert scale which is the most popular scaling method used by sociologists and psychologists (Bowling, 1998): from strongly agree to strongly disagree. In the analysis, these answers were given scores according to the degree of knowledge of the respondents, the higher scores corresponding to greater knowledge. For further analysis, the sum of these scores by respondent was calculated and sub-grouped into the quartiles of theoretical scores with a maximum of 56.

4.9.3. Competency in preventive care and preventive orientation

Self-perceived competency in carrying out preventive treatment was assessed among dental professionals by means of a four-point scale: very competent, quite competent, not very competent, or not at all competent. For the description of data, these answers were reclassified into two levels of competency: at least quite competent, which included the very and quite competent categories, and not very or not at all competent, which included the other two categories.

The preventive orientation of dentists was assessed by their reaction to the statement "Preventive training and practice should be increased both in undergraduate education and in clinical dental practice" ranked on a five-point Likert scale. For a further description, the answers were given scores of zero to four; higher scores corresponded with a more positive orientation.

4.9.4. Continuing education

Continuing education (CE) in preventive dentistry among practicing dentists was described by their attendance at and self-perceived need for such courses and their attitude towards CE. *Attendance* was determined by the question "If you had any learning opportunities in preventive dentistry during the last two years (1998-1999), how many times/courses and how long did they take, all together?" Those dentists who reported such a learning opportunity at least once during the targeted period were considered CE attendees in further analysis. *Self-perceived need* was determined by asking the dentists whether they had any need for a CE course on preventive dentistry regardless of whether they have taken a course on it during the above-described period. *Attitude towards CE* was assessed by reaction to the statement: "Continuing education courses would be of great use for dentists." Answers were ranked on a five-point Likert scale. For further description, the answers were given scores of zero to four; higher scores corresponded to a more positive attitude.

4.9.5. Oral self-care

Oral self-care of dental professionals was determined by a combination of original questions on tooth-brushing frequency, use of sugar-containing food between main meals, and use of fluoride-containing toothpaste. Originally, these questions had four to seven alternative answers, but in the analysis all the answers were reclassified into three. A recommended level of oral self-care was defined to include brushing the teeth twice a day or more, using fluoride-containing toothpaste always or almost always, and consuming sugar-containing food between the main meals less often than daily.

4.9.6. Oral health status

Oral health status was assessed on the basis of a self-completed dentigram (dental chart) and a report on gingival bleeding and tooth mobility. The presence of caries was to be recorded when caries was observed at a cavitation level reaching the dentine (WHO, 1987a). Based on the self-report, the DMFT index, excluding third molars, was calculated among dental students and dentists. Dentist-parents reported the dental health of their children aged 3 to 13 years in the same way as for themselves. Gingival bleeding experience was asked in three categories and dichotomized: never had gingival bleeding vs. all others, for further analysis. Tooth mobility was determined on the basis of a “yes” or “no” answer.

For reliability testing of the self-reported data on dental health, clinical examinations of 25 out of the 245 dentists who took part in the earlier survey in 2000 were carried out by the author in April 2002. In total, 701 teeth were examined. The agreement rate between survey and clinical data was 0.91. The kappa-value was 0.78 with 95%CI of 0.73 to 0.84.

4.10. Statistical methods

Statistical significance of differences was evaluated by one-way ANOVA test for mean values between subgroups and the chi-square test for frequencies. Tukey’s Honestly Significant Difference (HSD) test, which is one of the Post-Hoc (after the fact) tests for multiple group comparison of means (Munro, 2001), was used to allow dental health indicators of dental students and dentists to be compared with their population counterparts. The Dunnett t-test was used for comparison of means of dental health indicators of dentists’ children with those of their urban and rural population counterparts. The reference group was dentists’ children vs. their counterparts.

Logistic regression models (Bulman & Osborn, 1989) were applied to associate binary outcome variables with explanatory variables, and corresponding odds ratios were calculated, from two-by-two tables, with their 95% confidence intervals. The Hosmer-Lemeshow test (Hosmer & Lemeshow, 1989) served for goodness-of-fit of logistic models. Linear regression models (Altman, 1997) were applied to explain variation in outcome variables by explanatory parameters. The R-square was calculated for each model to estimate the variation in outcome variable by explanatory variables in each of linear regression models. Statistical significance was evaluated at the $p=0.05$ throughout this study.

5. Results

5.1. How do Mongolian dental students practice preventive dentistry for their patients? Is any change in professional preventive practice due to time and dental training? (I, II)

5.1.1. Reported professional preventive practice and its cross-sectional and longitudinal comparisons

Recommending the use of fluoridated toothpaste (FTP) and giving diet counselling were more commonly reported caries-preventive measures (CPMs) than were applying topical fluoride and placing sealant among the students both in 2000 and 2002 (I, II). The practice of placing sealant among the students in 2000 ($p=0.05$) and of applying topical fluoride among the students in 2002 ($p=0.01$) statistically significantly differed by study year, the fifth-year students being more likely to report it.

In cross-sectional, between-cohort comparisons, the professional preventive practice among the students in 2002 did not statistically significantly differ from that among their counterparts in the same study year in 2000 ($p>0.05$). In longitudinal, within-cohort comparisons, the fifth-year students' professional preventive practice, compared to that of their third year, statistically significantly improved in three of the four CPMs: recommending FTP, applying topical fluoride, and placing sealant (II).

5.1.2. Determinants of the students' professional preventive practice

The students' overall professional preventive practice was strongly correlated with their professional preventive knowledge and self-reported competency ($p\leq 0.002$) (I). Students' higher scores on overall professional preventive practice were positively related to their study year, professional preventive knowledge, and their dental health, as well (I). When each of the reported CPMs among the fourth- and the fifth-year students was explained by selected factors by means of four different logistic models (Table 7), better knowledge of that specific measure and perceiving themselves as more competent in carrying out CPMs were the most important factors for more frequent practice of recommending FTP (model 1) and of counselling on diet (model 2).

Table 7: Associations of fourth- and fifth-year Mongolian dental students' (n=101) frequent practice of caries-preventive measures explained by selected parameters, by means of logistic regression

Dependent variable and parameters in models	ES ¹	SE ²	p	OR ³	95%CI
1: Recommending fluoridated toothpaste					
Fifth year of study	-0.70	0.63	0.27	0.5	0.1-1.7
Better knowledge of fluoridated toothpaste	0.52	0.25	0.04	1.7	1.1-2.7
Self-perceived as more competent in prevention	1.32	0.69	0.05	3.8	1.0-14.3
Recommended oral self-care	0.34	0.65	0.61	1.4	0.4-5.0
Constant	-1.85	1.24			
2: Counselling on diet					
Fifth year of study	-0.75	0.46	0.10	0.5	0.2-1.2
Better knowledge on sugar consumption & xylitol	0.23	0.09	0.01	1.3	1.0-1.5
Self-perceived as more competent in prevention	1.66	0.66	0.01	5.3	1.4-19.2
Recommended oral self-care	0.09	0.47	0.85	1.1	0.4-2.7
Constant	-2.79	0.89			
3: Applying topical fluoride					
Fifth year of study	1.40	0.63	0.03	3.9	1.1-13.8
Better knowledge on benefit of topical fluoride	0.40	0.30	0.16	1.4	0.9-2.6
Self-perceived as more competent in prevention	7.63	22.4	0.73	2067	0-2.3E+22
Recommended oral self-care	-1.37	0.70	0.05	0.3	0.1-0.9
Constant	-11.5	22.4			
4: Placing sealant					
Fifth year of study	9.63	56.2	0.86	1523	0-9.6E+51
Better knowledge on effectiveness of sealant	1.82	1.10	0.10	6.16	0.7-53.5
Self-perceived as more competent in prevention	6.83	83.9	0.94	925	0-2.2E+74
Recommended oral self-care	-0.40	0.94	0.67	0.67	0.1-4.2
Constant	-24.6	100.9			

Recommended oral self-care: brushing teeth twice or more daily, using fluoridated toothpaste always or almost always, and consuming sugar-containing food between meals less often than daily; Goodness-of-fit test (Hosmer-Lemeshow) significance $p > 0.05$ for each model; ¹ estimate of strength; ² standard error; ³ odds ratio; statistically significant p-values and ORs in bold ($p < 0.05$)

5. 2. What do Mongolian dentists do for their own children to prevent dental caries? (III)

5.2.1. Caries-preventive measures applied to the dentists' own children

Of the seven caries preventive measures (CPMs), demonstrating tooth-brushing technique, taking children for preventive dental visits, and recommending the use of FTP were the ones most commonly reported as applied to the dentists' children aged 3 to 13 years by their dentist-parents, whereas restricting consumption of sugar-containing food between meals and placing sealant were the least (III).

5.2.2. Determinants of the dentists' practice of caries-preventive measures

The reported practice of CPMs did not statistically significantly differ by the dentists' work-related background factors (III), except for more frequent practice of recommending FTP by those with more than 5 years of work experience (OR=3.3, 95%CI 1.4-7.8) and for more frequently taking their children for preventive dental visits by general dental practitioners (GDPs) (OR=4.1, 95%CI 1.0-16.4) than by dentists with 5 or fewer years of work experience and those working in a speciality field, respectively.

Dentists' mean numbers of CPMs applied to their own children aged 3 to 13 years was positively correlated with their professional preventive knowledge (p=0.050), self-perceived competency (p=0.025) and with their own caries experience (p=0.010), whereas their work experience and oral self-care remained statistically non-significant (Table 8).

Table 8: Mongolian dentists' mean numbers of caries-preventive measures applied per child explained by selected parameters by linear regression analysis (n=146)

Parameters	Regression coefficient	Standard deviation	Beta	t	P
Work experience (years)	-4.51E-03	0.015	-0.023	-0.295	0.768
Professional preventive knowledge	3.52E-02	0.019	0.154	1.895	0.050
Self-reported competency	0.405	0.179	1.182	2.269	0.025
Oral self-care: ROSC ¹	6.02E-02	0.261	0.019	0.230	0.818
Caries experience (DMFT)	6.36E-01	0.014	0.208	2.615	0.010
Constant	1.617	0.831			

R²=0.115; Statistically significant p-values in bold (p<0.05); ¹ Recommended oral self-care included those brushing their teeth twice or more daily, using fluoridated toothpaste always or almost always, and consuming sugar-containing food between meals less often than daily

5.3. How knowledgeable are Mongolian dentists and dental students in preventive dentistry? (I, V) How do the dentists keep their professional knowledge and skills updated? (IV)

5.3.1. Professional preventive knowledge among the dental professionals

In general, dental professionals were knowledgeable in preventive matters: 42% of the students in 2000 and 48% in 2002, and 51% of dentists belonged to the highest quartile (Q4) of scores for professional preventive knowledge (I, II,V). Dental students' and dentists' background factors showed no statistically significant impact on their belonging to the Q4 (Table 9), except for dentists' main patient group.

Table 9: Belonging to the highest quartile (Q4) of reported professional preventive knowledge of Mongolian dental students and dentists in relation to their background factors

	Q4 (%)	P ¹
Dental students in 2002		0.338
3 rd year	48	
4 th year	36	
5 th year	58	
Dental students in 2000		0.468
3 rd year	42	
4 th year	50	
5 th year	33	
Dentists		
<i>Years of work experience</i>		0.637
≤ 5 years	48	
> 5 years	62	
<i>Current job</i>		0.079
State institution	55	
Private practice	43	
<i>Field of practice</i>		0.465
General practice	52	
Specialty field	47	
<i>Postgraduate degree</i>		0.455
Yes	48	
No	52	
<i>Main patient group attending</i>		0.005
Both adults and children	55	
Adults only	25	
Children only	44	

¹ Chi-square test for differences in number of students/dentists belonging in Q4 between subgroups for each factor; statistically significant p-value in bold (p<0.05)

In cross-sectional, between-cohort comparisons overall professional preventive knowledge was quite similar among students in 2002 compared to their counterparts in the same study year in 2000. In longitudinal, within-cohort comparisons, the percentage of students in their fifth year belonging to Q4, compared to their third year, did not increase ($p>0.05$) (II).

Most students and dentists reported being aware that FTP prevents tooth decay (statement #1) and that fluoride is the most important factor for tooth susceptibility (#3), but were unaware that FTP is more important than brushing technique (#2) and unaware of the benefit of fluoridation of drinking water (# 4) and topical fluoride (#5) (Table 10).

Table 10: Percentages of correct answers (strongly agree or agree) to statements involving preventive knowledge among Mongolian dental students in 2002¹ (n=73), and in 2000² (n=79) and dentists³ (n=245)

Statements:	1	2	3	P ¹
#1. Brushing teeth with fluoridated toothpaste prevents tooth decay.	97	95	95	0.933
#2. Using fluoridated toothpaste is more important than brushing technique in preventing caries.	19	32	43	0.077
#3. Fluoride is the most important factor for tooth susceptibility.	93	96	94	0.506
#4. Fluoridation of drinking water is an effective, safe, and efficient way to prevent dental caries.	59	78	82	0.430
#5. It is beneficial to recommend fluoride tablets and/or topical fluoride for children in areas without a fluoridated water supply.	56	63	46	0.010
#6. Frequency of sugar consumption has a greater role than total amount consumed in causing caries.	83	91	82	0.045
#7. Sugar-free chewing gum has a positive effect on dental health.	86	90	82	0.115
#8. Xylitol is not only non-cariogenic, but also suppresses the growth of acidogenic bacteria in dental plaque.	36	27	47	0.001
#9. Sealant is effective in prevention of pit and fissure caries.	90	56	76	0.001
#10. It is beneficial to visit a dentist for regular check-ups.	98	98	99	0.087
#11. Regular brushing helps in prevention of gum problems.	97	96	98	0.382
#12. Gingivitis is caused by dental plaque.	93	78	89	0.018
#13. Gingivitis can be cured by effective oral hygiene.	95	95	97	0.462
#14. Having dental problems can lead to general health problems.	96	96	97	0.820

¹chi-square test for differences in number of correct answers vs. others between dentists and dental students in 2000; statistically significant p-values in bold ($p<0.05$)

Statements on the benefit of xylitol (#8) and sealant (#9) got high percentages of “don’t know” answers. Students in 2000 had better knowledge on the benefit of topical fluoride for children (#5) (OR= 1.7, 95%CI 1.1-2.6) and on the role of frequency of sugar consumption in causing caries (#6) (OR= 2.3, 95%CI 1.0-5.4) than did dentists, whereas the dentists were better regarding xylitol (#8) (OR= 2.4, 95%CI 1.3-4.3) and sealant (#9) (OR= 2.5, 95%CI 1.5-4.3).

5.3.2. Attendance at and self-perceived need for courses in prevention

Of all dentists, 38% reported having had a continuing education learning opportunity during the preceding 2 years (1998-1999) of this survey in one of the five disciplines. Self-perceived need for continuing education in one of the disciplines was reported by 58% of them. Attendance at courses on preventive dentistry was reported by 4% of the dentists and self-perceived need by 22% (IV).

Dentists with 5 or fewer years of work experience ($p=0.007$, OR=6.7, 95%CI 1.4-32.2) and those in a speciality field of practice ($p=0.048$, OR=3.7, 95%CI 1.0-14.6) were more likely to attend courses in preventive dentistry, whereas dentists in general practice ($p=0.002$, OR=2.9, 95%CI 1.4-6.0) were more likely to perceive a need for such courses.

Dentists’ attendance at courses on preventive dentistry was best explained by their years of work experience and professional preventive knowledge, younger ones and those with higher knowledge being more likely to attend such courses (Table 11). The similar logistic model for dentists’ self-perceived need for such courses showed that field of practice was the only factor explaining the positive outcome, dentists in general practice being more likely to perceive it ($p=0.002$, OR=3.2; 95%CI 1.5-6.6).

Table 11: Association of Mongolian dentists’ (n=245) attendance at courses on preventive dentistry with selected parameters by means of logistic model and corresponding odds ratios (OR)

	ES ¹	SE ²	p	OR ³	95% CI
Work experience: ≤ 5	1.99	0.94	0.033	7.3	1.2-45.7
General practitioners	-0.77	0.83	0.355	0.5	0.1-2.4
Preventive knowledge	0.16	0.07	0.032	1.2	1.0-1.4
Preventive orientation	0.72	0.68	0.285	2.1	0.5-7.7
Attitude towards CE	9.10	38.2	0.812	8879	0-3.1+E36
Constant	-49.4	153.0			

Goodness-of-fit test (Hosmer-Leweshow) significance $p>0.05$ for each model;

¹ estimate of strength; ² standard error; ³ odds ratios; statistically significant p-values and 95%CI in bold ($p<0.05$)

5.4. What do Mongolian dental professionals do to maintain and improve their own oral health? What oral health outcomes have they achieved for themselves? (V)

5.4.1. Oral self-care and its determinants among the dental professionals

One-fifth of the dentists and students in 2000 and a third of the students in 2002 achieved the recommended oral self-care with no statistically significant difference between these three groups (Table 12). Achieving ROSC was also related to higher preventive knowledge among the dentists ($p=0.004$), but not among the students (Table 13). When ROSC was explained by selected factors in a logistic model, preventive knowledge remained a significant factor for it among the dentists (V).

Table 12: Percentages of Mongolian dentists and dental students achieving recommended oral self-care (ROSC) and recommended levels of its components

ROSC ² and its components	Dental professionals by survey year			P ¹
	Dentists (2000)	Students (2000)	Students (2002)	
Tooth-brushing twice or more daily	81	81	94	0.021
Use of FTP always/almost always	62	66	79	0.026
Between-meal sugar consumption < 1 daily	51	44	40	0.166
ROSC ²	24	24	32	0.420

¹ Chi-square test for differences between the three groups; statistically significant p-values in bold (df=2); ² Recommended oral-self care

Table 13: Percentages of Mongolian dentists (n=245) and dental students in 2000 (n=79) and 2002 (n=73) achieving recommended oral self-care (ROSC) and recommended levels of its components by selected backgrounds

	Tooth brushing ≥ 2 daily		Fluoridated toothpaste use "Always" ²		Sugar consumption <daily		ROSC	
	Yes %	p ¹	Yes %	p ¹	Yes %	P ¹	Yes %	p ¹
Dentists in 2000								
Working experience (years): ≤ 5	82	0.73	71	0.03	50	0.72	26	0.56
Higher preventive knowledge	84	0.20	74	0.00	53	0.56	32	0.00
More preventively orientated	80	0.36	66	0.00	50	0.18	25	0.31
Attendance at preventive courses	60	0.08	60	0.87	50	0.93	10	0.28
Dental students in 2000								
Higher preventive knowledge	79	0.67	67	0.89	54	0.12	30	0.27
Dental students in 2002								
Higher preventive knowledge	97	0.345	80	0.911	37	0.665	31	0.99

¹ chi-square test for differences in aspects of oral self-care; ² always or almost always

5.4.2. Cross-sectional and longitudinal comparisons of oral self-care

In the cross-sectional comparisons, the frequency of tooth-brushing among the students in 2002 was similar to that among their counterparts in the same study year in 2000. Use of FTP statistically significantly differed among the fifth-year students, those in 2002 (85%) having more frequent use than that of their counterparts in 2000 (52%) ($p=0.01$). A fewer number of third-year students in 2002 (20%) reported using sugar-containing food “less often than daily” between meals than did their counterparts (54%) in the same study year in 2000 ($p=0.01$) (II).

In the longitudinal comparison, the fifth-year students’ tooth-brushing frequency, use of FTP, and sugar consumption between meals did not improve compared to frequencies reported in their third year ($p>0.05$) (II).

5.4.3. Oral health and its determinants among the dental professionals

Mean numbers of DMFT were 6.4 (SD=4.4) for dentists, 5.0 (SD=3.4) for the students in 2000, and 6.1 (SD=3.4) for the students in 2002, with a statistically significant difference between these three groups ($p=0.031$). FT counted for half or more of total DMF teeth in all three groups (Table 14). Mean numbers of present teeth (T), sound (ST), decayed (DT), missing (MT) teeth, and experience of gingival bleeding statistically significantly differed between groups ($p<0.05$) (Table 14). Tooth mobility was reported by 7% of the dentists and 3% of the students, with no statistically significant difference between groups ($p=0.23$).

Table 14: Mean numbers of present (T), sound (ST), filled (FT) and decayed (DT) teeth and experience of gingival bleeding among Mongolian dentists ($n=245$) and dental students in 2000 ($n=79$) and in 2002 ($n=73$)

	Status of present teeth					Gingival bleeding		
	T	ST	FT	DT	MT	1	2	3
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	%	%	%
Dentists	24.9 (2.9)	21.5 (4.6)	3.2 (3.2)	0.3 (0.8)	3.1 (2.9)	49	43	8
Students (2000)	26.4 (1.9)	23.0 (3.4)	3.2 (2.9)	0.2 (0.6)	1.6 (1.9)	41	34	25
Students (2002)	26.3 (1.5)	21.9 (3.4)	3.9 (2.9)	0.5 (0.9)	1.7 (1.5)	33	53	14
p	<0.001 ¹	0.023 ¹	0.230 ¹	0.047 ¹	<0.001 ¹	<0.001 ²		

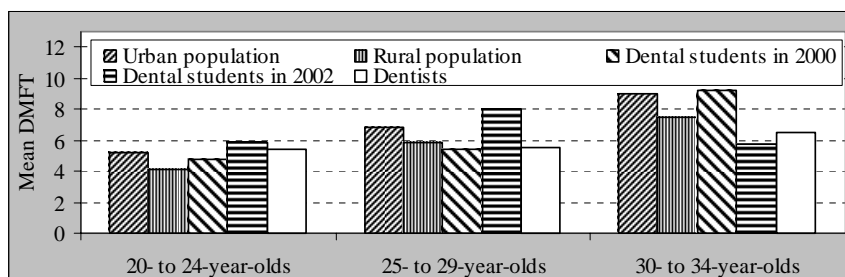
¹ ANOVA for differences in means between the three groups; ² Chi-square test ($df=4$) for difference in reported gingival bleeding: 1-never, 2-earlier, 3-currently

Of all the dentists, 86% were free of decayed teeth (DT=0), 49% had never experienced gingival bleeding. The respective percentages for the students (n=126) were 75% and 40%. When dentists' dental (DT=0) and gingival health were explained by means of logistic regression models, ROSC behaviour was the only significant factor for dentists' being free of decayed teeth ($p=0.01$) (V). The same model applied to dental students (n=126) showed that students' dental health was not explained by any of those factors.

5.4.4. Comparison of dental professionals' dental health with that of their counterparts in the general population

Comparison of dental health among dental students and dentists with that among their urban and rural counterparts in three age-groups showed that dental professionals had similar mean DMFT values ($p>0.05$) (Figure 7).

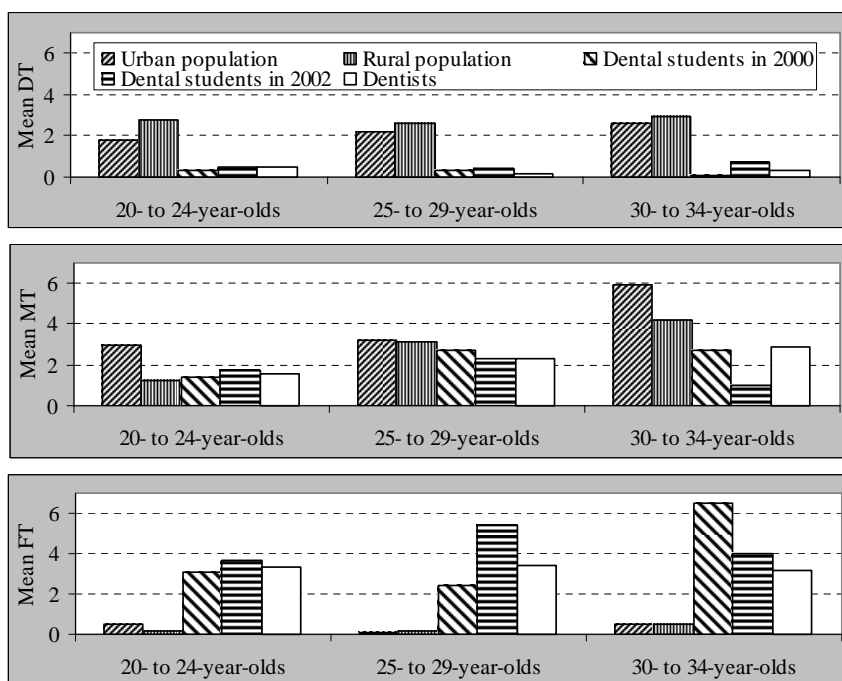
Figure 7: Comparison of mean numbers of DMFT of Mongolian dental students in 2000 (n=79) and in 2002 (n=73) and dentists (n=135) with those of their urban (n=171) rural (n=286) counterparts in the population, by age group



Comparison of mean DMFT by Tukey test between dental students in 2000 and in 2002 and dentists, one group at time, vs. their urban and rural counterparts, separately, by age group: $p>0.05$ for all age groups

When DMFT components were separately compared in the same age groups, mean numbers of DT were statistically significantly ($p<0.05$) smaller than those of both their urban and rural counterparts, whereas those of FT were notably ($p<0.05$) greater (Figure 8). Dentists 35 years or older had much smaller mean DMFT, DT, and MT but much greater mean FT (V).

Figure 8: Comparison of mean numbers of DT, MT, and FT of Mongolian dental students in 2000 (n=79) and in 2002 (n=73) and dentists (n=135) with those of their urban (n=171) and rural (n=286) counterparts in the general population, by age group



Comparison of mean DT and FT by Tukey test between dental students in 2000 and in 2002 and dentists, one group at a time, vs. urban and rural counterparts, separately, by age group: $p < 0.05$ in all age groups.

5.5. What oral health outcomes have Mongolian dentists achieved for their own children? (VI)

5.5.1. Oral health and related factors among dentists' children

Concerning the dental health of these dentists' children, mean number of dmft of 6-year-olds was 2.6 (SD=3.4) and mean DMFT of 12-year-olds 1.0 (SD=1.3). The younger the children, the higher was their total caries experience as the sum of their DMFT+dmft scores ($r = -0.22$; $p = 0.01$) (VI). Dentists' children aged from 3 to 7 years were more likely to have higher rates of caries experience ($p = 0.005$, OR=2.4, 95%CI 1.3-4.3) than did those aged 8 to 13. Within each of these two age groups, no statistically significant differences appeared in children's dental health by dentist-parents' background and work-related factors (VI).

Of all the children, 50% were caries free (DT=0), with the percentage of those free of caries highest at age 13 and lowest at age 7 years (VI). Half of the children with primary dentition, 38% of those with mixed dentition, and 66% of those with permanent dentition were caries free, whereas the respective percentages for those free of untreated caries were 67%, 81%, and 93%, respectively. When dental health outcome (DT=0) was associated with selected parameters, age of the children was the best explaining factor (Table 15), the older children being more likely to be free of DT. “Never gingival bleeding” was reported in 86% of the children. A model similar to the previous one with the same selected factors for gingival health showed that child’s age was the only significant factor ($p=0.045$, $OR=0.9$, $95\%CI\ 0.8-1.0$), the older children being more likely to have never experienced gingival bleeding.

Table 15: Association of Mongolian dentists’ children’s (n=208) dental health (DT=0) with child’s age and selected parameters related to their dentist-parents, by means of logistic model and corresponding odds ratios (OR)

Parameters	Being free of DT				
	ES ¹	SE ²	p	OR ³	95%CI
Age of a child	-0.233	0.063	0.000	0.8	0.7-0.9
Dentist-parents’ preventive knowledge	-0.036	0.034	0.289	1.0	0.9-1.0
Preventive orientation	0.132	0.202	0.513	1.1	0.8-1.7
Preventive measures	-0.020	0.126	0.871	1.0	0.8-1.3
Constant	1.471	1.580			

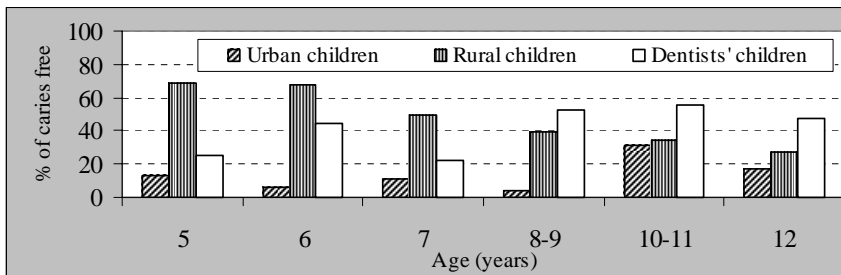
Goodness-of-fit test (Hosmer-Lemeshow) significance $p>0.05$ for each model;

¹ estimate of strength; ² standard error; ³ odds ratios; statistically significant p-values in bold ($p<0.05$)

5.5.2. Comparison of the dentists’ children’s dental health with that of their population counterparts

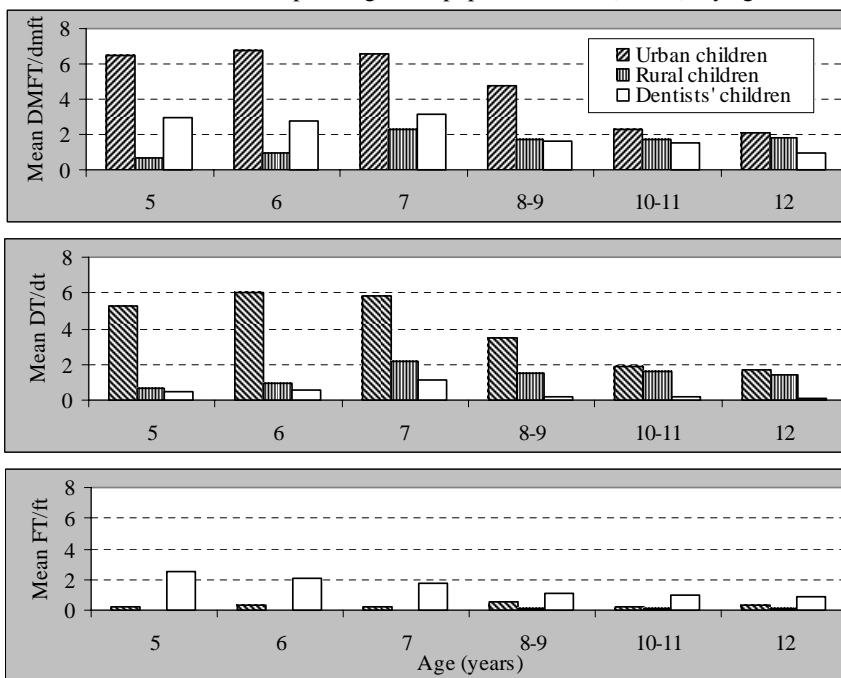
Urban dentists’ children were more likely to be free of caries in all age groups, compared to their urban counterparts at a general population level ($p<0.05$, except for those aged 5 and 7 years) (Figure 9). Mean numbers of DMFT/dmft ($p<0.05$, except 10- to 12-year-olds) and DT/dt ($p<0.05$ for all age groups) among the dentists’ children were lower than among their urban counterparts, whereas that of FT/ft ($p<0.05$ for all age groups) was much higher (VI, Figure 10).

Figure 9: Percentages of those caries-free among dentists' children (n=140) compared to their urban and rural counterparts at general population level (n=460), by age



Comparison of percentages of caries-free children by chi-square test between dentists' children vs. their urban and rural counterparts, one group at time (df=1), by age group: $p < 0.05$ except for urban 5- and 7-year-olds and for rural 6-, 8- to 9- and 12-year-olds vs. dentists' children

Figure 10: Mean numbers of DMFT/dmft, D/d teeth, and F/f teeth among Mongolian dentists' children (n=140) compared to their urban and rural counterparts a general population level (n=460), by age



Comparison of mean DMFT/dmft, DT/dt and FT/ft by Dunnett t-test between dentists' children (reference group) and their urban and rural population counterparts, one group at a time, by age group: $p < 0.05$ for mean DMFT of urban children 5- to 9 years old, for mean DT of urban children in all age groups and rural 8- to 12-year-olds, and for mean FT with both urban and rural children at all ages vs. dentists' children

6. Discussion

6.1. Results of the study

6.1.1. Study hypotheses

The findings of this study strongly support all of the hypotheses. Dental professionals' preventive knowledge of or self-perceived competency in carrying out preventive measures was a significant determinant for their achieving the recommended level of oral self-care. The dental professionals and dentists' children enjoyed better dental health than did their population counterparts. Those dental students with a better knowledge of or perceiving themselves as more competent in preventive dentistry were more likely to apply different caries-preventive measures to their patients. Such dentists were also more likely to provide appropriate preventive care to their own children and to be engaged in continuing education courses on preventive dentistry.

6.1.2. Preventive practice of Mongolian dental professionals

An encouraging result was that recommendations or advice on individual-active measures were given more frequently than were dental professional-active ones by Mongolian dental professionals. This is parallel to that reported for Swedish dentists (Wang, 1998) and Yorkshire GDPs (Roshan et al., 2003). Recently graduated dentists in Finland also reported individual-active measures as the most important for caries prevention (Vehkalahti & Widström, 2004). But a study on Finnish dentists' real-life decisions as to mode of preventive treatment showed that adolescents and young adults attending the public health service during 1994 to 1996 more frequently received dental professional-active measures than individual-active ones (Helminen et al., 1999). The limited practice of professional-active measures in Mongolia may in part be due to a lack either of caries-preventive agents used for this type of measures or lack of appreciation of and training in the use of these measures as part of comprehensive care for patients. This suggests a need for adoption of available and effective professional-active preventive measures in undergraduate and continuing education programmes and clinical practice in Mongolia.

In general, the use of preventive measures by the dental professionals was positively associated with their professional preventive knowledge of and/or self-perceived competency in preventive dentistry, coinciding with the aim of their professional education. However, frequent practice of applying topical fluoride and placing sealants was not related to better knowledge of these measures among the students. This may indicate that the use of preventive measures in practice is determined by a complex interaction between dentist and patient and the operating environment (Helminen et al., 1999). A gap between practice in and knowledge of some aspects of prevention has

been reported for Ontario dentists, in Canada (Lewis & Main, 1996) and for dentists in Michigan, in the USA, even after educational intervention (Lang et al., 1991).

Use of preventive measures among Mongolian dentists did not vary by their work-related backgrounds, the opposite of a finding among dentists in Texas where recent graduates more frequently practised preventive measures than did their counterparts graduated earlier (Chen, 1990). This may reflect the fact that the content of and appreciation of preventive dentistry within the Mongolian dental curriculum remains without major changes since its establishment.

6.1.3. Professional preventive knowledge of Mongolian dental professionals

In general, the dental professionals were knowledgeable in preventive matters. Most of them agreed as to the importance of fluoridated toothpaste for caries prevention, but a large proportion of them disagreed that fluoridated toothpaste is more important than brushing technique. This may reflect the fact that the current dental curriculum's overemphasis on the traditional preventive measures which focus on oral hygiene aspects of caries prevention. A similar overemphasis on traditional preventive measures has been reported for dentists in Korea (Moon et al., 1998b) and in Ontario, Canada (Lewis & Main, 1996).

There were also some inconsistencies in the knowledge of Mongolian dental professionals concerning the benefit of fluoridation of drinking water, fluoride tablets, and professionally applied topical fluorides for children living in non-fluoridated areas, and the preventive effects of sealants and xylitol. Therefore, a need exists for providing meaningful learning experiences to future and practicing dentists on modern preventive measures, since their preventive effects are beyond doubt (Seppä et al., 1995; Hayes, 2001; Peldyak & Mäkinen, 2002; Davies, 2003; Lynch & Milgrom, 2003; Marinho, 2003). An encouraging finding was the high level of Mongolian dental professionals' knowledge of the importance of plaque as an aetiological factor for gingivitis and the role of effective oral hygiene for its prevention and treatment.

Preventive knowledge between dental students and graduated dentists did not consistently differ, nor did dentists' overall preventive knowledge vary by their background factors, differing from earlier reports which have shown better knowledge among recently graduated dentists than among to their earlier graduated counterparts (Eijkman & de With, 1980; Chen, 1990; Moon et al., 1998b). These may indicate that even theoretical teaching in preventive dentistry at the Dental School has remained at the same level during all the years since its establishment.

6.1.4. Dentists' continuing education

Attendance at continuing education courses on preventive dentistry among Mongolian dentists was low. However, more dentists reported perceiving a need for such courses than reported having attended. This may suggest that available courses in preventive dentistry may be insufficient in number, calling for a need of organizing continuing education courses on a regular basis, based on dentists' needs. Low attendance at courses may suggest also that basic dental education could better prepare students for a lifelong learning process (Allen et al., 1994) to ensure the quality of care they provide in response to a rapidly developing science and a rapidly changing world. For this purpose, practising dentists' hindrances to keeping up-to-date should be studied in order to facilitate planning of continuing education programmes in Mongolia. In addition to attending formal courses, several other types of learning activities earlier found feasible could be encouraged, to facilitate dentists' life-long learning process. These include attending conferences and meetings, reading print media (Long et al., 1991), home study (Kuthy et al., 1996), distance-learning, and contact between dentists through meetings, visits, and study clubs (Rubenstein & Corbett, 1996).

6.1.5. Dental professionals' own tooth-brushing behaviour

The dental professionals were active in practicing oral self-care for themselves to prevent oral diseases. Among the students in 2002, the number of those reporting brushing their teeth "twice or more daily" and using fluoridated toothpaste "always or almost always" were even higher than in 2000. This indicates that oral hygiene behaviour is becoming a more desirable human behaviour in Mongolia than earlier. This trend may be due to increased numbers of mass media commercials regarding tooth-brushing and dentifrices.

Mongolian dental students' tooth-brushing frequency was as high as the reported frequency for French dental (Cavaillon et al., 1982) and Finnish university (Murtomaa et al., 1984) and dental students (Kolehmainen & Rytömaa, 1977; Laaksonen, 1996) in the 1970 to 1990s. Tooth-brushing frequency remained at the same level during Mongolian students' professional training, which may in part be due to the quite high (88%) frequency reported in the beginning of clinical training, allowing not much further increase.

Concerning Mongolian dentists' tooth-brushing frequency, the percentage of daily brushers was similar to that reported for lay adults in Germany, Japan, New Zealand, the USA, and Poland (Chen et al., 1997), the UK, (Kelly et al., 2000) and Finland (Murtomaa & Metsäniitty, 1994; Helakorpi et al., 2002). The gender difference in oral

hygiene habits—favouring women—reported in lay populations (Søgaard, 1986; Chen et al., 1997; Christensen et al., 2003) was not evident among Mongolian dental practitioners; their professional education apparently overcomes any such difference. Levelling of the gender difference in oral self-care among dental professionals has also been found among Japanese, Finnish, Chinese, Australian, Hong Kong, US, and Korean dental students (Kawamura et al., 1997; 2000; 2001; 2002). But female Greek dental students achieve better scores in the Dental Behaviour Inventory than do their male counterparts (Polychronopoulou et al., 2002).

6.1.6. Dental professionals' sugar-consumption behaviour

As dental professionals are typical of a certain population, they may follow any change in people's lifestyle due to system-level factors of society, for instance, the changing trend of the Mongolian general population's traditional way of living toward westernization. In other respects, dental professionals are atypical in that they belong to a captive group with scientifically sound knowledge on habits beneficial and harmful for oral health. They are therefore expected to be exemplars, for instance, in adopting healthier habits in consumption of sugar-containing food. Mongolian dental professionals' own sugar consumption between meals was high, parallel to dentists' infrequent restriction of sugar consumption for their own children. This may be explained by social and environmental determinants of oral health behaviour. On the other hand, absence of subsidized meals for schoolchildren and students, as well as none at work places may be influencing consumption of sugary snacks, which are cheap and accessible in an increasing number of private dining areas and kiosks at schools and work places.

Unexpectedly, the students' frequency of sugar-consumption remained unchanged after they went through professional education. This is contrary to the reduction in reported sugar ingestion among Finnish dental students in their last year compared to that reported when they were starting their clinical studies (Kolehmainen & Rytömaa, 1977).

There seems to be a great need for Mongolian dental education to emphasize the theoretical basis of the role of sugar for caries and behavioural aspects of oral diseases. Adoption of healthy food choices and sensible sugar use is generally recommended by international experts (WHO, 2003). These recommendations should be used as messages for the public by professionals who are promoters of prevention at various levels of society. To this end, inter-professional cooperation within the health-care field is needed. For instance, applying a common risk approach which promotes general health by controlling a small number of risk factors should be encouraged to have a major impact on a large number of diseases at a lower cost (Sheiham & Watt, 2000).

6.1.7. Dental health of dental professionals

There was no change in caries experience, expressed as DMFT score, of the Mongolian last-year dental students, compared to that reported when they were starting their clinical year. This differs from the increased DMFT scores due to increase in FT reported for dental students at Paris VII University after they went through clinical training (Cavaillon et al., 1982). Despite Mongolian dental students' increased mean numbers of FT, the unchanged DMFT score indicates that students got their existing carious cavities filled to meet their primary needs. After this, prevention and self-care may have shown its effectiveness among the students. Consequently, the FT component was the major contributor to total DMFT score among Mongolian dental students, corresponding with that revealed among their Australian, French, Finnish, and Spanish counterparts (Smales, 1974; Cavaillon et al., 1982; Laaksonen, 1996; Cortes et al., 2002).

Among dental students, there appeared changes in DMFT components that could not be revealed by DMFT index, such as decrease in DT and increase in FT. This may suggest that studies assessing differences and changes in dental health over time need sensitive indices which selectively weigh the components of DMFT. A number of such indices have been suggested (Sheiham et al., 1987; Carpay et al., 1988; Jakobsen & Hunt, 1990; Clarkson et al., 1998; Schuller & Holst, 2001), but not adopted into common use as yet.

The similar level of total caries experience (DMFT score) among Mongolian dental professionals and their population counterparts in younger age groups may be explained by the fact that most caries experience had already occurred before the students entered professional dental education, which then could have positively influenced their oral health.

On the other hand, Mongolian dentists' mean DMFT in older age groups was lower than that of their population counterparts of the same ages. This may partly be explained by their good access to preventive and curative care and due to better knowledge of and attitudes towards prevention, as well as to better oral self-care. Among Mongolian dentists aged 35 to 44 years, their mean DMFT (7.1) was even lower than that reported for the lay population in most Nordic and Western European countries and Australia (Petersen, 2003). This also may in part be due to the dentists' traditional lifestyle, which was dominant in their youth and is characterized by lower sugar consumption.

6.1.8. Gingival health of dental students

As expected, the dental students' gingival health improved markedly during their clinical years. This change coincides with that reported for Danish dental students (Lang et al., 1977). This can be seen as a positive and derived outcome of their professional training.

The percentage of students who reported being free of currently bleeding gums differed by study year among students in 2000, being in line with those found for Danish, Tunisian, and Finnish dental students (Lang et al., 1977; Ainamo & Ainamo, 1978; Howat et al., 1979). Among the students in 2002, the study year had no impact on their gingival health, in line with that found for their Indian counterparts (Ainamo & Ainamo, 1978).

6.1.9. Dental health of dentists' children

The dental health of dentists' children was better than that of their population counterparts in terms of percentages of those caries-free and of means for DT, agreeing with previous studies in Britain and Finland (Bradford & Crabb, 1961; Ainamo & Holmberg, 1974; Tala, 1983). This may be due to the promotive role of dentist-parents towards their children's oral health and a socio-economic class difference between the comparison groups.

Dentists' children in younger age groups had worse dental health than did those in older age groups. This may indicate that dentists do not appreciate the importance of the primary dentition, thus ignoring the infectious character of dental caries. The fact that dentists' children had as high caries experience as that seen among Mongolian urban-population children, especially among those with their primary dentition (Boldyn, 1993; NOHP, 1997), emphasizes the significance of social determinants of oral diseases.

Despite the differences in percentages of children free of dental caries, a similar level of DMFT among dentists' children and their counterparts in the general population, in older age-groups, may indicate that outcomes of preventive efforts reported by dentists for their own children had a minor effect on the children's dental health. Their efforts seemed to be more curative than preventive. This casts a shadow on dentists' preventive efforts and their implementation in reality for their children, and furthermore, for their patients.

6.2. Methodological aspects of the study

The almost 100% overall response rate of dentists and dental students in the present study guarantees that the subjects well represent the target population: urban dentists and clinical-year dental students in Mongolia.

A self-assessment questionnaire was used as a survey instrument for this study, since it is a quick, practical, and economical way of data collection (Pitiphat et al., 2002), especially among adult populations (Robinson et al., 1998), despite the fact that a tendency towards giving positive and socially accepted answers is always a concern (Palmqvist et al., 1991).

Studies of oral hygiene- and dietary-related behaviours rely heavily on self-reports (Kar & Berkanovic, 1987), despite diet interviews, dietary intake records, and 24-h recall all being recommended as more reliable tools (Holbrook, 1993; Thylstrup & Fejerskov, 1994). Self-reporting of dental health by lay people is of concern due to difficulties in understanding terminology and wording and in the subjects' possibly being unaware of their own oral health condition (Gilbert & Nuttall, 1999), leading to under- (Heløe, 1972; Könönen et al., 1986) or over-estimation of reality (Lahti et al., 1989; Arnbjerg et al., 1992). In this study, however, self-reporting of dental health can be expected to be valid and accurate, since the respondents were dental professionals. In addition, dental students are expected to be aware of their dental and periodontal status in detail due to dental check-ups as part of their clinical training, monitored by clinical teachers. This increases the reliability of their self-reported dental health. Moreover, to improve accuracy, a very simple method of recording dental health, one recommended by the World Health Organization (WHO, 1987a), was used. To increase the accuracy of dental health data, a tooth rather than a tooth surface served as the recording unit.

Cavitation level of caries, which is the interruption of enamel continuity and a softened cavity floor and walls, was served as a criterion for recording of dental decay. This was to ensure diagnostic consistency and to allow comparability of the dental health data with those of any other studies using this standard, including the NOHS in Mongolia. This was also to avoid over-estimation of treatment need among the present study subjects.

Regardless of different ways of returning the questionnaires due to practical reasons reflecting the transitional period of Mongolian society, the confidential and anonymous character of the questionnaires for data collection was maintained, increasing the validity and reliability of the self-reporting. The questionnaires included close-ended questions with several alternative answers in order also to improve the accuracy of

responses. Clinical examination of dental health of 25 dentists assessed the reliability of the self-reported data. As expected, the high kappa-value (0.78) exceeded those rates reported for agreement estimates for missing, replaced, and remaining teeth (Palmqvist et al., 1991; Axelsson & Helgadóttir, 1995), and removable denture wearing (Unell et al., 1997) among lay adults. Most disagreement was due to the fact that a few dentists confused the site of teeth: right molars being reported as left molars. However, these influence neither the dental health indices nor the results of this study, since dental health data was handled at individual level, not at tooth level.

For comparison of the dental health of dental professionals and dentists' children with that of their population counterparts, it would be ideal if data on the reference group came from exactly the same time-point. But because surveying population oral health was beyond the aim and resources of the present study, data from NOHS (1996), the most recent nationwide study among the Mongolian population, served this purpose. For this kind of comparison, two aspects must be taken into account. The first, perhaps the most important, is the effect of professional training on their and their children's oral health, and the second is the socio-economic class difference. The population counterparts, as a representative sample of the general population, are a mix of all social classes, but dental students seem to be recruited, at least in developed countries, from the upper social classes (Curson & Manson, 1965; Vigild & Schwarz, 2001).

It was gratifying to receive free-formulated (additional) comments from one quarter of the dentists. They enthusiastically expressed a need for organizing preventively orientated dental care in Mongolia. Some dentists provided encouraging motivation for this study by highlighting the importance of both research and prevention. The unexpectedly high number of free-formulated responses can be considered an indication of dentists' sincere attitudes towards the study, resulting in reliable data.

For statistical evaluation, Tukey's Honestly Significant Difference (HSD) test (Munro, 2001) served for comparisons of dental health indicators of the dental students and dentists with that of their population counterparts. It is an appropriate test when there are more than three comparison groups and the number of subjects in each group differs. The Dunnett t-test served for comparisons of means between dental health indicators of dentists' children and their population counterparts, because this test is proper when there is a single reference group tested against others. For binary outcomes, a logistic regression model was applied to indicate the strength of each explanatory factor, simultaneously controlling for the effects of the other factors included in the analysis, whereas a linear regression model served to explain the individual variation in continuous outcomes by a sum of the explanatory factors (Bulman & Osborn, 1989; Altman, 1997).

7. Conclusions

1. Preventive dentistry in Mongolia seems to be in its developmental phase, with room for improvement. Dental professionals need to make full use of preventive rather than curative approaches, to achieve better oral health outcomes for their patients, their own children, and for themselves. This would potentially be further reflected as improvement in the oral health of the Mongolian population.
2. There is room for improvement in the use of scientifically proven modern preventive measures by Mongolian dental professionals, especially concerning various forms of fluoride and sealant use.
3. Preventive knowledge of dental professionals needs improvement, especially concerning the role of sugar in caries and the preventive effects of fluorides, xylitol, and sealants.
4. Oral hygiene and dietary habits of dental professionals need improvement through integration of behavioural science subjects into the dental curriculum and emphasis on social and environmental determinants of health behaviour.

8. Recommendations

8.1. Recommendations at the administrative level:

- The use of preventive measures should be recommended among dentist's daily duties, integrating them as part of the comprehensive oral health care of patients.
- Continuing professional education should be supported to facilitate the life-long learning of dentists.
- Creating an oral surveillance system would be a tool to assess oral health needs and monitor implementation of oral health strategies in the rapidly-changing circumstances in Mongolia.
- An inter-professional approach in prevention should be applied, utilizing a common risk factor strategy.

8.2. Recommendations at the dental educational level:

- The content of and emphasis on preventive dentistry should be increased in the current dental curriculum and in continuing education programmes in order to help the learning environment to support adoption of preventive measures
- Basic dental education should integrate behavioural science subjects into its training curriculum and prepare dental students for life-long learning.
- In training of dental professionals, outcomes of oral health care—especially of preventive approaches—should be emphasized, rather than procedures.
- Research should be encouraged on strategies designed to gain more widespread individual, professional, and community adoption of preventive measures.

9. Summary

Changing circumstances due to socio-economic transition, health care reforms, and people's "modernizing" lifestyle in Mongolia require dental education to respond, setting new goals to meet the changing demands and needs of the population.

The aim of this study was to investigate preventive dentistry in Mongolia by assessing practicing and future dental practitioners' professional preventive practice, knowledge, and self-perceived competency, oral self-care, and oral health outcomes. The hypothesis was that those dental professionals with better knowledge of or perceiving themselves as more competent in preventive dentistry are practicing appropriate oral self-care for themselves, enjoying good oral health, and providing appropriate preventive care for their patients and their own children. The assumption of this study was that proper training in preventive dentistry facilitates professionals' use of prevention for benefit of themselves and their own children, patients, and the population.

A questionnaire-based survey was conducted among dentists practising in Ulaanbaatar in the year 2000 and among clinical-year dental students in 2000 and 2002 at the Dental School of the Mongolian National Medical University. Different questionnaires for dentists and dental students were used for data collection after formulation and pre-testing. Questionnaires collected personal data inquiring as to year of birth, gender, working experience, educational background, and characteristics related to their current professional study or work. Respondents' oral hygiene and dietary behaviours as well as dentists' use of oral health services were assessed by questions with multiple-choice answers. A dentigram with ready-given codes for dental health and questions on gingival bleeding experience and tooth-mobility were included for oral health. Self-perceived competency and preventive orientation, knowledge, and practice of the respondents were assessed by means of a four- or five-point scale. Dentists' continuing education activity was asked about in a separate section. Each dentists' questionnaire included three copies of the "Questionnaire concerning dentists' children aged 3 to 13" to be answered by each dentist-parent to survey preventive measures used for each child and to report on the child's oral health. The response rate was 98% for dentists (n=245) and 100% for students in 2000 (n=79) and 96% in 2002 (n=73). Mean age of the students was 23 years in both survey years and that of dentists 35. Of all dentists, 146 reported data on their children aged 3 to 13 years (n=204).

Cross-sectional and longitudinal designs were applied. Cross-sectional between-cohort comparisons assessed changes due to a time effect, and longitudinal within-cohort comparisons assessed changes due to effect of professional education. Both were carried out for students' preventive practice and knowledge, self-perceived competency, and oral self care. A cross-sectional design was used for dentists' and their children's data.

As hypothesized, the dental professionals' preventive knowledge of or self-perceived competency in carrying out preventive measures was a significant determinant for achieving the recommended level of oral self-care for themselves. They enjoyed better dental health than did their population counterparts. Those dental students with better knowledge and perceiving themselves as more competent were more likely to make use of preventive dentistry for the benefit of their patients. Such dentists also were more likely to make use of

prevention for the benefit of their own children, and potentially for their patients, and to be engaged in continuing education courses in preventive dentistry.

An encouraging finding was that the dental professionals were knowledgeable as to the importance of the use of fluoridated toothpaste for caries prevention and of oral hygiene measures for prevention of caries and gingivitis. However, their knowledge concerning benefits of fluoridation of drinking water, fluoride tablets, professionally-applied topical fluorides, xylitol, and sealants was deficient. Parallel to this, the dental students' and dentists' practice regarding the use of fluoridated compounds and sealants for their patients or their own children was low. This indicates a need for supporting the use of professional-active measures in their undergraduate curriculum and in continuing education programmes.

The dental professionals' consumption of sugar between meals was surprisingly high, parallel to dentists' infrequent restriction of sugar consumption for their own children. This may result from the fact that the sugar consumption of the population of Mongolia, especially in urban areas, is increasing tremendously, due to the changing lifestyle. This finding suggests that dental education should focus more on social and environmental determinants and behavioural aspects of adoption of healthy food choices and sensible use of sugar. Interdisciplinary collaboration based on a common risk factor strategy of health promotion is needed.

The dental professionals' having better dental health than their population counterparts, in terms of DT and FT, is perhaps explained by their better knowledge of and attitude towards oral health, due to their professional training. Dentists' children also had better dental health than did their population counterparts, a fact probably explained by their dentist-parents' role in promoting their oral health. However, dentists' children in younger age groups had worse dental health than those in older age groups, the importance of the primary dentition and the infectious character of dental caries perhaps both being ignored the dentists. In addition, in older age groups, dentists' children's dental health was similar to that of their population counterparts in terms of mean DMFT. This places in doubt the effect of preventive and curative efforts of the dentists for their own children and, furthermore, for their patients.

Based on the findings of this study, it can be concluded that there is a need for improvement in Mongolian dental professionals' use of preventive dentistry for the benefit of themselves and for their own children and patients. For this task, the undergraduate curriculum and continuing education programmes should place more focus than earlier on preventive care with especial emphasis on outcomes rather than the procedures of preventive measures. Dental education should support the learning environment for preventive dentistry to facilitate individual, professional, and community use of preventive measures. Recommendations at the administrative level, such as integrating preventive care in each dentist's daily duties, supporting the life-long learning of dentists, and creating an oral surveillance system for oral health may promote the adoption and more widespread use of prevention in oral health care in Mongolia.

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I dedicate this work to my entire family with my love and devotion and to all the Mongolian children for the better future of my country.

A handwritten signature in cursive script, appearing to read 'Battsetseg Tseveenjav'.

Battsetseg Tseveenjav

Helsinki

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11. References

- Ainamo A, Ainamo J. Development of oral health during dental studies in India and Finland. *Int Dent J* 1978;24:427-433.
- Ainamo J, Holmberg SM. The oral health of children of dentists. *Scan J Dent Res* 1974;82:547-551.
- Albert D, Ward A, Ahluwalia K, Sadowsky D. Addressing tobacco in managed care: a survey of dentists' knowledge, attitude, and behaviours. *Am J Public Health* 2002;92:997-1001.
- Allard RH. Tobacco and oral health: attitudes and opinions of European dentists; a report of the EU working group on tobacco and oral health. *Int Dent J* 2000;50:99-102.
- Allen DL, Caffesse RG, Bornerand M, Frame JW, Heyboer A. Participatory continuing education. *Int Dent J* 1994;44:511-519.
- Altman DG. *Practical Statistics for Medical Research*. London: Chapman & Hall, 1997. pp 336-350.
- American Academy of Paediatric Dentistry. Reference manual 2001-2002. *Pediatric Dentistry* 2001;23(Suppl):10-14.
- American Dental Association. Wake up to prevention for the smile of a lifetime. Guide to dental health. *J Am Dent Assoc* 1988;116(Special 5):3G:6-13.
- Anusavice KJ. Treatment regimens in preventive and restorative dentistry. *J Am Dent Assoc* 1995;126:727-743.
- Arnbjerg D, Söderfeldt B, Palmqvist S. Correction of self-assessment of dental condition. *Community Dent Oral Epidemiol* 1992;20:322-325.
- Axelsson P, Lindhe J, Nystrom B. On the prevention of caries and periodontal disease. Results of a 15-year longitudinal study in adults. *J Clin Periodontol* 1991;18:182-189.
- Axelsson G, Helgadottir S. Comparison of oral health data from self-administered questionnaire and clinical examination. *Community Dent Oral Epidemiol* 1995;23:365-368.
- Bader JD, Sams DH, O'Neil EH. Estimates of the effects of a statewide sealant initiative on dentists' knowledge and attitudes. *J Public Health Dent* 1987;47:186-192.
- Batchelor P, Sheiham A. The limitations of a "high-risk" approach for the prevention of dental caries. *Community Dent Oral Epidemiol* 2002;30:302-312.
- Beltran-Aguilar ED, Goldstein JW, Lockwood SA. Fluoride varnishes. A review of their clinical use, cariostatic mechanism, efficacy and safety. *J Am Dent Assoc* 2000;131:589-596.
- Bian JY, Wang WH, Wang WJ, Rong WS, Lo ECM. Effect of fluoridated milk on caries in primary teeth: 21-months results. *Community Dent Oral Epidemiol* 2003;31:241-245.
- Bjarnason S. High caries levels: problems still to be tackled. *Acta Odontol Scand* 1998;56:176-178.
- Blinkhorn AS. Dental health education: what lessons have we ignored? *Br Dent J* 1998;18:58-59.
- Boldyn O. *Orale Gesundheitszustand bei Mongolischen Kindern und Empfehlungen zur Optimierung des Zahnärztlichen Betreuungs-system [Mongolian children's and youth's oral health state and optimizing oral health care]* (In German). Erfurt: Medical Dissertation. 1993.
- Bowling A. *Research methods in health*. Philadelphia: Open University Press, 1998. pp.255-259.
- Bradford EW, Crabb HSM. Carbohydrate restriction and caries incidence. *Br Dent J* 1961;111:273-279.
- Brambilla E. Fluoride – Is it capable of fighting old and new dental diseases? *Caries Res* 2001;35(Suppl 1):6-9.
- Bratthall D, Peterson HG, Sundberg H. Reasons for the caries decline: what do the experts believe? *Eur J Oral Sci* 1996;104:416-422.
- Brennan DS, Spencer AJ, Szuster FSP. Service provision trends between 1983-84 and 1993-94 in Australian private general practice. *Aust Dent J* 1998;43:331-336.
- Brennan DS, Spencer AJ. Provision of diagnostic and preventive services in general dental practice. *Community Dent Health* 2003;20:5-10.
- Brunelle JA, Carlos JP. Recent trends in dental caries in U.S. children and the effect of water fluoridation. *J Dent Res* 1990;69 (Special issue):723-727.
- Bulman JS, Osborn JS. *Statistics in Dentistry*. London: BDJ books, 1989. pp. 58-106.
- Burt BA, Eklund SA, Morgan KJ, Larkin FE, Guire KE, Brown LO, Weintraub JA. The effects of sugar intake and frequency of ingestion on dental caries increment in a three-year longitudinal study. *J Dent Res* 1988; 67:1422-1429.
- Burt BA. Relative consumption of sucrose and other sugars: Has it been a factor in reducing caries experience? *Caries Res* 1993;27(Suppl 1):56-63.
- Burt BA, Szpunar SM. The Michigan study: the relationship between sugars intake and dental caries over three years. *Int Dent J* 1994;44:230-240.
- Burt BA. Prevention policies in the light of the changed distribution of dental caries. *Acta Odontol Scand* 1998;56:179-186.
- Carpay JJ, Nieman FH, Konig KG, Felling AJ, Lammers JG. The dental condition of Dutch schoolchildren assessed by a new dental health index. *Community Dent Health* 1988;5:231-241.
- Cavaillon J-P, Conge M, Mirisch D, Nemeth T, Sitbon J-M. Longitudinal study on oral health of dental students at Paris VII University. *Community Dent Oral Epidemiol* 1982;10:137-143.
- Chen M-S. Preventive dentistry in Texas, USA. *Community Dent Oral Epidemiol* 1990;18:239-243.

- Chen M, Andersen RM, Barmes DE et al. Comparing oral health systems: A second international collaborative study. Geneva: WHO, 1997. pp. 179-196.
- Chovanec GK, Majerus GJ, Duffy MB, Bernet JK, Frazier PJ, Newell KJ. Dental hygienists' knowledge and opinions about fluorides and fluoridation. *J Public Health Dent* 1990;50:227-234.
- Christensen LB, Petersen PE, Krstrup U, Kjølter. Self-reported oral hygiene practices among adults in Denmark. *Community Dent Health* 2003;20:229-235.
- Ciancio S. Improving oral health: current considerations. *J Clin Periodontol* 2003;30(Suppl 5):4-6.
- Cirino SM, Scantlebury S. Dental caries in developing countries. *N Y State Dent J* 1998;64:32-39.
- Clarkson JE, Worthington HV, Holloway PJ. Development of a classification and index of dental treatment experience for adults. *Community Dent Health* 1998;15:168-174.
- Clover K, Hazell T, Stanbridge V, Sanson-Fisher R. Dentists' attitudes and practice regarding smoking. *Aust Dent J* 1999;44:46-50.
- Cortes FJ, Nevot C, Ramon JM, Cuenca E. The evolution of dental health in dental students at the University of Barcelona. *J Dent Educ* 2002;66:1203-1208.
- Curson I, Manson JD. A study of a group of dental students, including their diet and dental health. *Br Dent J* 1965;7:197-205.
- Daly B, Watt R, Batchelor P, Treasure E. Sugar and caries prevention. In Daly et al., *Essential Dental Public Health*. Oxford: Oxford University Press 2002, pp. 183-196.
- Davies RM. The prevention of dental caries and periodontal disease from the cradle to the grave: what is the best available evidence? *Dental Update* 2003;30:170-179.
- Diehnelt DE, Kiyak HA. Socioeconomic factors that affect international caries levels. *Community Dent Oral Epidemiol* 2001;29:226-233.
- Donly KJ. Fluoride varnishes. *J Calif Dent Assoc* 2003;31:217-219.
- Downer MC. The caries decline. A comment in light of the UK experience. *Eur J Oral Sci* 1996;104:433-435.
- Eijkman MAJ, de With C. Answers from dentists, dental hygienists and dental assistants to questions asked by patients concerning preventive dental matters. *Community Dent Oral Epidemiol* 1980;8:339-346.
- Elderton RJ. Six-monthly examinations for dental caries. *Br Dent J* 1985;158:370-374.
- FDI Commission. Mouthrinses and dental caries. *Int Dent J* 2002a;52:337-345.
- FDI Commission. Mouthrinses and periodontal disease. *Int Dent J* 2002b;52:346-352.
- von der Fehr FR. Caries prevalence in the Nordic countries. *Int Dent J* 1994;44:403-413.
- Fejerskov O. Strategies in the design of preventive programs. *Adv Dent Res* 1995;9:82-88.
- Forss H. Efficiency of fluoride programs in the light of reduced caries levels in young populations. *Acta Odontol Scand* 1999;57:348-351.
- Frazier PJ. Fluoridation: a review of social research. *J Public Health Dent* 1980;40:214-233.
- Frazier PJ. Public health education and promotion for caries prevention: The role of dental schools. *J Public Health Dent* 1983;43:28-42.
- Freeman R. The determinants of dental health attitudes and behaviour. *Br Dent J* 1999;187:15-18.
- Frenkel H, Harvey I, Needs K. Oral health care education and its effect on caregivers' knowledge and attitudes: a randomised controlled trial. *Community Dent Oral Epidemiol* 2002;30:91-100.
- Gift HC. Prevention of oral diseases. *Curr Opin Dent* 1991;1:337-347.
- Gift HC, Corbin SB, Nowjack-Raymer RE. Public knowledge of prevention of dental disease. *Public Health Rep* 1994;109:397-404.
- Gilbert AD, Nuttall NM. Self-reporting of periodontal health status. *Br Dent J* 1999;186:241-244.
- Gillcrist JA, Brumley DE, Blackford JU. Community socioeconomic status and children's dental health. *J Am Dent Assoc*. 2001;132:216-222.
- Gonzalez CD, Frazier PJ, Messer LB. Sealant knowledge and use by pediatric dentists: 1987 Minnesota survey. *J Dent Child* 1988;55:434-440.
- Gonzalez CD, Frazier PJ, Messer LB. Sealant use by general practitioners: a Minnesota survey. *J Dent Child* 1991;58:38-45.
- Griffin SO, Griffin PM, Gooch BF, Barker LK. Comparing the costs of three sealant delivery strategies. *J Dent Res* 2002;81:641-645.
- Gustafsson BE, Quensel CE, Lanke LS, Lundquist C, Grahnen H, Bonow BE, Krasse B. The Vipeholm Dental Caries Study. The effect of different levels of carbohydrate intake on caries activity in 436 individuals observed for five years. *Acta Odontol Scand* 1954;11:232-364.
- Gyurkovics C, Zimmermann P, Hadas E, Bánóczy J. Effect of fluoridated milk on caries: 10-year results. *J Clin Dent* 1992;3:121-124.
- Hausen H, Kärkkäinen S, Seppä L. Application of the high-risk strategy to control dental caries. *Community Dent Oral Epidemiol* 2000;28:26-34.
- Hayes C. The effect of non-cariogenic sweeteners on the prevention of dental caries: A review of the evidence. *J Dent Educ* 2001;65:1106-1109.

- Heanue M, Deacon SA, Deery C, Robinson PG, Walmsley AD, Worthington HV, Shaw WC. Manual versus powered tooth-brushing for oral health. *Cochrane Database Syst Rev* 2003;2:Oxford: Update Software.
- Heasman PA, McCracken GI, Steen N. Supportive periodontal care: the effect of periodic subgingival debridement compared with supragingival prophylaxis with respect to clinical outcomes. *J Clin Periodontol* 2002;29(Suppl 3):163-172.
- Helakorpi S, Patja K, Prättälä R, Aro AR, Uutela A. Health behaviour and health among Finnish Adult Population, Spring 2002. Helsinki: Publication of the National Public Health Institute. B12/2002; 2002. p.60-3.
- Helminen SE, Vehkalahti M, Lammi R, Ketomäki TM, Murtomaa H. Dentists' decisions as to mode of preventive treatment in adolescents and young adults in Finland. *Community Dent Health* 1999;16:250-255.
- Helminen SKJ, Vehkalahti MM. Does caries prevention correspond to caries status and orthodontic care in 0- to 18-year-olds in the free public dental service? *Acta Odontol Scand* 2003;61:29-33.
- Helsinki City Health Department. Instructions for preventive treatment in municipal dental clinics (circular). Finland: 1985.
- Heløe LA. Comparison of dental health data obtained from questionnaires, interviews and clinical examination. *Scand J Dent Res* 1972;80:495-499.
- Hescot P, Roland E, Desfontaine J. Fluoridated salt in France. *Adv Dent Res* 1995;9:144-145.
- Hindle D, O'Rourke M, Batsuury R, Orgil B. Privatising general practice in Mongolia: A trail of need-adjusted capitation. *Aust Health Rev* 1999;22:27-43.
- Hjern A, Grindefjord M, Sundberg H, Rosén M. Social inequality in oral health and use of dental care in Sweden. *Community Dent Oral Epidemiol* 2001;29:167-174.
- Hjorting-Hansen E. The future dental educational process. *J Dent Educ* 1996;60:778-782.
- Holbrook WP. Dental caries and cariogenic factors in pre-school urban Icelandic children. *Caries Res* 1993;27:431-437.
- Holbrook WP, Arnadottir IB, Tkakzoe I, Birkhed D, Frostell G. Longitudinal study of caries, cariogenic bacteria and diet in children just before and after starting school. *Eur J Oral Sci* 1995;103:42-45.
- Holt RD. Foods and drinks at four daily time intervals in a group of young children. *Br Dent J* 1991;170:137-143.
- Honkala E, Nyyssönen V, Knuutila M, Markkanen H. Effectiveness of children's habitual tooth-brushing. *J Clin Periodontol* 1986;13:81-85.
- Honkala E. Oral health promotion with children and adolescents. In: Schou L & Blinkhorn AS. *Oral Health Promotion*. Oxford: Oxford University Press. 1993, pp. 169-176.
- Horowitz AM. The public's oral health: the gaps between what we know and what we practice. *Adv Dent Res* 1995;9:91-95.
- Hosmer DW, Lemeshow S. *Applied logistic regression*. New York: Wiley, 1989: pp.136-145.
- Howat A, Trabelsi I, Bradnock G. Oral hygiene levels and behaviour in pre-clinical and final-year dental students. *J Clin Periodontol* 1979;6:177-185.
- Idesh B. Ундны усны фтор, иодын эрүүл ахуйн үнэлгээ [Assessment of safe levels of fluoride and iodine in drinking water] (English summary). Thesis for Master of Science degree. National Medical University of Mongolia; 2001.
- Imfeld T. Efficacy of sweeteners and sugar substitutes in caries prevention. *Caries Res* 1993;27(Suppl 1):50-55.
- Inglehart M, Tedesco LA. Behavioural research related to oral hygiene practises: new century model of oral health promotion. *Periodontol* 2000 1995;8:15-23.
- Irigoyen ME, Szpunar SM. Dental caries status of 12-year-old students in the State of Mexico. *Community Dent Oral Epidemiol* 1994;22:311-314.
- Irigoyen ME, Maupome G, Mejia AM. Caries experience and treatment needs in a 6- to 12-year-old urban population in relation to socio-economic status. *Community Dent Health* 1999;16:245-249.
- Ismail AI, Tanzer JM, Dingle JL. Current trends of sugar consumption in developing societies. *Community Dent Oral Epidemiol* 1997;25:438-443.
- Isokangas P. Xylitol chewing gum in caries prevention: A longitudinal study on Finnish School children. PhD thesis, University of Turku; 1987.
- Jakobsen JR, Hunt RJ. Validation of oral status indicators. *Community Dent Health* 1990;7:279-284.
- Johansson I. Diet counselling and behavioural change. *Caries Res* 1993;27(Suppl 1):47-49.
- Johansson I, Birkhed D. Diet and the caries process. In Thylstrup A, Fejerskov O. *Textbook of clinical cariology*. Copenhagen: Munksgaard textbook. 1994, pp.283-299.
- John JH, Yudkin P, Murphy M, Ziebland S, Fowler GH. Smoking cessation interventions for dental patients-attitudes and reported practices of dentists in the Oxford region. *Br Dent J* 1997;183:359-364.
- John JH, Thomas D, Richards D. Smoking cessation interventions in the Oxford region: changes in dentists' attitudes and reported practices 1996-2001. *Br Dent J* 2003;195:270-275.
- Jokela J. Kariesriskin arviointi ja prevention kohdentaminen alle kouluikäisillä [Screening for high caries risk and targeted caries prevention in preschool-aged children] (English summary). PhD Thesis. University of Turku, Finland; 1997.
- Kar SB, Berkanovic E. Indicators of behaviour conducive to health promotion. In: *Measurement in health promotion and protection*. WHO Regional Publication, European Series No. 22. Copenhagen, 1987, pp.267-281.

- Kawamura M, Iwamoto Y, Wright FA. A comparison of self-reported dental health attitudes and behaviour between selected Japanese and Australian students. *J Dent Educ* 1997;61:354-360.
- Kawamura M, Honkala E, Widström E, Komabayashi T. Cross-cultural differences of self-reported oral health behaviour in Japanese and Finnish dental students. *Int Dent J* 2000;50:46-50.
- Kawamura M, Yip HK, Hu DY, Komabayashi T. A cross-cultural comparison of dental health attitudes and behaviour among freshman dental students in Japan, Hong Kong and West China. *Int Dent J* 2001;51:159-163.
- Kawamura M, Spadafora A, Kim KJ, Komabayashi T. Comparison of United States and Korean dental hygiene students using the Hiroshima university-dental behavioural inventory (HU-DBI). *Int Dent J* 2002;52:156-162.
- Kay EJ, Blinkhorn AS. A qualitative investigation of factors governing dentists' treatment philosophies. *Br Dent J* 1996;180:171-176.
- Kelly M, Steele J, Nuttall N, Bradnock G, Morris J, Nunn J, Pine C, Pitts N, Treasure E, White D. Adult dental health survey: Oral health in the United Kingdom 1998. London: The Stationery Office; 2000. pp. 13-15.
- Keogh T, Linden GJ. Knowledge, attitudes and behaviour in relation to dental health of adults in Belfast, Northern Ireland. *Community Dent Oral Epidemiol* 1991;19:246-248.
- Kim JB. What do the public and profession know about dental caries prevention in Korea? *Int Dent J* 1998;48:399-404.
- Klock B, Emilson CG, Lind SO, Gustavsdotter M, Olhede-Westerlund AM. Prediction of caries activity in children with today's low caries incidence. *Community Dent Oral Epidemiol* 1989;17:285-288.
- Kolehmainen L, Rytömaa I. Increment of dental caries among Finnish dental students during a period of 2 years. *Community Dent Oral Epidemiol* 1977;5:140-144.
- Kumar JV, Wadhawan S. Targeting dental sealants in school-based programs: evaluation of an approach. *Community Dent Oral Epidemiol* 2002;30:210-215.
- Kuthy RA, Bean TM, Mitchell GL. Characteristics of general dentists participating in home study courses. *J Dent Educ* 1996;60:686-92.
- Kuusela S, Honkala E, Kannas L, Tynjälä J, Wold B. Oral hygiene habits of 11-year-old schoolchildren in 22 European countries and Canada in 1993/1994. *J Dent Res* 1997;76:1602-1609.
- Källestål C, Wang NJ, Petersen PE, Arnadottir IB. Caries-preventive methods used for children and adolescents in Denmark, Iceland, Norway and Sweden. *Community Dent Oral Epidemiol* 1999;27:144-151.
- Kärkkäinen S, Seppä L, Hausen H. Dental check-up intervals and caries preventive measures received by adolescents in Finland. *Community Dent Health* 2001;18:157-161.
- König KG. Role of fluoride toothpaste in a caries-preventive strategy. *Caries Res* 1993;27(Suppl 1):23-28.
- Könönen M, Lipasti J, Murtooma H. Comparison of dental information obtained from self-examination and clinical examination. *Community Dent Oral Epidemiol* 1986;14:258-260.
- Künzel W. Systemic use of fluoride-other methods: Salt, sugar, milk, etc. *Caries Res* 1993;27(Suppl 1):16-22.
- Laaksonen P. Helsingin Yliopiston hammaslääkäri-opiskelijoiden hampaiden terveys ja terveystavat vuosina 1974-1994 [Dental health and oral health habits of dental students at the University of Helsinki from 1974 to 1994] (In Finnish). DDS thesis. University of Helsinki, Finland; 1996.
- Lachapelle D, Couture C, Brodeur J-M, Sevigny J. The effects of nutritional quality and frequency of consumption of sugary foods on dental caries increment. *Can J Public Health* 1990;81:370-375.
- Lahti S, Tuutti H, Honkala E. Comparison of numbers of remaining teeth from questionnaires and clinical examination. *Proc Finn Dent Soc* 1989;85:217-223.
- Lamberg M, Hausen H, Vartiainen T. Symptoms experienced during periods of actual and supposed water fluoridation. *Community Dent Oral Epidemiol* 1997;25:291-295.
- Lang NP, Cumming BR, Loe HA. Oral hygiene and gingival health in Danish dental students and faculty. *Community Dent Oral Epidemiol* 1977;5:237-242.
- Lang WP, Farghaly MM, Woolfolk MW, Ziemiecki TL, Faja BW. Educating dentists about fissure sealants: effects on knowledge, attitudes, and use. *J Public Health Dent* 1991;51:164-169.
- Lewis DW, Main PA. Ontario dentists' knowledge and beliefs about selected aspects of diagnosis, prevention and restorative dentistry. *J Can Dent Assoc* 1996;62:337-344.
- Lingström P, Holm AK, Mejáre I, Twetman S, Söder, B, Norlund A, Axelsson S, Lagerlöf F, Nordenram G, Petersson LG, Dahlgren H, Källestål C. Dietary factors in the prevention of dental caries: a systematic review. *Acta Odontol Scand* 2003;61:331-340.
- Locker D, Slade GD, Murray H. Epidemiology of periodontal disease among older adults: a review. *Periodontol* 2000 1998;16:16-33.
- Locker D. Deprivation and oral health: a review. *Community Dent Oral Epidemiol* 2000;28:161-169.
- Long AF, MacGregor AJ, Mercer PE. Updating practices among Yorkshire general dental practitioners. *Br Dent J* 1991;170:73-75.
- Lopez L, Berkowitz R, Spiekerman C, Weinstein P. Topical antimicrobial therapy in the prevention of early childhood caries: a follow-up report. *J Pediatr Dent* 2002;24:204-206.
- Lynch H, Milgrom P. Xylitol and dental caries: an overview for clinicians. *J Calif Dent Assoc* 2003;31:205-209.

- Main PA, Lewis DW, Hawkins RJ. A survey of general dentists in Ontario, Part I: Sealant use and knowledge. *J Can Dent Assoc* 1997;63:542-553.
- Manaseki S. Mongolia: a health system in transition. *Br Med J* 1993;307:1609-1611.
- Marinho VC, Higgins JP, Logan S, Sheiham A. Systematic review of controlled trials on the effectiveness of fluoride gels for the prevention of dental caries in children. *J Dent Educ* 2003;67:448-458.
- Markkula J, Murtomaa H, Ainamo J. Conceptions of Finnish people about the etiology and prevention of dental caries and periodontal disorders. *Community Dent Oral Epidemiol* 1977;5:108-115.
- Marthaler TM. Confidence limits of results of clinical tests with fluoride. *Caries Res* 1971;5:343-372.
- Marthaler TM. Changes in the prevalence of dental caries: How much can be attributed to changes in diet? *Caries Res* 1990;24:3-15.
- Marthaler TM, O'Mullane DM, Vrbic V. The prevalence of dental caries in Europe 1990-1995. *Caries Res* 1996;39:237-255.
- Marthaler TM. Successes and drawbacks in the caries-preventive use of fluoride – Lessons to be learned from history. *Oral Health Prev Dent* 2003;2:129-140.
- Marsh PD. Antimicrobial strategies in the prevention of dental caries. *Caries Res* 1993;27(Suppl 1):72-76.
- McCaul KD, Glasgow RE, Gustafson C. Predicting levels of preventive dental behaviors. *J Am Dent Assoc* 1985;111:601-605.
- Mejäre I, Lingström P, Petersson LG, Holm AK, Twetman S, Källestål C, Nordenram G, Lagerlöf F, Söder B, Norlund A, Axelsson S, Dahlgren H. Caries-preventive effect of fissure sealant: a systematic review. *Acta Odontol Scand* 2003;61:321-330.
- Mikami Y, Croucher R, Hector M. Knowledge and reported behaviour concerning the prevention of caries in children: a questionnaire survey of Japanese parents resident in London, UK. *Int Dent J* 1999;49:115-121.
- Mikami Y, Wakai S, Croucher R, Hector MP, Nakamura Y. Children's dental health: British expatriate residents in Tokyo, Japan. *Int Dent J* 2003;53:280-284.
- Milén A, Hausen H, Tala H, Heinonen OP. Dental health habits among pre-school non-participants in public dental care. *Community Dent Health* 1985;2:109-114.
- Moon HS, Jung JY, Horowitz AM, Ma DS, Paik DI. Korean dental hygienists' knowledge and opinions about etiology and prevention of dental caries. *Community Dent Oral Epidemiol* 1998a;26:296-302.
- Moon H, Paik D, Horowitz AM, Kim J. National survey of Korean dentists' knowledge and opinions: dental caries etiology and prevention. *J Public Health Dent* 1998b;58:51-56.
- Mulyani D, McIntyre J. Caris inhibitory effect of fluoridated sugar in a trail in Indonesia. *Aus Dent J* 2002;47:314-320.
- Mundorff SA, Featherstone JDB, Bibby BG, Curzon MEJ, Eisenberg AD, Espeland MA. Cariogenic potential of foods. I. Caries in the rat model. *Caries Res* 1990;24:344-355.
- Munro BH. Statistical methods for health care research., 4th ed. Philadelphia. Lippincott, 2001.
- Murtomaa H, Turtola L, Rytömaa I. Dental health practices among Finnish university students. *Proc Finn Dent Soc* 1984;80:155-161.
- Murtomaa H, Telivuo M. Preventive dentistry in private practice in Finland. *Proc Finn Dent Soc* 1988;42:199-203.
- Murtomaa H, Metsäniitty M. Trends in tooth-brushing and utilization of dental services in Finland. *Community Dent Oral Epidemiol* 1994;22:231-234.
- Murray JJ, Rugg-Gunn AJ, Jenkins GN. In: Fluorides and caries prevention, ed 3. Oxford, Butterworth-Heinemann, 1991.
- Murray JJ. Efficacy of preventive agents for dental caries. *Caries Res* 1993;27(Suppl 1):2-8.
- National Board of Health. Instructions on public oral health services for patients born after the year 1960. NBH regulation No 6/85. Finland, 1985.
- National Oral Health Policy of Mongolia. Ministry of Health and Social Welfare. Ulaanbaatar:1997. pp. 1-16.
- Okada M, Kawamura M, Miura K. Influence of oral health attitude of mothers on the gingival health of their school age children. *J Dent Child* 2001;68:379-383, 303.
- Okada M, Kawamura M, Kaihara Y, Matsuzaki Y, Kuwahara S, Ishidori H, Miura K. Influence of parents' oral health behaviour on oral health status of their school children: an exploratory study employing a causal modelling technique. *Int J Paediatr Dent* 2002;12:101-108.
- Ower P. The role of self-administered plaque control in the management of periodontal diseases: 2. Motivation, techniques and assessment. *Dent Update*. 2003;30:110-116.
- Palmqvist S, Söderfeldt B, Arnbjerg D. Self-assessment of dental condition: validity of a questionnaire. *Community Dent Oral Epidemiol* 1991;19:249-251.
- Park DY, Ma DS, Horowitz AM. Oral health education courses for university students: Why not? *J Pub Health Dent* 2004;64:3-4.
- Paulander J, Axelsson P, Lindhe J. Association between level of education and oral health status in 35-, 50-, 65- and 75-year-olds. *J Clin Periodontol* 2003;30:697-704.
- Peldyak J, Mäkinen KK. Xylitol for caries prevention. *J Dent Hyg* 2002;76:276-285.

- Petersen PE. Social inequalities in dental health. Towards a theoretical explanation. *Community Dent Oral Epidemiol* 1990;18:153-158.
- Petersen PE, Esheng Z. Dental caries and oral health behaviour situation of children, mothers and schoolteachers in Wuhan, People's Republic of China. *Int Dent J* 1998;48:210-216.
- Petersen PE, Torres AM. Preventive oral health care and health promotion provided for children and adolescents by the Municipal Dental Health Service I Denmark. *Int J Paed Dent* 1999; 9:81-91.
- Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century-the approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol* 2003;31(Suppl 1):3-24.
- Petersson LG. Fluoride mouthrinses and fluoride varnishes. *Caries Res* 1993;27(Suppl 1):35-42.
- Petersson GH, Bratthall D. The caries decline: a review of reviews. *Eur J Oral Sci* 1996;104:436-443.
- Pieniähäkkinen K, Jokela J. Clinical outcomes of risk-based caries prevention in preschool-aged children. *Community Dent Oral Epidemiol* 2002;30:143-150.
- Pilot T. The periodontal disease problem: A comparison between industrialised and developing countries. *Int Dent J* 1998;48(Suppl 1):221-232.
- Pitiphat W, Garcia RI, Douglass CW, Joshipura KJ. Validation of self-reported oral health measures. *J Public Health Dent* 2002;62:122-128.
- Polychronopoulou A, Kawamura M, Athanasouli T. Oral self-care behaviour among dental school students in Greece. *J Oral Sci* 2002;44:73-78.
- Rayant GA. Relationship between dental knowledge and tooth cleaning behavior. *Community Dent Oral Epidemiol* 1979;7:191-194.
- Reddy MS, Jeffcoat MK, Geurs NC, Palkanis KG, Weatherford TW, Traxler BM, Finkelman RD. Efficacy of controlled-release subgingival chlorhexidine to enhance periodontal regeneration. *J Periodontol* 2003;74:411-419.
- Reibel J. Tobacco and oral diseases. Update on the evidence, with recommendations. *Med Princ Pract* 2003;12(Suppl 1):22-32.
- Reisine S. The role of the decision maker in oral health promotion. In: Schou L & Blinkhorn AS. *Oral Health Promotion*. Oxford: Oxford University Press. 1993, pp.103-117.
- Riordan PJ, Widström E. Community dentistry in Nordic dental schools. *Community Dent Oral Epidemiol* 1984;2:351-354.
- Ripa LW. Sealants revisited: an update of the effectiveness of pit-and-fissure sealants. *Caries Res* 1993;27(Suppl 1):77-82.
- Roberts-Thomson KF, Spencer AJ. Public knowledge of the prevention of dental decay and gum diseases. *Aust Dent J* 1999;44:253-258.
- Robinson PG, Nadanovsky P, Sheiham A. Can questionnaires replace clinical surveys to assess dental treatment needs of adults? *J Public Health Dent* 1998; 58:250-253.
- Rose G. Sick individuals and sick populations. *Int J Epidemiol* 1985;14:32-38.
- Roshan D, Curzon ME, Fairpo CG. Changes in dentists' attitudes and practice in paediatric dentistry. *Eur J Paediatr Dent* 2003;4:21-27.
- Rozier RG. Effectiveness of methods used by dental professionals for the primary prevention of dental caries. *J Dent Educ* 2001;65:1063-1072.
- Rólla G, Øgaard B, Cruz R de A. Clinical effect and mechanism of cariostatic action of fluoride-containing toothpaste. A review. *Int Dent J* 1991;41:171-174.
- Rubenstein JR, Corbett SM. The study club as a continuing education format for training in implant dentistry. *J Dent Educ* 1996;60:297-301.
- Sakki TK, Knuutila MLE, Anttila SS. Lifestyle, gender and occupational status as determinants dental health behaviour. *J Clin Periodontol* 1998;25:566-570.
- Santos A. Evidence-based control of plaque and gingivitis. *J Clin Periodontol* 2003;30(Suppl 5):13-16.
- Scheinin A, Mäkinen KK, Ylitalo K. Turku sugar studies. V. Final report on the effect of sucrose, fructose, and xylitol diets on the caries incidence in man. *Acta Odontol Scand* 1976;34:179-216.
- Schou L. Behavioural aspects of dental plaque control measures: An oral health promotion perspective. In: Lang NP, Attström R, Löe H, eds. *Proceedings of the European Workshop on Mechanical Plaque Control*. Berlin: Quintessenz Verlag; 1998. pp. 286-309.
- Schuller AA, Holst D. Oral status indicators DMFT and FS-T: reflections on index selection. *Eur J Oral Sci* 2001;109:155-159.
- Schuller AA, Kalsbeek H. Effect of the routine professional application of topical fluoride on caries and treatment experience in adolescents of low-socio-economic status in the Netherlands. *Caries Res* 2003;37:172-177.
- Schwarz E. Is caries prevention cost effective? Does anybody care? *Acta Odontol Scand* 1998;56:187-192.
- Seppä L, Leppänen T, Hausen H. Fluoride varnish versus acidulated phosphate fluoride gel: a 3-year clinical trial. *Caries Res* 1995;29: 27-330.
- Seppä L, Kärkkäinen S, Hausen H. Caries in the primary dentition, after discontinuation of water fluoridation, among children receiving comprehensive dental care. *Community Dent Oral Epidemiol* 2000;28:281-288.
- Sheiham A. Changing trends in dental caries. *Int J Epidemiol* 1984;13:142-147.
- Sheiham A, Maizels J, Maizels A. New composite indicators of dental health. *Community Dent Health* 1987;4:407-414.

- Sheiham A, Joffe M. Public dental health strategies for identifying and controlling dental caries in high and low risk populations. In Johnson NW, ed. Risk markers for oral diseases. Volume 1. Dental caries. Markers of high and low risk groups and individuals. Cambridge: Cambridge University Press; 1991. pp. 445-481.
- Sheiham A, Watt RG. The common risk factor approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol* 2000;28:399-406.
- Sheiham A. Dietary effects on dental diseases. *Public Health Nutr* 2001;4:569-591.
- Siegal MD, Garcia AI, Kndray DP, Giljahn LK. The use of dental sealants by Ohio dentists. *J Public Health Dent* 1996;56:12-21.
- Simonsen RJ. Pit and fissure sealant: a review of the literature. *Pediatr Dent* 2002;24:393-414.
- Smales RJ. Dental health of junior dental students. *Aust Dent J* 1974;19:105-110.
- Soskolne WA, Proskin HM, Stabholz A. Probing depth changes following 2 years of periodontal maintenance therapy including adjunctive controlled release of chlorhexidine. *J Periodontol* 2003;74:420-427.
- Spencer AJ. An evidence-based approach to prevention of oral diseases. *Med Princ Pract* 2003;12(Suppl 1):3-11.
- Sreenivasan P, Gaffar A. Antiplaque biocides and bacterial resistance: a review. *J Clin Periodontol* 2002;29:965-974.
- Stephen KW. Systemic fluoride: Drops and tablets. *Caries Res* 1993;27(Suppl 1):9-15.
- Stephen KW, Macpherson LM, Gorzo I, Gilmour WH. Effect of fluoridated salt intake in infancy: a blind caries and fluorosis study in 8th grade Hungarian pupils. *Community Dent Oral Epidemiol* 1999;27:210-215.
- Stookey GK. Caries prevention. *J Dent Educ* 1998;62:803-811.
- Søgaard AJ. Present state of dental health knowledge, attitude and behaviour, and developmental trends in Scandinavia. In Gjermo P, editor. Promotion of oral-self care in oral health. Oslo: Dental Faculty; 1986. pp. 53-70.
- Søgaard AJ. Theories and models of health behaviour. In: Schou L & Blinkhorn AS. Oral Health Promotion. Oxford: Oxford University Press. 1993. pp. 25-57.
- Tala H. Dental caries of children, their parents' social status and knowledge of the prevention of the disease (English summary). PhD Thesis. University of Kuopio, Finland; 1983.
- Telivuo M, Murtomaa H. Preventive dentistry in private practice in Finland. *Proc Finn Dent Soc* 1988;84:183-190.
- Telivuo M, Vehkalahti M, Lahtinen A, Murtomaa H. Finnish dentists as tobacco counsellors. *Community Dent Oral Epidemiol* 1991;19:221-224.
- Telivuo M, Murtomaa H, Lahtinen A. Observations and concepts of the oral health consequences of tobacco use of Finnish periodontists and dentists. *J Clin Periodontol* 1992;19:15-18.
- Thorild I, Lindua B, Twetman S. Effect of maternal use of chewing gums containing xylitol, chlorhexidine or fluoride on mutans streptococci colonization in the mothers' infant children. *Oral Health Prev Dent* 2003;1:53-57.
- Tickle M, Moulding G, Milsom K, Blinkhorn A. Socioeconomic and geographical influences on primary dental care preferences in a population of young children. *Br Dent J* 2000;189:559-562.
- Thomson WM. Mission Report 1999, Mongolia. WHO: Oral Health programme electronic version at: <http://www.whocollab.od.mah.se/searo/mongolia/dat a/mongomiss99.html>
- Toumba KJ. Slow-release devices for fluoride delivery to high risk individuals. *Caries Res* 2001;35 (Suppl 1):10-13.
- Tseveenjav B. Prevalence of periodontal disease among adults aged 18 years and over in Ulaanbaatar. Thesis for Master of Science in Dentistry degree. National Medical University of Mongolia; 1996.
- Tseveenjav B. Prospective ways to develop preventive and public health orientated dental health education in Mongolia. Thesis for Master in Oral Public Health degree. University of Helsinki, Finland; 1999.
- Tunkel J, Heinecke A, Flemmig TF. A systematic review of efficacy of machine-driven and manual subgingival debridement in the treatment of chronic periodontitis. *J Clin Periodontol* 2002;29(Suppl 3):72-81.
- Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, Lingström P, Mejäre I, Nordenram G, Norlund A, Petersson LG, Söder B. Caries-preventive effect of fluoride toothpaste: a systematic review. *Acta Odontol Scand* 2003;61:347-355.
- Unell L, Söderfeldt B, Halling A, Paulander J, Birkhed D. Oral disease, impairment, and illness: congruence between clinical and questionnaire findings. *Acta Odontol Scand* 1997; 55:127-132.
- Van der Weijden GA, Timmerman MF. A systematic review on the clinical efficacy of subgingival debridement in the treatment of chronic periodontitis. *J Clin Periodontol* 2002;29(Suppl 3):55-71.
- Varsio S, Vehkalahti M, Murtomaa H. Dental care of six-year-old high-caries patients in relation to their cooperation. *Community Dent Health* 1999;16:171-175.
- Vehkalahti M, Rytömaa I, Helminen S. Decline in dental caries and public oral health care of adolescents. *Acta Odontol Scand* 1991;49:323-328.
- Vehkalahti MM, Widström E. Teaching received in caries prevention and perceived need for Best Practice Guidelines among recent graduates in Finland. *Eur J Dent Educ* 2004;8:7-11.

Vigild M, Schwarz E. Characteristics and study motivation of Danish dental students in a longitudinal perspective. *Eur J Dent Educ* 2001;5:127-133.

Walsh LJ. Preventive dentistry for the general dental practitioner. *Aust Dent J* 2000; 45:76-82.

Wang NJ. Preventive dental care of children and adolescents in the 1990s: Denmark, Iceland, Norway, and Sweden. *Acta Odontol Scand* 1998;56:169-172.

Wei SHY & Yiu CKY. Evaluation of the use of topical fluoride gel. *Caries Res* 1993;27(Suppl 1):29-34.

Whittle JG, Whittle KW. Household income in relation to dental health and dental health behaviours: the use of Super Profiles. *Community Dent Health* 1998;15:150-154.

WHO. Organizational changes in dental education. Report on a WHO intercountry workshop, 1984. Regional Office for Europe, Copenhagen. ICP/ORH 103 c02.

WHO. Dental caries levels at 12 years. Oral Health Programme, 1993. WHO/ORH/DMFT12/93 pp3.

WHO. Dental caries levels at 12 years. Oral Health Programme, 1996. WHO/ORH/DMFT12/96. pp5.

WHO. Oral Health Surveys: Basic Methods, 3rd ed. Geneva, 1987a.

WHO. Prevention of oral diseases. WHO Offset Publication No 103. Geneva, 1987b.

WHO. Diet, nutrition and the prevention of chronic diseases. WHO Technical Report Series 916. Geneva 2003. pp. 105-128.

Woodward M, Walker ARP. Sugar consumption and dental caries: evidence from 90 countries. *Br Dent J* 1994;176:297-302.

World Bank data base 2003. Electronic version at www.worldbank.org/data/countryclass.html

World Fact Book, 2003. Electronic version at www.odci.gov/cia/publications/factbook.html

Zimmer S, Jahn K-L, Barthel CR. Recommendations for the use of fluoride in caries prevention. *Oral Health Prev Dent* 2003;1:45-51.

12. Appendix

Questionnaire¹

Preventive dentistry in Mongolia:
Knowledge, skills, and attitudes
of dentists and dental students

Department of Oral Public Health
Institute of Dentistry
University of Helsinki
Helsinki
2000

¹ Combined version of the questionnaires for dentists and dental students in the appendix of this thesis

To participants in this questionnaire survey

Thank you for taking part in this survey.

The main aim of this questionnaire survey is to investigate preventive dentistry in Mongolia to provide a constructive contribution to the improvement of oral health of our population.

The questionnaire includes different sections on the preventive knowledge, practice, and attitudes of dentists and dental students. The essential purpose of these questions is to find out the role and character of preventive dentistry among presently practicing and future dentists for further improvement.

The questionnaire answers will not be shared with anyone except the researchers. No conclusion can be made concerning individual persons. Therefore, while filling in the questionnaire, feel free to answer. Please, don't put your name on the questionnaire. You only need to be registered on the separate sheet as a participant and for further contact if needed. Your participation and answers will help a lot to comply with the purpose of the study.

To the "Questionnaire for dentists" are attached three "Questionnaire for dentists' children" forms, and you are asked to answer them on the oral health status and caries-preventive measures used for your children of 3 to 13 years. If you have more than three children of that age group, please fill it in only on the 3 youngest ones.

Instructions on how to answer the questions are given in the beginning of every section. If you have any questions related to the questionnaire or study, don't hesitate to ask. For that, please contact any teaching staff or Lecturer Battsetseg Tseveenjav of the Restorative Dentistry Department of the Dental School (phone 328994).

Thank you for your cooperation.
Researcher
Battsetseg Tseveenjav

I. Personal data (for dentists)

(Please write down your answer to questions 1-6 & circle to questions 7-12)

QI-1. Year of birth

QI-2. Year of graduation from dental school

QI-3. How long have you been working as a dentist?

QI-4. How long have you been working in public practice?

QI-5. How long have you been working in private practice?

QI-6. How long have you been working in both combined?

QI-7. Gender

1. Female
2. Male

QI-8. Where did you complete your basic degree as a dentist?

1. In Mongolia
2. Abroad

QI-9. Have you got a higher educational or professional degree than a University diploma? (Circle all degrees you have)

1. Master
2. PhD
3. Higher professional degree
4. Advanced professional degree

QI-10. Current job (Please circle number for each describing your job)

1. Self-employed dentist in private clinic
2. Dentist in private clinic employed by someone
3. Dentist in public clinic
4. Dentist or specialist in University hospital or dental centre
5. School or kindergarten dentist
6. No clinical work presently

QI-11. Field of practice (Please circle one)

1. General dentist
2. Therapeutic dentist
3. Prosthodontist & Orthodontist
4. Oral surgeon
5. Paedodontic dentist

QI-12. Patient group you presently work with (Please circle one)

1. Children (0-18)
2. Adults
3. Mixed

I. Personal data (for dental students)

(Please circle your answer to questions 1-2 and write down your answer to question 3 in the space given)

QI-1. In which year are you studying?

3. Third
4. Fourth
5. Fifth

QI-2. Gender

1. Female
2. Male

QI-3. Date of birth

II. Oral hygiene and dietary behaviour and utilization of oral services

(Utilization of dental service; for dentists only)

(Please circle your answer to questions 1-6)

QII-1. Do you use toothpaste containing fluoride, while brushing?

1. Always or almost always
2. Quite often
3. Seldom
4. Not at all

QII-2. At what time of day do you primarily clean your teeth?

(Please circle each one describing your daily tooth-brushing practice)

1. Before breakfast
2. In the morning (without breakfast)
3. After breakfast
4. Usually before meals
5. Usually after meals
6. When going out
7. Before going to bed
8. Other times, specify when

QII-3. How often do you usually brush your teeth?

1. Not at all
2. Once a month or less
3. A few (2-3) times a month
4. Once a week
5. A few (2-6) times a week
6. Once a day
7. Two or more times a day

QII-4. How often do you eat sugar-containing snacks, coffee, or tea between your main meals?

1. About 3 times a day or more
2. About twice a day
3. About once a day
4. Occasionally; not every day
5. Rarely or never eat between meals

QII-5. About how long ago was your most recent dental treatment?

1. No more than 6 months ago
2. More than 6 month up to 1 year ago
3. More than 1 up to 2 years ago
4. More than 2 years up to 5 years ago
5. More than 5 years up to 10 years ago
6. More than 10 years ago
7. Never

QII-6. What was your reason for this visit?

1. I had trouble with my teeth/gums
2. For regular check-up
3. Other, specify the reason

III. Oral Health Status (for dentists & students)

QIII-1. Dental status

(Please mark your present oral health status using abbreviations given)

7	6	5	4	3	2	1	1	2	3	4	5	6	7
7	6	5	4	3	2	1	1	2	3	4	5	6	7

- | | | | |
|-----|-------------------------|-----|------------------------|
| S | healthy | U- | unerupted |
| D- | decayed (cavitation) | C- | crown |
| M- | missing due to decay | B- | bridge |
| F- | filled, but no decay | RP- | Removable prothesis |
| FD- | filled, but with caries | T- | Traumatic lesions |
| R- | Root to be removed | H- | Hypoplasia & fluorosis |

QIII-2. Do you currently experience, or have you earlier experienced, gingival bleeding?

1. Currently experiencing gingival bleeding
2. Earlier experienced gingival bleeding, but not now
3. Never had gingival bleeding

QIII-3. Do you currently experience tooth mobility because of periodontal problems?

1. No
2. Yes

IV. Continuing dental education

(This section has one question and two statements to be answered)

(For dentists only)

QIV-4. If you had any learning opportunities during the last 2 years (1998-1999), in which field of dentistry, how many times, and how long did they take? Please circle whether you had any need for a continuing education course on these subjects regardless of whether you have taken a course on it during the last 2 years.

Subject	How many times?	How long in total (estimated as working days)?	Have you had need for any more courses?
1.Restorativedays	1. Yes 2. No
2.Prostodonticsdays	1. Yes 2. No
3.Oral surgerydays	1. Yes 2. No
4.Preventiondays	1. Yes 2. No
5.Pedodontics & Orthodonticsdays	1. Yes 2. No

(Please circle number for your opinion SIV2-3)

SIV-2. Continuing education courses would be of great use for dentists.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SIV-3. Continuing education should be compulsory for dentists.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

V. Competency and orientation in preventive care

(for dentists & students)

(Please circle the number for the appropriate answer for each question)

	Very	Quite	Not very	Not at all
QV-1. How competent do you feel in giving clinical care to patients?	1	2	3	4

QV-2. How competent do you feel in giving preventive treatment to patients?	1	2	3	4
--	---	---	---	---

QV-3. How competent do you feel in giving oral health education to patients?	1	2	3	4
---	---	---	---	---

SV-1. Training on and practice of preventive dentistry both in dental undergraduate education and in clinical dental practice should be increased.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

VI. Preventive knowledge

(In this section are 14 statements on preventive knowledge. Please circle the number for appropriate answer for you in each statement)

SVI-1. Brushing teeth with fluoride toothpaste prevents tooth decay.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-2. Using fluoride toothpaste is more important than the brushing technique to prevent caries.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-3. Fluoride is the most important factor for tooth susceptibility to decay.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-4. Fluoridation of drinking water is an effective, safe, and efficient way to prevent dental caries.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

VI-5. It is beneficial to recommend fluoride tablets and/or topical fluorides for children in areas without a fluoridated water supply.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-6. The frequency of sugar-consumption has a greater role than the total amount of sugar consumed in causing caries.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-7. Sugar-free chewing gum has a positive effect on dental health.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-8. Xylitol is not only non-cariogenic, but also suppresses the growth of acidogenic bacteria in dental plaque.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-9. Sealant is effective in prevention of pit and fissure caries in molars.

1. Strongly agree
2. Agree
3. Disagree
4. Strongly disagree
5. Don't know

SVI-10. It is beneficial to visit a dentist for regular check-ups.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 5. Don't know

SVI-11. Regular brushing helps in prevention of gum problems.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 5. Don't know

SVI-12. Gingivitis is caused by dental plaque.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 5. Don't know

SVI-13. Gingivitis can be cured by effective oral hygiene.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 5. Don't know

SVI-14. Having dental problems can lead to general health problems.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 5. Don't know

VII. Preventive practice for patients

(for dental students only)

(There are four questions concerning your practice offered to your patients.

Please circle number of the appropriate answer for you, in each question)

QVII-1. Do you recommend fluoride toothpaste to your patients?

- 1. Always or almost always
- 2. Quite often
- 3. Seldom
- 4. Not at all

QVII-2. Do you give nutrition and diet counselling to your patients?

- 1. Always or almost always
- 2. Quite often
- 3. Seldom
- 4. Not at all

QVII-3. Do you use topical application of fluoride for your patients?

- 1. Always or almost always
- 2. Quite often
- 3. Seldom
- 4. Not at all

QVII-4. Do you place sealant in the molars of your patients?

- 5. Always or almost always
- 6. Quite often
- 7. Seldom
- 8. Not at all

If you have any thoughts or ideas or suggestions about this research study or issues related to preventive dentistry in Mongolia, we would appreciate it if you wrote them here.

My thoughts/ ideas/ suggestions:.....
.....
.....

Thank you for your participation

Questionnaire concerning dentists' children

(to be filled in by dentist-parent)

I. Personal data (No child's name is needed)

QI-1. Gender

1. Male
2. Female

QI-2. Year of birth of this child

II. Preventive measures applied for this child

(Please circle one appropriate answer for each question)

QII-1. Do you recommend to him/her the use of fluoride toothpaste for brushing?

1. Always or almost always
2. Quite often
3. Seldom
4. Not at all

QI-2. Do you supervise his/her tooth-brushing?

1. Always or almost always
2. Quite often
3. Seldom
4. Not at all

QI-3. Do you restrict his/her frequency of consumption of sugar and sugar-containing snacks, soft drinks, coffee, and tea?

9. Always or almost always
10. Quite often
11. Seldom
12. Not at all

QII-4. Have you demonstrated to him/her how to clean the teeth?

1. Yes
2. No

QII-2. Have you used any topical application of fluoride for him/her?

1. Yes
2. No

QII-3. Do you check yourself, or take this child to a dentist for regular check-ups?

1. Yes
2. No

QII-7. Have you placed any sealant in any of his/her teeth?

1. Yes
3. No

III. Child's oral health

QIII-1. Dental status (please mark his/her present oral health status using the same code as used in yours. For primary teeth, fill in the short columns numbered as 1 and 4; for permanent teeth, fill in long columns numbered as 2 and 3. If the child has mixed dentition, please fill in for each tooth in the corresponding column, showing clearly the unerupted ones.)

	7	6	5	4	3	2	1	1	2	3	4	5	6	7
1														
2														
3														
4														
	7	6	5	4	3	2	1	1	2	3	4	5	6	7

QIII-2. Does or did he/she experience bleeding gums?

1. Currently experiencing gingival bleeding
2. Earlier experienced gingival bleeding, but not now
3. Never had gingival bleedin

