

**International Dental Conference
on “Caries Control throughout life in Asia”**

Organized
by

Dental Innovation Foundation under Royal Patronage (DIF)
Ministry of Public Health (MOPH)
Dental Association of Thailand (DAT)

International Co-sponsored
by

World Health Organization (WHO)
World Dental Federation (FDI)
International Association for Dental Research (IADR)

November, 20-22, 2013

@ Beyond Resort Krabi, Krabi, Thailand

Editors

Yupin SONGPAISAN

Khun Mettachit NAWACHINDA

Chantana UNGCHUSAK

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	3
WELCOME MESSAGES	
<i>Mr THEINTONG</i> Vice-Minister Ministry of Public Health	8
<i>Prof Thanpuying Petchara TECHAKUMPUTCH</i> President Dental Innovation Foundation under Royal Patronage (DIF)	10
<i>Dr. Porntep SIRIWANARANGSUN</i> Director-General, Department of Health Ministry of Public Health	13
<i>Prof Lt Gen Phisal THEPSITHAR</i> President Dental Association of Thailand	14
<i>Prof Poul Erik PETERSEN</i> Chief, Oral Health, World Health Organization (WHO)	16
<i>Dr Tin Chun WONG</i> President FDI World Dental Federation	18
<i>Prof Helen WHELTON</i> President International Association for Dental Research (IADR)	20
SCIENTIFIC PROGRAM	25

	Page
GUEST LECTURES	29
Global oral health inequalities - the need for public health strategies in disease prevention and restorative dental care <i>PE PETERSEN</i> World Health Organisation (WHO)	31
FDI World Dental Federation: A Focus on Prevention <i>TC WONG</i> President International Dental Federation (FDI)	39
Global Caries Perspective: the Research Agenda <i>ECM LO</i> Treasurer International Association for Dental Research (IADR)	55
Cariology Research Update <i>D ZERO</i> Professor, Indiana University, USA	59
Cariology Education in Dental School <i>JC LLODRA</i> Professor, Granada University, Spain FDI – Public Health Committee, Chair	
Dental Caries Control in Children <i>ECM LO, D DUANGTHIP</i> Professor, University of Hong Kong, HK-SAR;	
Nutrition and Oral Health <i>A RUGG-GUNN, P MOYNIHAN</i> Professor, University of New Castle, UK; WHO-Collaborating Centre for Nutrition and Oral Health	
Dental Caries Control In Elderly <i>H OGAWA</i> Assoc/Professor, Niigata University, Japan; WHO–Collaborating Centre for Translation of Oral Health Science	

COUNTRY REPORT

Bhutan

*Sonam NGEDUP
Dorji PHURPA*

Brunei Daressalam

Mary Cheong Poh HUA

Hong Kong, SAR

*Frankie HC SO
Joseph CY CHAN*

India

Naseem SHAH

Indonesia

*Dewi Kartini SARI
ZAURA Kiswarina Anggraeni*

Japan

Masaki KAMBARA

Korea

Deok-Young PARK

Lao PDR

*Khamhoung PHOMMAVONGSA
Sakpaseuth SENESOMBATH*

Malaysia

*KHAIRIYAH Abd. Muttalib,
WAN MOHD NASIR bin Wan Othman,
YAW Siew Lian
Norliza ISMAIL*

Myanmar

*AYE AYE MAW
MYINT MYINT SAN
SAW TUN AUNG*

Nepal

Shaili PRADHAN

Philippines

Maria Liza C CENTENO

Page

Singapore

Eu Oy CHU

Taiwan

Lin-Yang CHI

Lih-Jyh FUH

Thailand

Sutha JIENMANEECHOTECHAI,

Chantana UNGCHUSAK,

Suprane DALODOM

Piyada PRASERTSOM,

Oranart MATANGKASOMBUT

Vietnam

Trinh Dinh HAI

Ngo Dong KHANH

Organizing Committee & Editors

Map of the workshop venue

Notes

WELCOME MESSAGES

???

Vice Minister,
Ministry of Public Health



On behalf of the organizers of the International Dental Conference on “Caries Control throughout life in Asia”, it is my great honor to welcome you to the Conference.

This event is organized by the Dental Innovation Foundation under Royal Patronage (DIF), which is a section of His Majesty the King’s Dental Service Unit, in conjunction with the Ministry of Public Health and the Dental Association of Thailand. The conference is co-sponsored by the World Health Organization, the International Association for Dental Research and the World Dental Federation.

It is the belief of the Dental Innovation Foundation that dental caries is a preventable and controllable disease. Dental caries management procedures may be different in each country based on the availability of dental man- power and resources. We believe that resources can be better optimized by the sharing of learning and experiences amongst member countries.

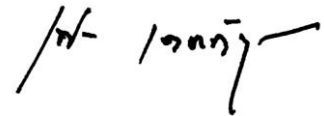
The objectives of this Conference are, therefore, to

1. Share and exchange experiences in caries prevention and control,
2. Apply new development in appropriate dental caries prevention for future success,
3. Discuss the implementation of the Minamata Global Convention on phasing down of dental amalgam,

On behalf of the Dental Innovation Foundation, I would like to extend my appreciation to the resource persons and international experts from WHO, FDI and IADR for their expertise and valued time to exchange their knowledge and experiences with the participants.

I wish all success and fruitful benefits for this Conference

Sincerely,



*Professor Thanpuying Petchara Techakampuch
President
Dental Innovation Foundation under Royal Patronage (DIF)*



Department of Health, Ministry of Public Health honor to organize the “International Dental Conference on Caries control throughout life in Asia” during 20-22 November 2013 in cooperation with Dental Innovation Foundation under Royal Patronage (DIF) and The Dental Association of Thailand (DAT) with support from the World Health Organization (WHO), International Association for Dental Research (IADR), and World Dental Federation (FDI).

The Department of Health has a policy to promote health of Thai people in all age groups. Oral health related quality of life has also been prioritized and implemented all over the country in Thailand. Dental caries problem in all age groups has been solved at the individual level: an early detection and specific prevention, and community level: Sweet Enough Network, Oral Health School Network, Non-carbonated soft drink in school and Oral health network in Elderly Club, but dental caries still be a problem in some areas. This meeting will give us an opportunity to learn from other countries and create cooperation among Asian countries to work together on management of dental caries in all age groups in the future.

A handwritten signature in black ink, appearing to read 'Porntep S.' with a stylized flourish at the end.

*Dr. Porntep Siriwanarangsun
Director-General
Department of Health
Ministry of Public Health*



Dear All Participants

The Dental Association of Thailand would like to welcome you to Thailand and enjoy one of the best tourist attractions of Thailand, Krabi. We appreciate your efforts in spending your prestigious time to make this congress a success.

The Dental Association of Thailand has fully supported this congress of “Caries Control throughout Life in Asia” aiming that all the experts and authorities will together summarize the modalities that enable the very fundamental Oral Health Issue of the World, especially in Asia: Dental Caries and its control.

For the passing half century, The Dental Association of Thailand has dedicated in both clinical means and public health to promote various technologies and health promotional schemes for improving the Oral Health of Thais. We have collaborated with the private enterprises and government agencies to create the awareness of the importance of Good Oral Health through the “Thai Smiles”. Make sure that every single Thais would want to have those attractive appearances till the very last day of life. Today we have a new generation of kids that is caries free and the percentage is increasing by all the helps and supports from both the private and government sectors.

With the changes in filling material which bases heavily on the environmental perspective, not on the practical Scientific Evidence Base, we wish all Thais still receive best dental treatments without

sacrificing the standard and safety they used to. Turning to the new softer, unproven longevity and short lasting material should not be unseen risks to Thais and all mankind.

On behalf of the Dental Association of Thailand, I would like to express my sincere gratitude to all of you that make this event happen, success and be another initiative for good quality of life. This event would not have happened if we do not have the input from all of those who dedicated their times and efforts, not wanting to be named and get recognition. Thanks again. We really appreciated your kind consideration.

Sincerely,

*Professor Lt. Gen. Phisal Thepsithar
President
The Dental Association of Thailand*



In 2010, the World Health Organization published an important report on “Equity, Social Determinants and Public Health Programmes”. It takes the challenges to public health several steps forward, with the aim of translating knowledge into concrete, workable actions. The four main criteria in identifying priority public health conditions were:

- 1) they represent a large aggregate burden of disease;
- 2) they display large disparities across and within populations;
- 3) they disproportionately affect certain populations or groups within populations, and
- 4) they are emerging or epidemic prone.

The burden of oral disease matches these four main criteria of critical public health conditions. In particular, oral diseases are most prevalent non-communicable diseases (NCDs) worldwide. They cause much suffering, such as pain and discomfort, and they are a considerable economic burden to people and society. Moreover, oral diseases are linked to major chronic diseases, i.e. cardio-vascular diseases, cancer, and chronic respiratory diseases. Poor diet, tobacco use, and excessive use of alcohol are shared risk factors. The World Health Assembly Resolution on Oral Health (WHA60.17) specifies both the need for prevention and control of oral diseases. Dental caries is major disease burden in all countries around the globe. Integrated

disease prevention must be strengthened; however, many people still require restorative dental care, especially the poor and disadvantaged population groups. Primary Health Care (PHC) addresses both disease prevention and disease control. The challenges to PHC are evident to low- and middle income countries as these countries continue to have limited capacity in oral health care. The WHO highly welcomes the Thailand Krabi meeting “Caries control throughout life” which will consider the achievement of better health for all through the integration of primary prevention, secondary disease prevention, and tertiary intervention.

*Dr Poul Erik Petersen
World Health Organization (WHO)*



Caries management and a focus on prevention

It gives me great pleasure to welcome delegates to this important conference on dental caries, the most pervasive medical condition in the world. Dental caries afflicts 90% of the world's population and, as a disease that causes pain and discomfort, its social and economic impact is significant, especially in developing countries. If a child is in pain, he or she cannot go to school. The same applies to the working population who have to take time off work.

This conference will provide a huge opportunity to focus on this important issue, exchange ideas, discuss solutions and recommend actions. Let me remind you briefly of the objectives:

- To share and exchange experiences in caries prevention and control in Asia;
- To assess the applicability of dental caries intervention programmes from industrial countries;
- To apply novel development in appropriate dental caries prevention for future success;
- To discuss the implementation of the Minamata Global Convention of phasing down of dental amalgam: The WHO – UNEP Initiative.

In the end, the debate about caries is all about prevention; in the end, this is one of the few viable options if our goal is to increase access to oral health since access to treatment is, for many in this world, geographically or financially impossible.

This is all the more important since the dental materials we use for our restorative work are increasingly coming under the critical eye of groups concerned with health and the environment. Just over a month ago, I was in Japan to observe the proceedings of the ‘Conference of Plenipotentiaries on the Minamata Convention on Mercury. As you are probably aware, this Convention contains special provisions for dental amalgam, one of dentistry’s most clinically proven, safe and cost-effective restorative materials.

During the negotiation process, there was a view that it should be subject to a phase-out, leading ultimately to a ban. Effective advocacy from FDI working its partners at the World Health Organization (WHO), the International Association for Dental Research (IADR) and International Dental Manufacturers managed to turn that into a ‘phase-down’, which means that it can continue to be used – for the moment.

In return, however, the dental sector made a certain number of commitments on prevention, research and implementing best management practice for dental waste. Now it is up to us to deliver. In this sense, this International Dental Conference on “Caries Control throughout life in Asia” is part of the process of developing strategy in one of those key areas, prevention.

I very much look forward to giving my own presentation during the course of this event. FDI has a unique voice and message in the world and I am delighted to be, as President, that voice communicating that message. I am also, naturally, looking forward with keen interest to what my colleagues from Thailand, elsewhere in Asia and from around the world have to say on the subject of caries control.

I wish you all an excellent conference!

*Dr Tin Chun Wong
President
FDI World Dental Federation*



Dear Conference Delegates,

As the president of the International Association for Dental Research (IADR), it is my pleasure to welcome you to the 2013 International Conference on "Caries Control Throughout Life in Asia." I am appreciative to the Dental Innovation Foundation under Royal Patronage, the Ministry of Public Health and the Dental Association of Thailand for organizing this meeting, along with the World Dental Federation and the World Health Organization for co-sponsoring it with IADR.

IADR's three-pronged mission is to advance research and increase knowledge for the improvement of oral health worldwide; to support and represent the oral health research community; and to facilitate the communication and application of research findings. Preceded by the 2011 International Conference themed "Effective Use of Fluoride in Asia," this year's meeting aligns well with the IADR mission in its effort to improve oral health. Following the success of the 2011 meeting, this one will bring attention to the global oral disease burden and allow us to work together to find a solution.

We know that oral diseases are among the most common chronic diseases, affecting in excess of 3.9 billion people worldwide. The recently adopted Minamata Convention includes a provision for dental amalgam that sets national objectives aiming at dental caries prevention and health promotion, thereby minimizing the need for

dental restoration. Although dental caries is preventable in many populations, it is still intractable in many others. Expansion of the benefits of prevention of this disease to all people, including those with the greatest need, will require a multisectoral and interdisciplinary approach.

Everyone who attends this meeting has a direct responsibility to increase awareness of the importance of oral health and contribute to the improvement of the global oral disease burden. Your attendance at this meeting takes us a step closer to solving this problem and raising the global profile of oral health.

While I regret that I cannot attend personally, I look forward to hearing about the discussions that will take place at this meeting and the positive outcomes that will be produced.

Sincerely,

A handwritten signature in blue ink that reads "Helen Whelton". The signature is written in a cursive style with a large initial 'H'.

Helen Whelton, BDS, MDPH, FFD, PhD, FFPHM

President, International Association for Dental Research

SCIENTIFIC PROGRAM

International Dental Conference on “Caries Control throughout life in Asia”

Organized
by
Dental Innovation Foundation under Royal Patronage (DIF)
Ministry of Public Health (MOPH)
Dental Association of Thailand (DAT)

International Co-sponsored
by
World Health Organization (WHO)
World Dental Federation (FDI)
International Association for Dental Research (IADR)

November, 20-22, 2013

@ Beyond Resort Krabi, Krabi, Thailand

Wednesday, November 20, 2013

- 09.00-09.30 Opening Ceremony
- Report by Organizing Chair
 - Opening by Minister of Public Health, Thailand
 - Address by Representatives from WHO, FDI and IADR
- 09.30-10.00 *Break* and poster viewing
- 10.00-10.30 Global oral health inequalities - the need for public health strategies in disease prevention and restorative dental care
Prof PE PETERSEN
WHO, Switzerland
- 10.30-11.00 FDI World Dental Federation: A Focus on Prevention
Dr TC WONG
President FDI, Switzerland
- 11.00-11.30 Global caries perspective: the research agenda
Prof. ECM LO
Treasurer IADR, Hong Kong SAR
- 11.30-12.00 Discussion
- 12.00-13.00 *Lunch break*
- 13.00-13.45 Cariology Research Update
Prof D ZERO
Indiana University, USA
- 13.45-14.30 Cariology Education in Dental School
Prof JC LLODRA
Granada University, Spain
FDI – Public Health Committee, Chair
- 14.30-15.15 Dental Caries Control in Children
*Prof ECM LO**, *Dr Duangporn DUANGTHIP*
University of Hong Kong, HK-SAR;
- 15.15-16.00 Nutrition and Oral Health
*Prof A RUGG-GUNN**, *Prof P MOYNIHAN*
University of New Castle, UK
WHO - Collaborating Centre for Nutrition and Oral Health
- 16.00-16.45 Dental Caries Control In Elderly
Prof H OGAWA
Niigata University, Japan
WHO–Collaborating Centre for Translation of Oral Health Science
- 16.45-17.30 Discussion
- 19.00-21.00 *Welcome reception*

Thursday, November 21, 2013

- 09.00-09.15 Summary of Day 1
09.15-10.30 Success story in Asia: Examples from
China
Prof. Tao XU
School of Stomatology
Peking University
Korea
Prof. PARK Deok-young
College of Dentistry
Gangneung-Wonju National University
Malaysia
Dr KHAIRIYAH bt abd Muttalib
Division of Oral Health
Ministry of Health
Singapore
Dr Eu Oy CHU
School Dental Services
Department of Health
Thailand
Dr. Sutha JIENMANEECHOTECHAI
Department of Health
Ministry of Public Health
- 11.00-12.30 Group Discussion: First round
- Group 1: Dental Education and Research in Cariology
(*ECM LO, C FOX & JC LLODRA*)
Group 2: Caries Control in Children & Elderly
(*PE PETERSEN, A RUGG-GUNN, & H OGAWA*)
Group 3: Home Care Caries Prevention
(*D ZERO, TC WONG & P PHANTUMVANT*)
- 12.30-13.30 *Lunch break*
- 13.30-15.00 Group Discussion: Second round
15.00-16.30 Group Discussion: Third round
18.00-19.00 Special session:
Future Use of Materials for Dental Restoration
Summary of Minamata Convention on Global
Reduction of Mercury
Prof PE PETERSEN, WHO
- 19.00-21.00 *Dinner*

Friday, November 22, 2013

09.00-10.30	Group Reports
10.30-11.30	Discussion
11.30-12.30	Next Steps and Networking
12.30-13.00	Summary
13.00-14.00	<i>Lunch break</i>
14.00	Meeting adjourn

GUEST LECTURES

**GLOBAL ORAL HEALTH INEQUALITIES
THE NEED FOR PUBLIC HEALTH STRATEGIES
IN DISEASE PREVENTION AND
RESTORATIVE DENTAL CARE**

Poul Erik PETERSEN

**GLOBAL ORAL HEALTH INEQUALITIES
THE NEED FOR PUBLIC HEALTH STRATEGIES
IN DISEASE PREVENTION AND RESTORATIVE DENTAL CARE**

Poul Erik PETERSEN¹

Dental caries is still a major public health problem in countries across the world as the disease affects 60-90% of school-aged children and the vast majority of adults. At present, the distribution and severity of dental caries vary in different parts of the world and within the same region or country (1). According to the WHO Global Oral Health Data Bank (2), the global dental caries index among children aged 12 years is 1.7 teeth on average, however, there are marked differences in severity amongst regions. The disease level in children of this age is relatively high in the Americas and in the European region; the index is low among children of the African and Western Pacific regions, while at the moment dental caries severity is moderate in countries of South East Asia and in the Eastern Mediterranean regions. The WHO Global Oral Health Data Bank also provides information on the time trends in dental caries experience of children. In most low and middle income countries, dental caries levels were low until recent years whereas dental caries prevalence rates and dental caries experience have tended to increase rapidly with changing lifestyles and growing consumption of sugars, inadequate exposures to fluoride, and lack of national programmes for prevention of oral disease (1,2). In contrast, a decline in dental caries prevalence has been observed in most high income countries over the past 20 years or so. This pattern is seen as the result of a number of public health measures, including effective use of fluoride, coupled with changing living conditions, lifestyles and improved self-care practices, and establishment of school oral health programmes (1,2).

For the child population of the several countries the amount of untreated dental caries (dt/DT) contributes significantly to the total caries experience, as measured by the dmft and DMFT indices. This pattern is documented for countries within each of the WHO Regions

¹ World Health Organization, Oral Health Programme, Prevention of Non-communicable Diseases, Geneva, Switzerland. Email: Poul Erik Petersen <petersenpe@who.int>

and Figure 1a-b present selected data for those standard age groups of children recommended by WHO.

Worldwide, dental caries prevalence is high among adults as the disease affects nearly 100% of the population in the majority of countries (1). Most high income countries and some countries of Latin America show high DMFT values (i.e. 14 teeth affected by caries or more at the age of 35-44 years) while dental caries experience levels at present are lower in the low income countries of Africa and Asia. The pattern of disease in adults is illustrated in Figure 1c.

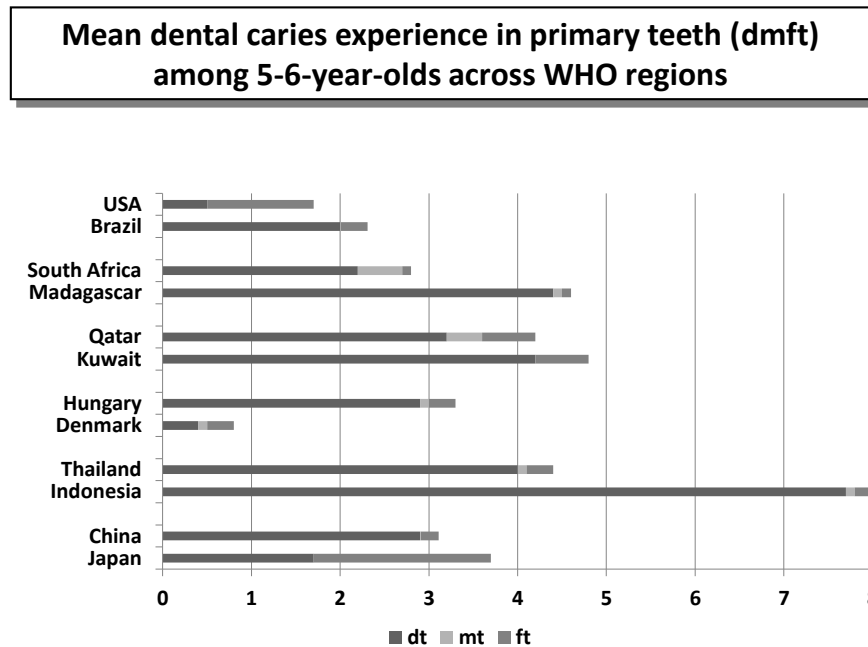


Figure 1a: Mean dental caries experience in populations of selected countries as measured by the dmft or DMFT indices at age 5-6 years (2).

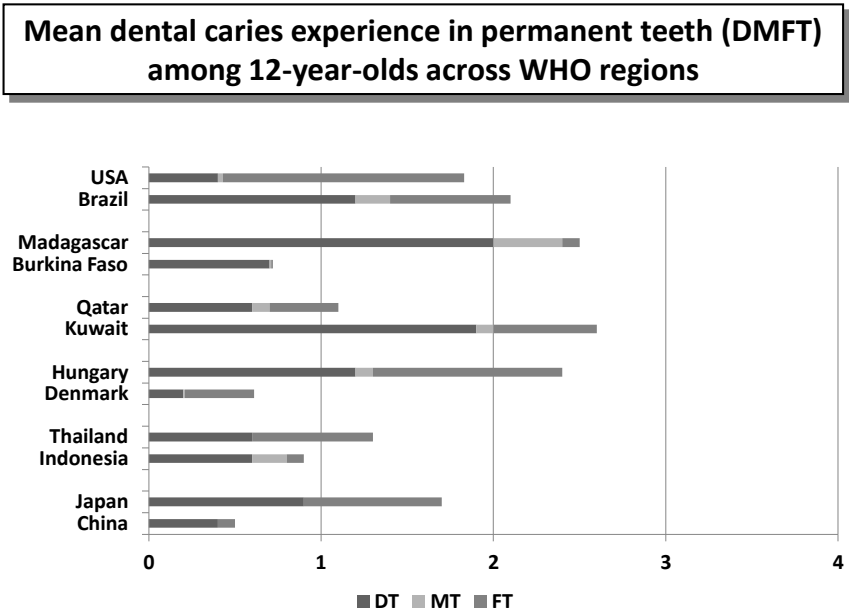


Figure 1b: Mean dental caries experience in populations of selected countries as measured by the dmft or DMFT indices at age 12 years (2).

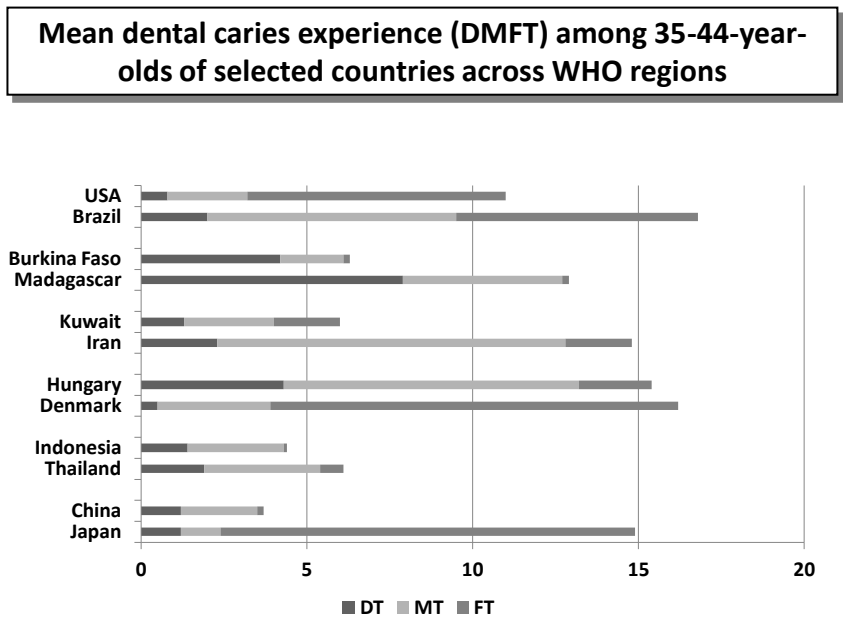


Figure 1c: Mean dental caries experience in populations of selected countries as measured by the dmft or DMFT indices at age 35-44 years (2).

Universally, the burden of disease is high among the poor and disadvantaged people compared to wealthy population groups (3). In addition, underprivileged population groups are less likely to visit a dentist if available and often have unhealthy habits, or knowledge and attitudes to oral health. The social consequences or the impact of ill-health on daily life of people are notable. Poor oral health could threaten job security and economic productivity that in turn may exacerbate adverse social, psychological and economic circumstances. In several high income countries, older people often have had their teeth extracted early in life because of pain or discomfort, leading to reduced quality of life (3). The proportion of edentulous adults aged 65 years or more is still high in many countries; meanwhile, in industrialized countries there has been a positive trend of reduction in tooth loss among older adults in recent years. In parallel, an increase in the proportion of adult people with functional dentition (i.e. 20 teeth or more) reflects the growing use of preventive oral health services available (1,2).

THE NEED FOR PREVENTIVE DENTAL CARE

There is a tremendous need for prevention of dental caries and consideration should be given to the fact that tooth extraction equals to failure. The efficiency of dental caries prevention methods has been substantiated in several countries around the world; however, despite this knowledge, not all countries have or will implement such public health programmes in the near future and many people that have suffered from dental caries need their teeth restored to normal function; failure to do this will undoubtedly result in loss of teeth. Population oriented oral disease prevention programmes and health promotion do not exist in many low and middle income countries, and oral health services may only provide emergency care aiming at relief of pain. Such care mostly implies tooth extraction which is most simple and less expensive form of treatment.

THE NEED FOR RESTORATIVE DENTAL CARE

In spite of success in the prevention of dental caries, caries in need of restoration still occur. Unless the access to dental restorative treatment is further upgraded, the growing burden of dental caries in low and middle income countries will result in even higher numbers of people becoming edentulous in the near future. Dental amalgam has been used for dental restoration over the past 150 years and is considered to be safe. Providers of oral health care in most countries

consider dental amalgam of relevance in serving their patients. Meanwhile, over the past 10 years or so, the awareness and recognition of the environmental implications of mercury has increased and dentistry being a source to contamination of the environment has gained further attention. In general, the quality of materials alternative to dental amalgam is limited. There is an urgent need to strengthen research into the long-term performance, possible adverse effects, and viability of alternative materials. In addition, some countries require systems for waste management to prevent release of mercury to the environment.

WHO AND THE ENVIRONMENT

WHO and the United Nations Environment Programme (UNEP) have strengthened the work for reduction of the mercury releases and usage. UNEP was mandated to elaborate legally binding instrument on a ban of mercury; the work commenced in 2010 with the goal of completing it prior to the UNEP Governing Council/Global Ministerial Environment Forum in 2013. This so-called Minamata treaty will have a significant impact on delivering oral health care worldwide and includes the following elements(3): Setting national objectives aiming at dental caries prevention and health promotion, thereby minimizing the need for dental restoration; (ii) Setting national objectives aiming at minimizing its use; (iii) Promotion of the use of cost-effective and clinically effective mercury-free alternatives for dental restoration; (iv) Promotion of research and development of quality mercury-free materials for dental restoration; (v) Encouraging representative professional organizations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promotion of best management practices; (vi) Discouraging insurance policies, and programmes that favour dental amalgam use over mercury-free dental restoration; (vii) Encouraging insurance policies and programmes that favour the use of quality alternatives to dental amalgam for dental restoration; (viii) Restricting the use of dental amalgam to its encapsulated form; and (ix) Promotion of the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land.”

REFERENCES

1. *Petersen PE (2008). Oral Health. In: Kris Heggenhaugen and Stella Quah, Editors. International Encyclopedia of Public Health, Volume 4, San Diego: Academic Press, pp. 677-685*
2. *World Health Organization. WHO Global Oral Health Data Bank (2011). WHO, Geneva.*
3. *Petersen PE (2005). Socio-behavioural risk factors in dental caries - international perspectives. Community Dentistry Oral Epidemiology 33:274-9.*
4. *Rekow ED, Fox CH, Petersen PE, Wattson T (2013). Innovations in materials for direct restoration. Why do we need innovations? Why is it so hard to capitalize on them? Journal Dental Research 92: 945-947*

**FDI WORLD DENTAL FEDERATION:
A FOCUS ON PREVENTION**

Tin Chun WONG

**FDI WORLD DENTAL FEDERATION:
A FOCUS ON PREVENTION**

Tin Chun WONG²

First of all, thank you for the kind invitation to speak here today. I am delighted to be present at this important event. Caries control is a particularly important theme for the FDI World Dental Federation. I will come to the question of 'why?' later in my presentation.

But first, a little background information on FDI World Dental Federation. It was set up over 110 years ago as a forum for dentists around the world together to share views and experiences. Its continued existence today implicitly recognizes that the profession needs an international voice to defend its positions and promote its views. Thus, FDI speaks and acts internationally on behalf of dentists worldwide.

FDI is now headquartered in Geneva, in close proximity to international partners such as the World Health Organization and other agencies of the United Nations. It represents some 200 national dental associations and specialist groups around the world. FDI can therefore claim to be the authentic international 'voice' of around 1 million dentists with a mission to 'lead the world to optimal oral health'.

DIRECT IMPACT OF FDI

Although the perspective of an international organization such as FDI may seem distant from the reality of people's lives, its activities and decision can frequently have a direct impact on people's lives in a number of quite specific ways. These include dental materials, dental practice and ethics, dental waste management as well as guidelines, the good practice recommendations and public information messages. All of these together have a tremendous impact on health professionals - but on also patients, both directly and indirectly.

² *President of FDI World Dental Federation, World Dental Federation, Tour de Cointrin, Avenue Louis Casai 84, Case Postale 3, 1216 Genève - Cointrin SWITZERLAND. www.fdiworldental.org*

FDI Policy Statements are of particular significance to the work of the dentist. These are declarations of current thinking on various significant issues related to oral health, oral health policies and the dental profession. They are put together by FDI’s Science Committee in collaboration with partners such as the World Health Organization (WHO), the International Association for Dental Research (IADR), and the International Organization for Standardization (ISO), through intensive discussion, the consensus among leading dental experts from around the world and wide consultation with all national dental associations.

For example, as a result of the 2013 General Assembly, five new Policy Statements have been adopted and issued in key fields of public health, oral health and dentistry. The subjects covered include Non-communicable Diseases (NCDs); Oral Health and the Social Determinants of Health; Oral Infection/Inflammation as a Risk Factor for Systemic Diseases; Salivary Diagnostics; and Bisphenol-A in Dental Restorative and Preventive Materials.

They will be published in the December 2013 edition¹ of the *International Dental Journal* along with an editorial by FDI Science Committee Chair and my compatriot Prof Lijian Jin. The Policy Statement on Noncommunicable Diseases has particular resonance for FDI’s work in the field of oral disease prevention and control.

VISION 2020

Today, more than ever before, the practice and art of dentistry are called upon to meet new and urgent demands. In response to this—and FDI considers this a positive step—the scope of dental medicine is expanding way beyond operative and restorative dentistry and into the important fields of education and prevention.

In its role of ‘thought leadership’, FDI is responding to the expanded role for the dental profession with a strategy for the coming decade. Two strong values have emerged. The first is that oral health should be considered a fundamental right, along with the right to health. The ‘right to health’ was first articulated in the founding documents of the World Health Organization.

The second value is ‘oral health in all policies’. This notion derives from the Adelaide Statement on Health in all Policies², a WHO report published in 2010.

These values are integrated into FDI Vision 2020³, document drafted by an FDI Task Team and adopted by the General Assembly in Hong Kong in 2012. This Vision being articulated through five basic approaches, focusing on prevention, the dental workforce, access to oral care and the promotion of technology and research and the move towards green dentistry.

The fifth basic approach is education, which includes patient education and oral health literacy for prevention.

IMPLEMENTING VISION 2020

Two aspects of Vision 2020 are now in the process of implementation: one of these is to generate data and information achieve two goals: one is to update FDI's landmark Oral Health Atlas, the only one of its kind in existence but, with figures from as far back as 1997, not a reflection of oral health today. The other goal is to develop a global observatory whose principal aim would be as a tool to measure oral health in the world.

The other aspect of Vision 2020 in the process of implementation is interprofessional collaborative practice (ICP), one of the major themes among members of the medical professions today. From the perspective of the healthcare professional, the focus should be on the contribution of ICP to patient care and rehabilitation. But the sub-text of collaborative practice for governments is as a means of cutting waste and improving efficiency in the health service.

I cannot go into too much detail at this stage since the project was only recently launched. We will, naturally, be liaising closely with our colleagues in other medical professions, in particular the physicians, nurses, pharmacists and physical therapists with whom we are in partnership in the World Health Professions Alliance WHPA⁴.

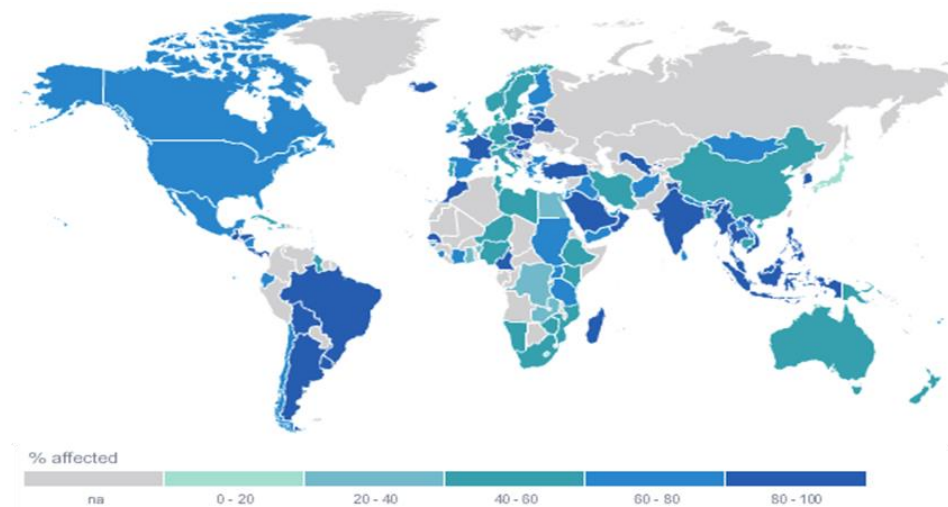
In this, dentists have some unique points to make not only from the perspective of health care providers within the health service but also, for many of us, as heads of our own small business, that is, our dental practice. We understand better than most the need to ensure that we are working well, effectively and economically.

THE THEME OF PREVENTION

Today, prevention is an important theme, reflecting the tendency among dentists to always have an eye on the future. It is essential to the well-being of our profession: we have worked with an ever-evolving technology and are always on the lookout for the best, most solid and aesthetically pleasing materials in our restoration.

We also have an eye to the future when it comes to prevention: dentists probably entered this domain well in advance of other professions and, with our partners in industry, have been key in helping develop the tools of prevention. We constantly remind our clients and patients of the importance of brushing their teeth daily with fluoride toothpaste to *prevent* caries and tooth decay.

Dental caries in young people age 6-19 (% affected-highest value, latest data available 1982-2008. Source: WHO)



In fact, FDI’s flagship prevention programme Live.Learn.Laugh.⁵ (LLL), carried out in partnership with Unilever Oral Care, has already been running for nine years—phase I from 2005 to 2009, phase II 2010-2013—with phase III about to begin. The basic LLL message is one of prevention. Its goal is to measurably improve oral health through encouraging twice daily brushing with a fluoride toothpaste.

Where public funds are lacking, like in many developing countries, prevention is the best, and in some cases, the only option available. Much of what is termed ‘prevention’ focuses on encouraging good individual behaviour. We estimate that the eleven LLL projects

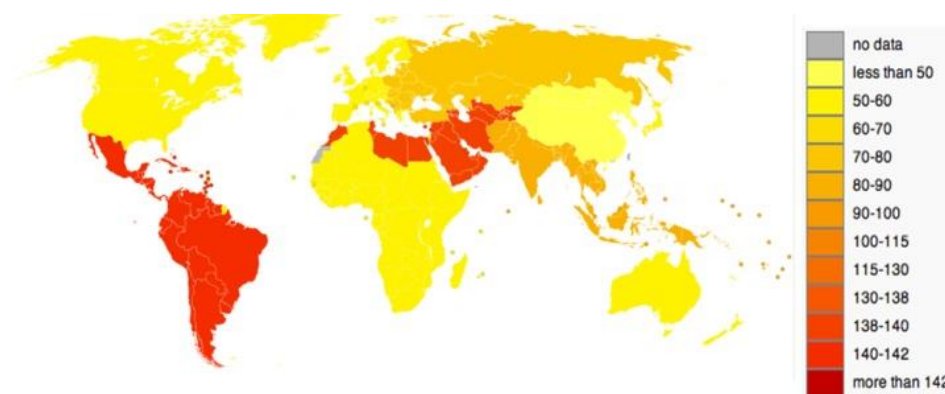
underway in Asia will reach at least 10,700 children and patients. We are looking forward to seeing a change in oral health habits of the populations. I think all involved can take immense pride in being part of an effort to raise awareness.

GLOBAL CARIES INITIATIVE: A FOCUS ON PREVENTION

LLL is taking place at a time when the dental profession is implementing a shift toward a prevention-based model of oral-health care. This transformation will, over time, become the most robust and long-term strategy to address the issue of dental restorative materials, including dental amalgam.

With limited funds available for restorative care in many countries, an essential part of FDI's work is to raise awareness of the importance of oral health and focus its projects and activities on prevention strategies. This, for example, is the key message of the landmark Global Caries Initiative⁶, GCI for short. It is a profession-led "call to action" to implement a new paradigm for caries management, disease prevention and health promotion, thus improve the oral and general health of populations globally by the year 2020.

Age-standardized disability-adjusted life year (DALY) rates from dental caries by country (per 100,000 inhabitants)- (Source: WHO 2004)



The GCI vision is based on our current knowledge of the disease process and its prevention, so as to deliver optimal oral and thus general health and well being to all peoples. The GCI aims to establish a broad alliance of key influencers and decision-makers from research, education, clinical practice, public health, government, and

industry to bring about fundamental change in health systems and individual behaviour.

Within the context of GCI has now developed an overarching Global Oral Health Improvement Matrix (GOHIM)⁷ to integrate oral health into health, thereby establishing a collaborative, prevention-oriented model of oral health care.

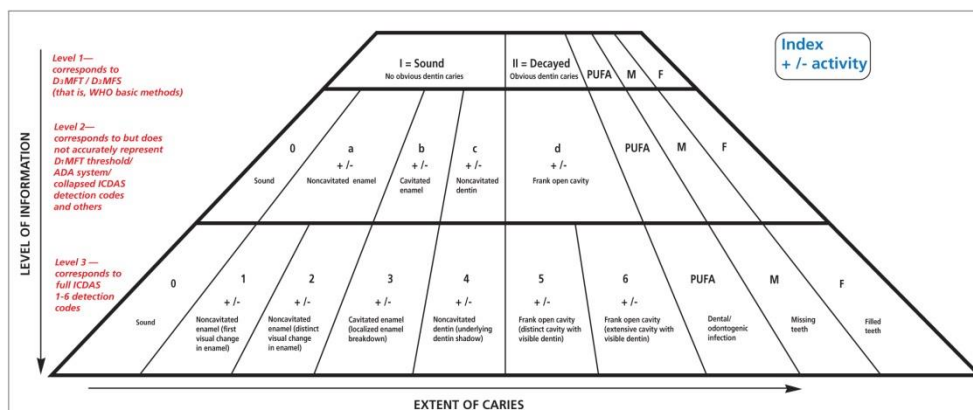


Figure 1: The FDI World Dental Federation Caries Matrix.

It consists of three tiers, one above the other. The extent of the caries lesion and pathology is depicted on the horizontal axis. The top tier (level 1) represents the World Health Organization⁸ Basic Methods (Decayed, Missing, Filled Teeth [D3MFT]/Decayed, Missing Filled Surfaces [D3MFS]) system. The bottom tier (level 3) is the full International Caries Detection and Assessment System (ICDAS),⁹ which provides the most detailed level of information and allows for an expanding degree of detail. The middle tier (level 2) seeks to describe the D1MFT threshold, the American Dental Association (ADA) Caries Classification System (D.M. Meyer, DDS, written communication, April 2012) and the collapsed ICDAS detection, as well as other systems. The middle tier (level 2) of the FDI Caries Matrix makes differentiations between cavitated and noncavitated enamel that correspond to ICDAS but do not correspond to all the named systems. Note that even for the sound/decayed interface at level 1 (WHO Basic Methods), there are a range of regional variations in the conventions used for exact positioning of the vertical lines that subdivide the extent of caries. Future harmonization of these conventions is highly desirable. The + and - symbols indicate the activity of caries lesions as defined in the glossary of terms for caries by Longbottom and colleagues.¹³ The FDI World Dental Federation Caries Matrix as illustrated does not address surface origin of the

caries. F: Filled. M: Missing. PUFA: Pulpal involvement (P/p), ulceration caused by dislocated tooth fragments (U/u), fistula (F/f) and abscess (A/a).²⁴.

MANAGING CARIES RISK AS AN INTEGRAL PART OF GLOBAL HEALTH

Through the GCI, FDI is seeking to expand the role of dental medicine within the field of healthcare. It has the support of the World Health Organization Oral Health Programme, which has recognized the importance of promoting “a new paradigm among dental practitioners, shifting from a restorative to preventive/health promotion model”.⁸

It is important to be clear that the vision of the GCI is not simply to move from a surgical and a restorative model of care to a preventive one, i.e. replacement. Rather it seeks encompass appropriate restorative care within a prevention based model of oral health to expand value and contribute to health outcomes.

As WHO highlighted “different approaches to dental caries management in countries need to be considered in oral health policy, development and planning of public health programmes. Implications for training of dental personnel and costs to society as well as the individual are significant”⁹






Noncommunicable diseases 4 Modifiable Shared Risk Factors 5 Diseases				
	Tobacco use	Unhealthy diet	Physical Inactivity	Harmful Use of Alcohol
Cardio-vascular				
Diabetes				
Cancer				
Chronic Respiratory				
Oral Diseases				

Figure 2: Oral diseases share common risk factors with noncommunicable diseases.

ORAL HEALTH and NCDs

This expansion of the role of dentists can also be seen in FDI’s focus in recent times on NCDs or ‘chronic diseases’. They include cardiovascular disease, cancer, chronic respiratory disease and diabetes, among others and are responsible for 60% of deaths worldwide, in both industrialized and developing countries.

In 2011, FDI and its partners succeeded in having a specific reference to oral diseases included in the United Nations Political Declaration on the Prevention and Control of Non-communicable Diseases (2011)¹⁰ and the ‘common risk factor approach’ described in Article 19.

There, governments recognize “that renal, **oral** and eye diseases pose a major health burden for many countries and that these diseases share common risk factors and can benefit from common responses to non-communicable diseases;”

Dental practitioners are in a unique position when it comes to detecting risk factors. They are one of the few medical professions to see patients who are not actually ill but just there for a check-up. Furthermore, many behaviours are immediately visible during the course of a dental check-up, so dentists are well placed to launch discussion on risks.

PREVENTION AND CONTROL

With the common risk factor approach to disease control and prevention now inscribed in UN principle, the FDI Policy Statement on ‘Non-communicable Diseases’ takes the recognition of the impact of oral health on general health one step further.

This Statement advocates incorporating oral health prevention and control strategies into the NCD agenda, interventions, programmes and campaigns. It calls on FDI and its member national dental associations to make governments, policy makers and community leaders more aware of the great importance of major common risk factors affecting both oral health and other NCDs.

The common risk factor theme also emerges in the FDI Policy Statement ‘Oral Health and the Social Determinants of Health’, which sees the dentists worldwide aligning with other health care professionals to deplore “the structural determinants and conditions

of daily life responsible for a major part of health inequities between and within countries”.

Among other things, the Statement calls on FDI to engage with key partners, notably WHO and the IADR, to develop an integrated approach to reducing oral health inequalities globally. It further calls upon oral health care professionals, in the interest of oral health in all policies, to engage with leaders and policy-makers of government and NGOs, locally, nationally, regionally and globally.

CREDIBILITY

FDI’s credibility has been particularly crucial in defining FDI as a key partner in major international initiatives and ensuring its place at the negotiating table. I was able to view the result of that early in October, when I attended the Conference of Plenipotentiaries on the ‘Minamata Convention on Mercury’.

It was a proud moment. In the run-up to the final FDI had with its partners in the WHO Oral Health Programme and the International Association for Dental Research (IADR), had been in the vanguard of advocacy to defend the right of dentists around the world to continue to exercise their freedom in the choice of the materials they use for restorative work.

The Convention’s provisions for dental amalgam make it highly relevant to the dental profession. Dental amalgam is clinically proven, safe and cost effective restorative material, in use for over 150 years in the fight against dental caries, the cause of tooth decay, which afflicts 90 percent of the world’s population.

However, it is also, within the terms of the Minamata Convention, a mercury-added product, containing 50% mercury. FDI’s goal during the negotiations was to ensure that discussions were based on the best available science. In this respect, the GCI also proved useful as an example of a system for managing caries risk as an integral part of global health.

It was during the fifth and final negotiation session (INC5) in January 2013 that consensus built around a phase-down approach to dental amalgam advocated by the FDI, the [International Association for Dental Research](#) (IADR) and the World Health Organization (WHO)¹¹. Thus, efforts by a team representing the international dental and oral-health sector succeeded in ensuring that dental practitioners would continue to have access to dental amalgam.

OPPORTUNITIES FOR THE PROFESSION

The phase-down approach—versus a ban (phase-out)—advocated by FDI calls for increased research and development on alternatives and the implementation of the best management techniques for amalgam waste.

It also calls for a greater focus on dental prevention and health promotion. Ideally, use of dental amalgam will fall due to a reduction in demand created by more effective prevention strategies. Dental professionals living in a country that has ratified the Convention need to be aware of the direct impact this will have on their profession. In addition, national dental associations, their partners and individual dental professionals have a critical role to play in ensuring that the impact is positive.

This entails taking an active role by helping inform governments about opportunities to improve health and protect the environment within the context of the Convention without diminishing the importance of safe, effective and affordable oral-health care.

CONVENTION PROVISIONS ON DENTAL AMALGAM

The Minamata Convention contains nine provisions for dental amalgam, with ratifying countries under an obligation to implement at least two. They fall into five thematic groups, as follows:

Disease prevention and health promotion

- i. Setting national objectives aiming at dental caries prevention and health promotion, thereby minimizing the need for dental restoration;
- ii. Setting national objectives aiming at minimizing its use;

Research on alternative materials

- iii. Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration;
- iv. Promoting research and development of quality mercury-free materials for dental restoration;

Education

- v. Encouraging representative professional organizations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices;

Financial incentives

- vi. Discouraging insurance policies, and programmes that favour dental amalgam use over mercury-free dental restoration;
- vii. Encouraging insurance policies and programmes that favour the use of quality alternatives to dental amalgam for dental restoration;

Best management practice

- viii. Restricting the use of dental amalgam to its encapsulated form;
- ix. Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds in water and land.

IMPLEMENTATION

The Convention enters into force once it has been ratified by 50 countries, but *only in the ratifying countries*. The next few years will see the implementation stage (2014 to 2017), to be monitored by what the Convention calls the 'Conference of the Parties'. Article 4, item 8, calls for a review of progress within a period of 2014-2017.

It is now up to the members of the oral-health profession to develop ways and means to demonstrate their understanding of the issues and commit to its undertakings in the field of prevention, research and the development of new materials as outlined in the treaty.

Recommended actions include:

- *Implementing* a preventive based model of oral health care; increased emphasis on health promotion, risk assessment, disease prevention and surveillance
- *Establishing* a comprehensive global research agenda, including both public and private sectors, to develop and commercialise quality mercury-free materials for dental restoration, alongside expanded preventive approaches
- *Developing and delivering* education for health care providers on the safe handling, effective waste management and appropriate disposal of dental restorative materials and environment.
- *Adopting* environmentally sound lifecycle management of all dental materials, including dental amalgam.

CONTINUING EDUCATION

Once a year, FDI holds its Annual World Dental Congress: in 2014 it will be in New Delhi. In 2015, the congress will be kindly hosted in Bangkok by our friends at the National Dental Association of Thailand. Today, the FDI Congress is not only one of the key global sources of Continuing Education; it is also rapidly becoming the key place to debate issues of political and strategic concern for the dental profession.

For example, the 2013 congress in Istanbul saw a number of World Oral Health Forums where important issues of public health issues were discussed including one entitled ‘How might the Minamata Convention on Mercury Change Dentistry. A second World Oral Health Forum took up the theme again under the title: ‘Addressing Oral Health into the Global Noncommunicable Diseases Initiative: A focus on the opportunities provided by such integration at regional and country level.

These are important debates for all of us and I do encourage you to join us in September 2014 to pursue these and other debates on issues of concern, in particular caries management and oral health promotion and disease prevention.

WORLD ORAL HEALTH DAY 2014

We all know and understand the importance and effectiveness of public service messages about prevention and caring for your mouth, teeth and gums. Perhaps we also have memories of some of the messages we heard as children about brushing your teeth after each meal. That is why I would also very much encourage your participation in World Oral Health Day 2014 either as an individual dentist—example, by having a poster or logo on the wall of your dental practice—or through an event organized by the local branch of your national dental association.

Projects and events vary from country to country and from culture to culture but they all have important messages to communicate about oral and dental health and the individual’s role in securing his or her own oral health and preventing oral disease. This year’s theme is ‘celebrating healthy smiles’ – and I hope I can count on all present here today to join FDI in, using the words of this year’s theme ‘celebrating healthy smiles’ on 20 March 2014.

CONCLUSION

The activities and policies outlined in this paper demonstrate FDI’s commitment to oral health promotion and disease prevention. It is a key part of its vision, as described in FDI Vision 2020. It plays a pivotal role in FDI’s Live.Learn.Laugh. Programme. Furthermore, FDI’s Global Caries Initiative is predicated on a preventive model of oral care and the key to its approach to the prevention and control of oral diseases within the context of NCDs.

The concept of caries prevention permeates key FDI documents, notably its most recent Policy Statements. Its landmark GCI was central to the negotiation strategy of FDI and its partners during all five sessions Intergovernmental Negotiating Committee (INC) on Mercury, which led ultimately to the Minamata convention and its provisions for dental amalgam.

REFERENCES

1. FDI Policy Statements ‘Non-communicable Diseases (NCDs)’; ‘Oral Health and the Social Determinants of Health’; ‘Oral Infection/Inflammation as a Risk Factor for Systemic Diseases’; ‘Salivary Diagnostics’; and ‘Bisphenol-A in Dental Restorative and Preventive Materials’. *International Dental Journal* 63, no. 6 (2013):
2. *Future Use of Materials for Dental Restoration*, WHO, 2009.
3. Da Silva, Orlando Monteiro, and Michael Glick. “FDI Vision 2020: a Blueprint for the Profession.” *International Dental Journal* 62, no. 6 (2012): 277–277. doi:10.1111/idj.12011. and Glick, Michael, Orlando Monteiro da Silva, Gerhard K. Seeberger, Tao Xu, Gilberto Pucca, David M. Williams, Steve Kess, Jean-Luc Eiselé, and Tania Séverin. “FDI Vision 2020: Shaping the Future of Oral Health.” *International Dental Journal* 62, no. 6 (2012): 278–291. doi:10.1111/idj.12009.
4. WHPA: World Medical Association (WMA), International Council of Nurses (ICN), International Pharmaceutical Federation (FIP) and the World Confederation of Physical Therapy (WCPT)
5. Pine CM, Dugdill L. Analysis of a unique global public-private partnership to promote oral health. *Int Dent J.* 2011;61:11–21. and Cohen LK. Live.Learn.Laugh.: A Unique Global Public-Private Partnership to Improve Oral Health. *Int Dent J.* 2011;61:1–1.
6. Fisher J, Johnston S, Hewson N, van Dijk W, Reich E, Eiselé J-L, et al. FDI Global Caries Initiative; implementing a paradigm shift

in dental practice and the global policy context. Int Dent J. 2012;62(4):169–74.

7. *Fisher, Julian, BDS, MSc,MIH; Glick, Michael, DMD;for the FDI World Dental Federation Science Committee. ‘A new model for caries classification and management. The FDI World Dental Federation Caries Matrix’. Journal of the American Dental Association (JADA). JADA 143(6) <http://jada.ada.org> June 2012, 546-551.*
8. *‘Future Use of Materials for Dental Restoration’, WHO, 2009.*
9. *‘Future Use of Materials for Dental Restoration’, WHO, 2009.*
10. *For explanations of the contents of the UN Political Declaration on Noncommunicable Diseases, consult the FDI publication ‘Oral Health and the United Nations Political Declaration on NCDs: a guide to advocacy’, online at www.fdiworldental.org/media/9465/oral_health_and_un_political_dec_on_ncds.pdf.*
11. *In particular ‘Future Use of Materials for Dental Restoration’, WHO 2010.*

**GLOBAL CARIES PERSPECTIVE:
THE RESEARCH AGENDA**

Edward CM LO

GLOBAL CARIES PERSPECTIVE: THE RESEARCH AGENDA

Edward CM LO³

The International Association for Dental Research (IADR) is the largest international organization of dental researchers, with more than 11,500 members worldwide. Its mission is: (1) to advance research and increase knowledge for the improvement of oral health worldwide; (2) to support and represent the oral health research community; and (3) to facilitate the communication and application of research findings.

IADR recognizes that there is marked social gradient in oral health and that there are global inequalities in oral health, both between and within different regions and societies. Dental caries is among the most prevalent oral diseases of concern. Despite having much research into the biological and social determinants of oral health, including dental caries, there has been limited success in translating research into effective action to promote global oral health and improve on the dental caries inequality situation. Earlier this year, the IADR Global Oral Health Inequalities Research Agenda (IADR-GOHIRA®) was published (Sgan-Cohen *et al.*, 2013). This calls for coordinated action and strategy to address the prioritized research agenda so as to close the knowledge gaps in different aspects of reducing inequalities in oral health.

The overall aim of the IADR-GOHIRA is to focus attention on the need: (1) for better understanding of the full range of oral health determinants; (2) to promote research on social and physical environments, across the social gradient, with emphasis on marginalized and vulnerable communities; (3) to focus on research strategies that can better serve to reduce existing oral health inequalities, within and between countries; and (4) to develop and maintain usable resources for compiling evidence-based systematic reviews and guidelines on methods and strategies to address the inequalities in oral health.

³ *Treasurer, International Association for Dental Research. Edward LO <hrdplcm@hku.hk>*

REFERENCES

Sgan-Cohen HD, Evans RW, Whelton H, Villena RS, MacDougall M, Williams DM, and IADR-GOHIRA Steering and Task Groups (2013). IADR Global Oral Health Inequalities Research Agenda (IADR-GOHIRA®): a call to action. J Dent Res 92:209-211.

CARIOLOGY RESEARCH UPDATE

Dominick T ZERO

CARIOLOGY RESEARCH UPDATE

Dominick T ZERO⁴

⁴ Professor, Indiana University, USA. Email: Dominick T Zero <dzero@iupui.edu>

CARIOLOGY IN DENTAL EDUCATION

Juan Carlos Llodra CALVO

CARIOLOGY IN DENTAL EDUCATION

Juan Carlos Llodra CALVO⁵

First of all, thank you for the kind invitation to speak here today.

I have been asked to prepare a lecture about Cariology in Dental Education. Therefore, I’m going to present the results “of a joint workshop of the European Organization for Caries Research (ORCA) together with the Association for Dental Education in Europe (ADEE), which was held in Berlin from 27 to 30 June 2010.”

The European Core Curriculum in Cariology can be divided into 5 domains (Figure 1)

- The knowledge base
- The risk assessment and diagnosis
- The clinical decision making (preventive non-surgical therapy and surgical therapy)
- Evidence-based cariology

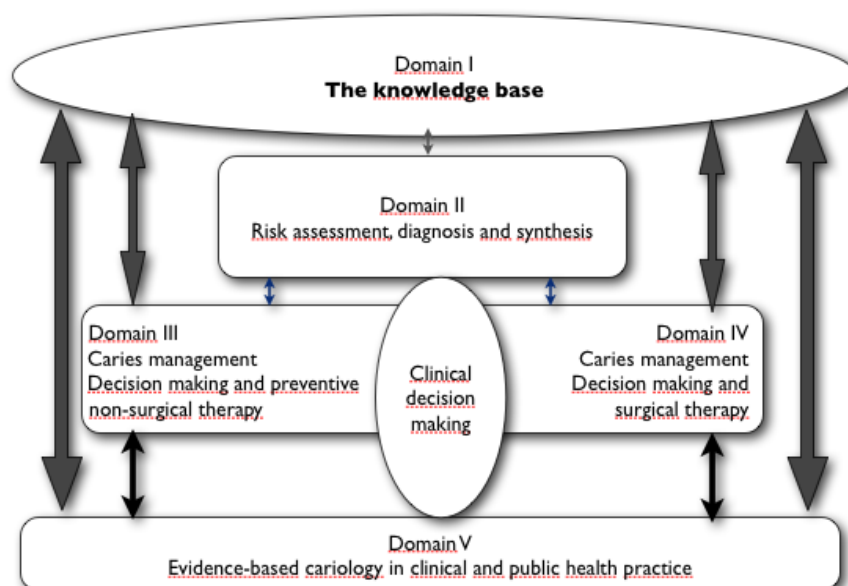


Figure 1: The European Core Curriculum in Cariology.

⁵ Preventive and Community Dentistry, University of Granada, Spain; FDI Public Health Committee Chair. Email: Juan Carlos Llodra <jllodra@hotmail.com>

DOMAIN I: THE KNOWLEDGE BASE⁽¹⁾

The domain knowledge base includes not only the traditional fields of basic sciences such as anatomy and histology but propose to include emerging sciences such as molecular biology, nanotechnology, behavioural sciences fields and research methodology. This also includes all aspects relating to prevention.

It is very important that the future dentist learn to make a clear distinction between dental caries as symptomatic process such as caries lesion and caries disease with all its etiological connotations stemming from it. Furthermore, we believe that we must insist on the evolution of the dental caries concept, from a merely surgical therapy to preventive option in order to avoid or reduce those aggressive therapies.

We cannot forget the dynamic and reversible concept of the process of caries. This includes an analysis of pathological and protective factors.

DOMAIN II: RISK ASSESSMENT, DIAGNOSIS AND SYNTHESIS⁽²⁾

Three major competencies were identified: Risk Assessment – competent at identifying and estimating the probability for a patient of developing new caries lesions or progression of existing lesions during a specified period of time; Diagnosis – competent through collecting, analysing and integrating data on signs and symptoms of dental caries and assess activity status of a lesion on a tooth surface to arrive at an identification of past or present occurrence of the disease caries; and Synthesis – competent at synthesising all relevant information by combining and interpreting findings from: risk assessment and diagnostic processes; from patients' needs, preferences and best interests; and from monitoring, review and re-assessment findings, when available.

All these concepts must be translated into an educational process in which the future dentist knows to integrate all matters relating to risk assessment on one hand, and on the other, the current concepts of caries diagnosis with the aim of being able to achieve a synthesis based on scientific evidence. To accomplish this educational goal, a number of terms, which are often confusing and used in a wrong and inappropriate way for the dental community, should be clarified. The terms of lesion detection, lesion assessment and caries diagnosis should be clearly defined from the beginning of the educational

process.

As previously mentioned, in this process should be a distinction between the risk assessment performed at the tooth surface level and that performed at the patient level. (Fig.2). All this information subsequently allows the development of a right treatment plan for the patient in order to avoid a merely technical vision of caries disease.

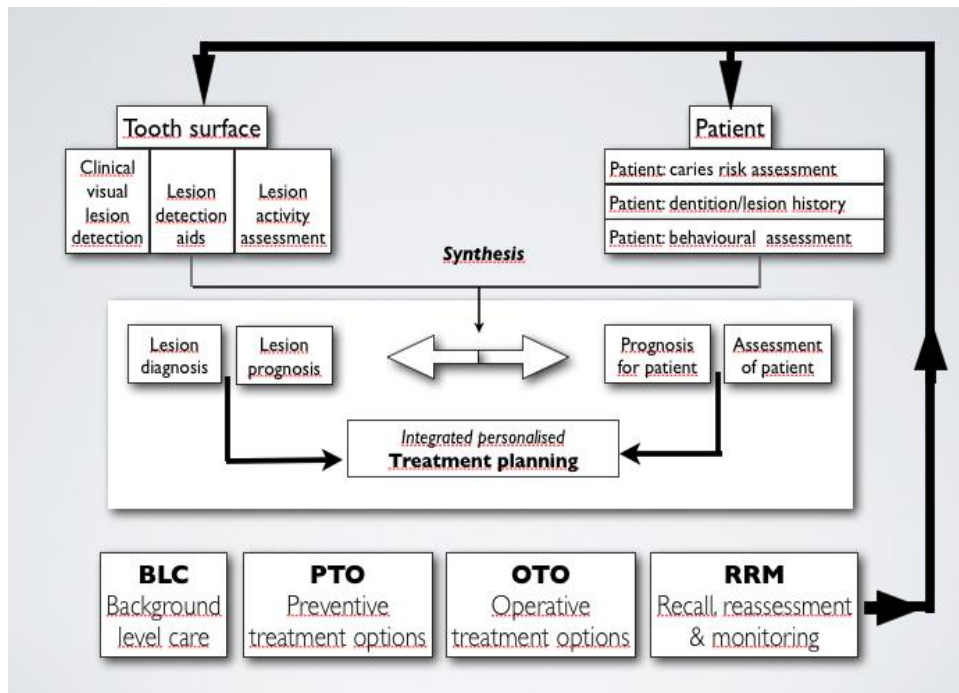


Figure 2: Framework for ICDAS-enabled, patient-centred caries management.

Regarding diagnosis, the International Caries Detection and Assessment System (ICDAS) is currently proposed for several reasons:

- It employs an evidence-based and preventively oriented approach,
- Is a detection and assessment system classifying stages of the caries process
- Provides all stakeholders with a common caries language
- Has evolved to comprise a number of approved, compatible ‘formats’
- Supports decision-making at both individual and public health levels.

ICDAS system is extremely versatile and it is very useful not only in the education field but also in the dental practice, research and public health fields. This system has also the ability, in those situations that require it, to incorporate the PUFA index which includes pulp problems (such as ulceration, fistula and abscesses)

Domains III and IV are dedicated to Caries Management. Domain III corresponds to the preventive and non-surgical therapy while domain IV is reserved for surgical therapy.

DOMAIN III. DECISION MAKING AND PREVENTIVE NON-SURGICAL THERAPY⁽³⁾

Traditionally, the dental curriculum usually prevail surgical therapy. One factor that is essential in the provision of a preventive, non-surgical approach is that of communication with the patient. However, this unfortunately takes less space in the dental curricula compared with technical skills aimed at restorative procedures; this weighting needs to be more equally balanced.

The teaching of these competencies to undergraduate dental students and the application of these competencies in clinical situations require not only a thorough understanding of the caries process according to the best evidence but also acceptance of moving away from a surgical-only model of dental care. The latter has to be accepted not only by all branches of the dental profession but also by patients and healthcare institutions.

For this reason, dental student must correctly handle all the available preventive tools and learn the basic notions of communication with patients. For dental students to become competent in the assessment of caries activity and preventive strategies, early patient contact is essential so that these students can follow up patients long enough to establish the outcome of their assessment and management.

To fulfil this approach, it is extremely important the students know the effectiveness of the different prevention methods and its health economic aspects. Teaching prevention should not focus in an isolated way on aspects related to Cariology. It must be integrated into a global prevention in the field of dentistry in order to avoid conflicting messages. Furthermore, because many active practitioners graduated some decades ago, the new message that caries treatment does not consist of operative treatment alone needs to be disseminated. Continuing education is a good way to reach these practitioners.

DOMAIN IV. DECISION MAKING AND SURGICAL THERAPY⁽⁴⁾

Domain IV focuses on surgical therapy aspects, defined as "any step undertaken by the dentist, or other qualified personnel to intentionally remove dental hard tissue and includes treatment options such as cavity preparation to place a restoration". It is unanimously agreed that surgical therapy was not reasonably balanced regarding the preventive aspects. In any case, the long-term results of surgical therapy will largely depend on preventive measures implanted.

Undergraduate education should be able to prepare students in the manual skills of quality in surgical therapy of dental caries. That includes a good knowledge of the effectiveness and longevity of the different treatments available, the cost of them and ethical considerations in order to provide the best treatments available to the patient.

In this decision-making of surgical therapy a number of factors need to be considered. These factors include patient's needs, preventive strategies, tooth preservation, short and long term results of treatments and the cost of them. It is obvious that the best training in this field, the better the results in the medium and long term.

Regarding the caries process, numerous variables have been identified:

- Misperception of caries: Caries is still perceived by dentists and patients as a disease that can be 'cured' by drilling and filling
- Lack of patient and professional education: Preventive concepts do not lead to instant results
- Lack of integration: Usually dental education and educators are organised, think and act in divisions (e.g. operative, restorative, preventive departments)
- Lack of evidence base: Most decisions in dental practice are based on low evidence levels
- How to increase acceptability of less invasive treatment: prevention and risk assessment must be worthwhile for the patient, dentists, insurers and politicians.
- Remineralisation therapies are evidence-based standard methods to treat carious lesions, and the benefits over restorative approaches are well accepted.
- Inverse teaching approach: In most dental schools students learn initially the skills of cavity preparation and restoration with phantom-heads and subsequently with patients. Only at a later stage in the course will preventive treatment options be taught and practised on the clinic.

Regarding to the caries removal two aspects have been identified:

- The existence of a very high level of variability at the time of removal of caries based on the classical criteria (dentin hardness, its colour, etc.)
- The maximum preservation of dental hard tissues should be considered a priority (minimal dentistry intervention).

Regarding to the cavity restoration, a number of relevant aspects must also be highlighted:

- Lack of patient education: many patients prefer immediate and tangible results instead of waiting for possible intangible benefits of longer-term prevention. The time value is very important, especially nowadays. In this sense, the patients prefer a quick restoration and not having to go through repeated preventive treatments that take much longer.
- Lack of dentist and educator motivation: the student's own assessment is usually based on the tangible number of therapeutic acts carried out: number of filling, number of crowns, etc. However, other treatments such as those related to minimal intervention therapies, are not evaluated with the same intensity probably because its difficult to assess them.
- Lack of long-term effectiveness: the average life of restorative treatment depends on several factors. In dentistry re-restorations are usually after a certain period of time, which means an increase of dental treatment cost for patients.

In relation to financial considerations in most models of dental care around the world, surgical treatments are more important than preventive treatments. These are not usually reimbursed and therefore suffer severe discrimination that determines, in part, the way to practice dentistry. We thus come to a dangerous vicious circle in which dentist assumes that prevention do not compensate because they are not going to be paid for it. On the other hand, the patient also assumes that will not pay for prevention if dentist have not really done anything tangible. It is obvious that only through the undergraduate educational process, these false axioms could be gradually changed (Figure 3).



Figure 3: The vicious circle of prevention.

In short, at the end of their undergraduate education, the future dentist should be prepared to make the best treatment decisions possible, providing the most benefit to the patient with the best available scientific evidence. This also includes a good training in manual skill in order to provide the best treatments, being aware of its longevity, its costs, and its potential adverse effects in terms of repercussions in oral and global health. The future dentist should have training in relation to the importance of the preservation of dental hard tissues and the relevance of health promotion. All this goes through a proper knowledge and manual skills training, properly balanced throughout the whole curriculum, and if possible, from the beginning of it.

DOMAIN V. EVIDENCE-BASED DENTISTRY IN CLINICAL AND PUBLIC HEALTH PRACTICE⁽⁵⁾

Domain V focuses on the study of evidence-based cardiology in clinical and public health practice. The Berlin Workshop recommends “On graduation, a dentist must understand the benefits of practicing in an evidence-based manner at both individual and public health levels, and have good knowledge and skills in these areas, and apply them to the fields of caries”.

To conclude, The European Core Curriculum in Cariology, proposed by the European Organization for Caries Research (ORCA) together

with the Association for Dental Education in Europe (ADEE) is based on 5 domains interrelated with each other. It is a versatile proposal based on the available scientific evidences. Its main objective is helping the future dentist not only to be able to do things right, but also to be able to do the right things.

REFERENCES

1. *P. Anderson, J. Beeley, P. Manarte Monteiro, H. de Soet, S. Andrian, B. Amaechi and M.-C. D. N. J. M. Huysmans. A European Core Curriculum in Cariology: the knowledge base. Eur J Dent Educ 2011; 15(Suppl 1): 18-22*
2. *N. Pitts, P. Melo, S. Martignon, K. Ekstrand and A. Ismail. Caries risk assessment, diagnosis and synthesis in the context of a European Core Curriculum in Cariology. Eur J Dent Educ 2011; 15(Suppl 1): 23-31*
3. *P. Bottenberg, D. N. J. Ricketts, C. Van Loveren, C. Rahiotis and A. G. Schulte. Decision-making and preventive non-surgical therap in the context of a European Core Curriculum in Cariology. Eur J Dent Educ 2011; 15(Suppl 1): 32-39*
4. *W. Buchalla, A. Wiegand and A. Hall. Decision-making and treatment with respect to surgical intervention in the context of a European Core Curriculum in Cariology. Eur J Dent Educ 2011; 15(Suppl 1): 40-44*
5. *Ch. H. Splieth, N. Innes and A. Söhnel. Evidence-based cariology in clinical and public health practice as part of the European Core Curriculum in Cariology. Eur J Dent Educ 2011; 15(Suppl 1): 45-51*

DENTAL CARIES CONTROL IN CHILDREN

*Edward CM LO
Duangporn DUANGTHIP*

DENTAL CARIES CONTROL IN CHILDREN

*Edward CM LO⁶
Duangporn DUANGTHIP⁷*

Dental caries is one of the most common childhood diseases worldwide, including in Asia. To plan and implement the effective caries control program in children, one should have good knowledge of the causes of and factors associated with dental caries in children. In a systematic review of the literature on the risk factors for dental caries in young children, Harris *et al.* (2004) identified 106 factors which were significantly related to the prevalence or incidence of caries. Among these factors, the ones that are more important for planning caries prevention programs include reduction in the frequency of sugary food/drink intake, good or supervised brushing/cleaning of teeth, and less use of feeding bottle especially when going to bed at night. The above should be included in the key messages in **ORAL HEALTH EDUCATION** programs for parents and caretakers of young children. However, evidence showing effectiveness of oral health education in preventing dental caries in young children is limited (Ammari *et al.*, 2007). Despite this, oral health education for children and their parents should still be an important component of the dental caries control program for children as it can help to raise the participants' awareness of good oral health, increase their dental health knowledge and improve their attitudes (Kay & Locker, 1998).

USE OF FLUORIDE

Besides oral health education there should be other preventive measures for dental caries control. From the extended host-agent-environment disease causation model for dental caries (Ten Cate, 2009), the use of fluorides appears to be one of the most important factors for caries prevention. Fluoride acts on the tooth surface to reduce demineralization and to promote remineralization of dental hard tissues, and it also has antimicrobial actions such as suppressing the production of acids by plaque bacteria (Buzalaf *et al.*, 2007). Fluorides can be administered through community-based

⁶Faculty of Dentistry, University of Hong Kong. Email: Edward Lo <hrdplcm@hku.hk>

⁷ Faculty of Dentistry, University of Hong Kong. Email: Duangporn <dduangporn@yahoo.com>

delivery program, applied topically by professionals or through the use of self-care products. Among the various fluoride delivery methods, fluoridation of the community drinking water supply has the longest history which is over 60 years. The dental caries preventive effect of water fluoridation is clearly shown in the systematic review of the literature conducted by McDonagh *et al.* (2000). Two-thirds of the 30 included studies in the review showed a significant increase in the proportion of children without dental caries experience after water fluoridation was introduced compared to the situation when there was no water fluoridation. There was also a decrease in the mean number of decayed, missing, and filled primary/permanent teeth (dmft/DMFT) in the range of 0.5 to 4.4 teeth. Water fluoridation is probably the most cost-effective community-based dental caries prevention method for children. It is recommended by both the World Health Organization (WHO) and the World Dental Federation (FDI). In situations where water fluoridation cannot be implemented, salt fluoridation and milk fluoridation are feasible alternatives. These programs have been implemented successfully in some countries in Asia (Petersen *et al.*, 2012).

Results from numerous studies have shown that topical fluorides can effectively prevent dental caries in children, with a pooled prevented fraction of 26% of DMFS scores (Marinho *et al.*, 2003). The most commonly used topical fluoride agents is fluoride toothpaste. A recent Cochrane systematic review confirmed that the effectiveness of fluoride toothpaste in preventing dental caries in children increased with the fluoride concentration and supervision of tooth brushing (Walsh *et al.*, 2010). Besides promoting the use of fluoride toothpaste at home, regular tooth brushing with fluoride toothpaste in kindergarten or school can be a good program for dental caries control in children when indicated. The conventional concentration of fluoride ion in toothpaste is around 1000 parts per million (ppm). For better control of dental caries in older children who do not have significant risk for developing dental fluorosis, for example those older than 6 years, higher concentration fluoride toothpaste would be appropriate. However, there are different views on the appropriate use of fluoride toothpaste in the very young children. On one hand, there may be an increased risk of development of mild dental fluorosis when a child starts to use fluoride toothpaste at or before 12 months of age (Wong *et al.*, 2011). On the other hand, the use of toothpaste with a fluoride concentration at around 500 ppm or below may not be effective in preventing dental caries (Walsh *et al.*, 2010). When balancing the risk and benefit of using fluoride toothpaste in young children, in most cases the need for preventing dental caries outweighs the possibility of a minor cosmetic side effect of mild fluorosis. It has been proposed

that reducing the amount of toothpaste applied onto a toothbrush would be a better strategy than using low fluoride concentration toothpaste, and that a thin smear to a small pea size amount of toothpaste be used for children under the age of 6 years (Zero *et al.*, 2012).

Another effective topical fluoride agent is fluoride mouthrinse. Sodium fluoride rinse used daily at a lower concentration (around 0.05%) or used weekly at a higher concentration (at around 0.2%) has been found to have a caries preventive effect in children with limited background fluoride exposure but its additional effect in children with daily use of fluoride toothpaste is questioned (Twetman *et al.*, 2004). Use of fluoride mouthrinse is generally recommended for children starting from age 6 years but it can also be used safely for children 4-5 years old under close supervision (Zero *et al.*, 2012).

Fluoride gel/foam and fluoride varnish are both used by dentists in the private sector and in public services in Asian countries and both are effective in preventing dental caries in children (Lo *et al.*, 2012). Compared to fluoride gel, fluoride varnish has the advantage of more targeted application onto the tooth surfaces which require protection against caries and the amount of fluoride used in each application is less and well controlled by the operator. The latter advantage is of particular importance when used in young children as the risk of fluoride toxicity due to ingestion would be much reduced. In the systematic review on fluoride varnish conducted by Marinho *et al.* (2002), the reported pooled prevented fraction for the DMFS and the dmft scores were 46% and 33%, respectively. The frequency of fluoride varnish application should be based on the dental caries risk of the children and 2 to 4 times a year has been suggested (American Dental Association Council on Scientific Affairs, 2006).

PREVENTION OF PRE-CAVITATED DENTAL CARIOUS LESION

Other than the use of fluorides, placement of sealants on the pits and fissures of permanent teeth has been found to be very effective in preventing dental caries. The 3-year pooled risk for developing dental caries in the sealed sites of first permanent molars is only 30% of that of unsealed sites (Ahovuo-Saloranta *et al.*, 2008). The traditional fissure sealants use resin-based material, and good moisture control and use of dental equipment is needed for successful placement. In the last two decades, glass ionomer materials suitable for use as sealants have been developed and their application is technically less demanding. A systematic review by Beiruti *et al.* (2006) found no

clinical evidence supporting that either resin-based or glass ionomer sealant material was superior to the other in preventing dentin caries lesion development in pits and fissures over time. Notwithstanding that dental sealants are highly effective in preventing pit and fissure caries in permanent teeth, evidence showing their effectiveness in primary teeth is very limited.

It should be noted that the use of the above-mentioned dental caries preventive methods can be combined to achieve a better outcome. There is good evidence of the complementary efficacy of preventive strategies such as using fissure sealants and fluoride varnish, as well as toothbrushing with fluoride toothpaste and dietary counseling (Azarpazhooh & Main, 2008). Use of fluoride mouthrinse, gel or varnish in combination with fluoride toothpaste can result in a pooled prevented fraction of around 10% in DMFS score in children compared to using fluoride toothpaste alone (Marinho *et al.*, 2004). Thus, when planning dental caries prevention programs for children, the use of complementary strategies should be considered.

Besides preventing the development of new dental caries, a good caries control program for children should also include component which can prevent or halt the progression of existing non-cavitated and cavitated carious lesions. It has been documented that daily brushing with fluoride toothpaste can arrest active carious dentin lesion in the primary teeth of preschool children (Lo *et al.*, 1998). The active dentin caries lesion will become dark in color with a shiny appearance when arrested and the surface of the arrested lesion is hard on gentle probing. There is no pain or discomfort from the arrested lesions which had not previously progressed into the dental pulp. Whether an arrested caries lesion needs to be restored depends to a great extent on the wish of the child/parent and the availability of resources. Clinical studies have found that repeated applications of sodium fluoride varnish or silver fluoride solution can arrest active dentin caries in young children, with the latter being more effective (Rosenblatt *et al.*, 2009). With regular applications of silver diammine fluoride solution over 2 years, up to 90% of the cavitated dentin caries lesions in primary teeth can be arrested while removal of the superficial soft carious dental tissues by using hand instruments can speed up the process of complete caries arrest (Wong *et al.*, 2005).

Fissure sealants with a good seal can also stop the progression of early dental caries. A review of the literature on the effect of dental sealants on bacteria levels in caries lesions by Oong *et al.* (2008) found sealing caries in teeth was associated with a drastic reduction in the number of viable bacteria in the lesions and that the concerns

about poorer outcomes associated with inadvertently sealing caries was not supported. A recent report of the American Dental Association Council on Scientific Affairs also supports the use of fissure sealants to prevent the initiation and progression of dental caries in children (Beauchamp *et al.*, 2008).

PREVENTIVE RESTORATION OF CAVITATED DENTAL CARIOUS LESION

Traditionally, cavitated dental carious lesions in vital teeth have been treated using a restorative approach. Placement of amalgam or resin composite into a surgically prepared cavity in a dental clinic setting has been a common practice by dental professionals for restoring the function of a decayed tooth. However, placement of dental fillings in young children is not easy and challenging for many dentists. In many places, most of the decayed primary teeth in preschool children are unfilled. Furthermore, the success of dental restorations placed in primary teeth is highly variable and is significantly affected by the operator. In a recent systematic review on the survival of Class II amalgam restorations placed in primary molars, a wide range of failure rates from 0 to 58% was reported (Kilpatrick & Neumann, 2007). Another systematic review conducted by Hickel *et al.* (2005) on the longevity of different restorations placed in stress-bearing cavities of primary molars reported annual failure rates of 0-15% for resin composite restorations.

The use of glass ionomer material in restoring cavities in stress-bearing areas in teeth is relatively new. This was prompted by the introduction of the atraumatic restorative treatment (ART) which was developed in response to a need to provide effective preventive and restorative treatment in underserved communities where running water and electricity was not easily available. Nowadays, high viscosity glass ionomer restorative materials are marketed by various dental material manufacturers for use in both clinical and field settings. A recent systematic review on the survival of ART sealants and restorations placed using high-viscosity glass ionomers reported 2-year survival rates of 93% and 62% for single-surface and multiple-surface ART restorations in primary teeth, respectively (de Amorim *et al.*, 2012). These rates are comparable to those of the traditional amalgam or resin composite restorations. With its fluoride releasing property, secondary caries around glass ionomer restorations is uncommon and it can help to remineralize the underlying soft dentin left behind when treating a deep carious cavity (Massara *et al.*, 2002).

CONCLUSION

In summary, there are a number of effective primary and secondary prevention methods available for use in dental caries control programs for children. The notable ones include the use of fluorides and fissure sealants. Careful assessment of the situation and the caries risk of the children should be undertaken before deciding on the most appropriate method to be used. Combination of different complementary strategies is feasible and should be considered when planning dental caries control programs. The use of fluoride releasing adhesive material for restoring cavitated lesions seems promising. Caries arrest treatment is a viable alternative to the traditional restorative approach in treating dentin caries, especially in the primary teeth of young children. More clinical trials on the effectiveness of various methods in preventing and arresting dental caries, especially those using a combination strategy and those for use in preschool children, are needed.

REFERENCES

- Ahovuo-Saloranta A, Hiiri A, Nordblad A, Makela M, Worthington HV (2008). Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents. *Cochrane Database Syst Rev Issue 4: CD001830.*
- American Dental Association Council on Scientific Affairs (2006). Professionally applied topical fluoride: evidence-based clinical recommendations. *J Am Dent Assoc 137:1151-1159.*
- Ammari JB, Baqain ZH, Ashley PF (2007). Effects of programs for prevention of early childhood caries. A systematic review. *Med Principles Prac 16:437-42.*
- Azarpazhooh A, Main PA (2008). Fluoride varnish in the prevention of dental caries in children and adolescents: a systematic review. *J Can Dent Assoc 74:73-79.*
- Beauchamp J, Caufield PW, Crall JJ, et al. (2008). Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. *J Am Dent Assoc 139:257-268.*
- Beirut N, Frencken JE, van 't Hof MA, van Palenstein Helderma WH (2006). Caries-preventive effect of resin-based and glass ionomer sealants over time: a systematic review. *Community Dent Oral Epidemiol 34:403-409.*

Buzalaf MA, Pessan JP, Honório HM, ten Cate JM (2011). Mechanisms of action of fluoride for caries control. Monogr Oral Sci 22:97-114.

de Amorim RG, Leal SC, Frencken JE (2012). Survival of atraumatic restorative treatment (ART) sealants and restorations: a meta-analysis. Clin Oral Investig 16:429-441.

Harris R, Nicoll AD, Adair PM, Pine CM (2004). Risk factors for dental caries in young children: a systematic review of the literature. Community Dent Health 21(Suppl):71-85.

Hickel R, Kaaden C, Paschos E, Buerkle V, Garcia-Godoy F, Manhart J (2005). Longevity of occlusally-stressed restorations in posterior primary teeth. Am J Dent 18:198-211.

Kay E, Locker D (1998). A systematic review of the effectiveness of health promotion aimed at improving oral health. Community Dent Health 15:132-44.

Kilpatrick NM, Neumann A (2007). Durability of amalgam in the restoration of class II cavities in primary molars: a systematic review of the literature. Eur Arch Paediatr Dent 8:5-13.

Lo ECM, Schwarz E, Wong MCM (1998). Arresting dentine caries in Chinese preschool children. Int J Paed Dent 8:253-260.

Lo ECM, Tenuta LMA, Fox CH (2012). Use of professionally administered topical fluorides in Asia. Adv Dent Res 24(1):11-15.

Marinho VCC, Higgins JPT, Logan S, Sheiham A (2002). Fluoride varnishes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev Issue 1: CD002279.

Marinho VCC, Higgins JPT, Logan S, Sheiham A (2003). Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents. Cochrane Database Syst Rev Issue 4: CD002782.

Marinho VCC, Higgins JPT, Sheiham A, Logan S (2004). Combinations of topical fluoride (toothpastes, mouthrinses, gels, varnishes) versus single topical fluoride for preventing dental caries in children and adolescents. Cochrane Database Syst Rev Issue 1: CD002781.

Massara ML, Alves JB, Brandao PR (2002). Atraumatic restorative treatment: clinical, ultrastructural and chemical analysis. Caries Res 36: 430-436.

McDonagh MS, Whiting PF, Wilson PM et al. (2000). Systematic review of water fluoridation. Br Med J 321:855-9.

Oong EM, Griffin SO, Kohn WG, Gooch BF, Caufield PW (2008). *The effect of dental sealants on bacteria levels in caries lesions: a review of the evidence. J Am Dent Assoc* 139: 271-278.

Petersen PE, Baez RJ, Lennon MA (2012). *Community-oriented administration of fluoride for the prevention of dental caries: a summary of the current situation in Asia. Adv Dent Res* 24(1):5-10.

Rosenblatt A, Stamford TC, Niederman R (2009). *Silver diamine fluoride: a caries "silver-fluoride bullet". J Dent Res* 88: 116-125.

Ten Cate JM (2009). *The need for antibacterial approaches to improve caries control. Adv Dent Res* 21:8-11.

Twetman S, Petersson L, Axelsson S, et al. (2004). *Caries-preventive effect of sodium fluoride mouthrinses: a systematic review of controlled clinical trials. Acta Odontol Scand* 62:223-30.

Walsh T, Worthington HV, Glenny AM, Appelbe P, Marinho VCC, Shi X (2010). *Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. Cochrane Database Sys Rev Issue 1: CD007868.*

Wong MCM, Lam KF, Lo ECM (2005). *Bayesian analysis of clustered interval-censored data. J Dent Res* 84:817-821.

Wong MC, Clarkson J, Glenny AM, et al. (2011). *Cochrane reviews on the benefits risks of fluoride toothpastes. J Dent Res* 90:573-579.

Zero DT, Marinho VCC, Phantumvanit P (2012). *Effective use of self-care fluoride administration in Asia. Adv Dent Res* 24(1):16-21.

NUTRITION AND ORAL HEALTH

*Andrew RUGG-GUNN
Paula MOYNIHAN*

NUTRITION AND ORAL HEALTH

Andrew RUGG-GUNN⁸

Paula MOYNIHAN⁸

INTRODUCTION

Nutrition is a major influence on growth, well-being, and the presence and absence of disease. Nutrient deficiency diseases used to be common – causing failure to thrive, death, and increased susceptibility to infections. In developed countries they still exist but are now much rarer, overtaken in importance by diseases related to food intake which is both excessive and badly balanced. In the 20 countries of interest at this conference, both problems exist – under-nutrition, and excessive and badly balanced nutrition, contributing, in turn, to a rise in non-communicable diseases – cardiovascular diseases, diabetes, cancer and chronic respiratory diseases, to name but a few. Non-communicable diseases are now responsible for 63% of total world mortality: nearly 80% of this disease burden is in low- and middle-income countries [1]. They are now the most frequent cause of death in South-East Asia. These non-communicable diseases share many risk factors, including imbalanced nutrition. Most oral diseases fit within this group, being due, in a large part, to badly balanced diet. WHO projections show that NCD mortality will rise in South-East Asia, 2010 to 2020, by over 20%, while no increase is expected in Europe. In parallel with these changes in disease profile have been changes in diet. In many countries, there has been a change from traditional diets to fast-foods and sugared drinks aggressively marketed by multinational companies.

ORAL DISEASES

The oral diseases that will be considered are: dental caries, periodontal disease, cancer, and dental fluorosis. The importance of oral diseases from medical, social and economic viewpoints is considerable. According to WHO, oral disease is the fourth most expensive disease to treat [2]. Dental caries remains the most

⁸ WHO Collaborating Centre for Nutrition and Oral Health, Professor, Newcastle University, UK.
Email: Andrew Rugg-Gunn <andrew@rugg-gunn.net>,
Paula Moynihan <p.j.moynihan@newcastle.ac.uk>

prevalent and economically important oral disease. In the 20 Asian countries being considered, there is a mixed picture. In some, dental caries severity is decreasing, in others, severity is increasing, and in others there has been little change over recent years. The South-East Asia Consultation on Oral Health in 2008 reported caries prevalences of 50% to 80% at age 6 years, with mean DMFT at age 12 years varying between 0.5 and 2.2 [3]. The WHO collaborating centre at Niigata has been coordinating data on periodontal disease [www.dent.niigata-u.ac.jp/prevent/perio/contents.html]. The incidence of oral cancer varies widely within Asia. Globally, it is the seventh most prevalent cancer, while in south-central Asia, it is the third, affecting more than 150 thousand Indians each year [4].

Although there are major challenges in improving oral health, there are many building blocks in place which could lead to considerable reduction in the burden of oral disease. First, information on the occurrence of oral diseases within each country is much improved. Second, information about nutrition and diet within countries is also improving. Third, our knowledge of the relation between nutrition, diet, and health and disease is now very well documented. Fourth, much of these chronic, non-communicable diseases are preventable. Fifth, the realisation that good nutrition is fundamental to health is now influencing policy within Regions, within countries, within communities, and is understood by individuals: the goals set are achievable. This is well-illustrated by looking through the Agendas for the World Health Assembly for recent years and the web-pages for SEARO and WPRO. I wish now to consider the third point above – the relation between nutrition, diet and oral health.

EVIDENCE FOR THE RELATION BETWEEN NUTRITION, DIET AND ORAL DISEASE

The book 'Nutrition and dental health', published in 1993, is 470 pages long and contains some 1,500 references [5]. This is evidence of the vast amount of information published on this subject. Since then, other reviews have been published but the conclusions have not changed significantly. The evidence will not be discussed in detail but reference will be made to the most authoritative, recent review – the WHO Technical Report 916 'Diet, Nutrition and the Prevention of Chronic Diseases', 2003 [6]. It is a report of a joint WHO/FAO Expert Consultation. There were 30 members and each draft underwent intense external scrutiny. Dental disease was one of six chronic diseases considered because of their public health importance and the many common risk factors.

Nutrition and dental disease. Nutritional status affects teeth pre-eruptively, although this influence is much less important than the post-eruptive local effect of diet on teeth. Deficiencies of vitamins D and A, and protein-energy malnutrition have been associated with enamel hypoplasia and salivary gland atrophy, so that undernutrition coupled with a high intake of sugars may exacerbate the risk of dental caries. There is some evidence to suggest that periodontal disease progresses more rapidly in undernourished populations. Undernourishment exacerbates the severity of oral infections – for example, acute necrotizing gingivitis and, more severely, noma. To complete the picture, it is well known that excessive ingestion of fluoride during tooth formation results in dental fluorosis.

Regarding dietary sugars and dental caries, to quote the WHO report: "there is a wealth of evidence from many different types of investigation, including human studies, animal experiments and experimental studies in vivo and in vitro to show the role of dietary sugars in the aetiology of dental caries." "Sugars are undoubtedly the most important dietary factor in the development of dental caries". There are some aspects of sugars consumption which need to be considered.

First, frequency and amount of sugars consumed. There are studies showing that both are important – some studies measured frequency and showed this to be important, and others measured amount and showed this to be important. Likewise, in animal experiments, both increasing frequency and increasing amount of sugars intake have been positively related to caries development. In free-living people, there is a close correlation between frequency of sugars intake and amount of sugars consumed. It is, therefore, good advice to decrease both frequency and amount. Which takes preference will depend on the situation: when giving personal advice, people understand the concept of frequency well; on the other hand, national guidelines and goals must be given in terms of amount, as this is the method used for all other nutrients.

Second, different types of sugar. Summarising quite a quantity of information from several types of study – lactose is less cariogenic than other sugars, and there is little difference in cariogenicity between the other dietary sugars.

Third, the potential impact of reducing sugars consumption on the rest of the diet. This has centred on the issue – 'would intake of fats rise as sugar intake falls?' This was mentioned in the WHO trs 880, published in 1998 [7]. This is incorrect and was corrected in WHO trs

916, 2003 [6]. I quote: "There is, however, a growing body of evidence from studies over time that shows that changes in intake of fat and free sugars are not inversely related, and that reductions in fat intake are offset by increases in intakes of starch rather than free sugars." "Overall, dietary goals that promote increased intake of wholegrain staple foods, fruits and vegetables and reduce consumption of free sugars are thus unlikely to lead to an increased consumption of fat."

Fourth, the influence of fluoride. Does fluoride do the job of preventing dental caries so well that there is no need to reduce sugars consumption? This view was also included in the WHO trs 880, 1998, mentioned previously [7]. Again, this view is incorrect. Fluoride reduces caries development but does not eliminate it. Several reviews have stated that the gain in sugars restriction is reduced when fluoride is used appropriately, but is still significant. As Marthaler [8] concluded in his review: "...in industrialised countries where there is adequate exposure to fluoride, no further reduction in the prevalence and severity of dental caries will be achieved unless the intake of sugars is reduced." WHO trs 916, 2003, concludes: "Thus, restricting sugars consumption still has a role to play in the prevention of caries in situations where there is widespread use of fluoride but this role is not as strong as it is without exposure to fluoride."

A view put forward, particularly by the sugar-related industries, is that all carbohydrates cause dental caries. This would remove the spotlight from sugars alone. This is not true, as several reviews have shown, including WHO trs 916 [6]. This document states that the evidence that starch intake has no relation with dental caries risk is 'convincing'; in contrast, the evidence was also 'convincing' that 'amount of free sugars' and 'frequency of free sugars' increases risk. A worrying trend is for food manufacturers to include a number of oligosaccharides into products. Limited evidence indicates that these are not free of cariogenic risk [9].

Are fruit and vegetables caries risks? After all, they both contain sugars. A number of reviews, including WHO trs 916, conclude "No risk" [6]. The level of evidence in this report was that it was 'probable' that there was no relation between 'whole fresh fruit' and caries risk, but that evidence was 'insufficient' that 'whole fresh fruit' decreased caries risk.

Is milk a caries risk? Again, reviews conclude "No". WHO trs 916 states that the evidence that milk decreases caries risk as 'possible' [6]. This refers to cow's milk (or 'bovine' milk). Soy milk is marketed as an alternative to bovine milk but it cannot be considered safe for teeth.

Soy milks contain sugars other than lactose, which are well recognised as being more cariogenic than lactose [5]. Although the calcium contents of bovine and soy milk are similar, calcium in soy milk is not so available. A recent publication from Australia and Singapore concluded "... that soy beverages have a higher potential acidogenicity than bovine milk beverages due to the relatively higher rates of organic acid production by bacterial fermentation. The soy beverages also contained relatively low bioavailable calcium concentrations and low buffering capacity. These results may indicate that soy beverages have a higher cariogenic potential than bovine milk beverages and therefore this potential should be investigated further" [10].

A brief word about 'probiotics' and oral health. They could be termed 'dietary supplements'. They are living micro-organisms added to food which beneficially affect the host by improving microbial balance. There is some evidence that they have an inhibitory effect on dental caries but this evidence is not extensive [11]. There are, though, two recent studies from Sweden showing that a combination of fluoride and probiotics added to milk prevented caries development – the effects appear to be additive [12,13].

Thus, restriction of sugars consumption and increasing consumption of staple starchy foods, fresh fruit and vegetables will decrease risk of dental caries [5,6,14].

As far as periodontal disease is concerned, evidence of the effect of nutrition and diet is less and conclusions must be tentative. Four possible effects are worth comment. First, protein-energy undernutrition has been associated with periodontal disease -- WHO trs 916 gave the level of evidence for 'undernutrition' increasing risk of periodontal disease as 'possible' [6]. There is growing evidence that obesity is associated with risk of periodontal disease [15] and of the protective roles of dietary anti-oxidant vitamins [16] and omega-3 fatty acids [17]. Although scurvy, with destruction of periodontal tissues, is a severe deficiency disease, it is rare and not of public health importance. There is no evidence of benefit from vitamin C intakes above the Dietary Reference Intake, which is achieved in most populations [6]. Although dietary calcium intake affects bone density, there is insufficient evidence to make any recommendation [6].

It is important to include oral cancer in any review of nutrition, diet and oral disease. The most authoritative review is the World Cancer Research Fund document; the most recent edition was published in 2007 [18]. First, regarding alcohol, the report concluded: "There is

ample and consistent evidence, both from case-control and cohort studies, with a dose-response relationship. There is robust evidence for mechanisms operating in humans. The evidence that alcoholic drinks are a cause of mouth, pharynx, and larynx cancers is convincing. Alcohol and tobacco together increase the risk of these cancers more than either acting independently. No threshold was identified." No differences in risk were reported for different types of alcoholic drink. Second, fruit and vegetables probably have a protective role. These three statements are from the WCRF document [18]: "Non-starchy vegetables probably protect against mouth, pharynx, and larynx cancers." "Foods containing carotenoids probably protect against mouth, pharynx, and larynx cancers." "Fruits probably protect against mouth, pharynx, and larynx cancers." There is growing evidence that 'Body fatness' is a risk factor for several types of cancer and that physical exercise is protective – this was a new addition to this WCRF document. It concluded that 'energy-dense foods', 'fast-foods', and 'sugary drinks' were probable risk factors for weight gain. Thus, there is good reason to restrict consumption for sugary foods and drinks to reduce cancer risk.

It is right to mention dental fluorosis. This is a public health issue affecting many people in SE Asia. Although appearance is adversely affected, it is not classed as a disease. There is evidence that under-nutrition while teeth are forming increases the severity of dental fluorosis, but more information is needed on this topic [5]. Prevention is seemingly simple – reduce fluoride intake during childhood – but we all know that this is very hard to achieve in endemic areas. Dental erosion is not considered a public health issue and dietary recommendations [5] will not be included here.

In conclusion, nutritional guidelines to improve oral health are: avoid energy/protein under-nutrition; low sugars intake; majority of intake should be staple starchy foods, fresh fruit and vegetables; low to zero consumption of alcoholic drinks. All of these will benefit general as well as oral health.

GUIDELINES FOR HEALTHY EATING

As there are differences between countries in nutritional intake and dietary habits, wealth, customs, and agriculture, it is sensible for each country to decide their own nutritional guidelines. Looking at the literature, much progress has been made in this area. Most these guidelines are 'food-based dietary guidelines', or FBDG for short. It is worth a few moments to comment on 'nutrient guidelines' and food-

based guidelines. Nutrient guidelines are well established in many countries. They almost always give recommendations for specific ages and special groups – for example, pregnant women – usually as ‘Recommended Dietary Allowances’ or Dietary Reference Values’ [19]. Nutrition surveys (eg. recording all dietary intake for a number of days) will indicate whether the population is receiving adequate and appropriate nutrition. But it is well understood that people eat ‘foods’ not ‘nutrients’, and understand dietary advice when given in terms of foods. Therefore, it is not surprising that countries have opted to give guidelines in terms of foods. Formulating food based dietary guidelines is not easy as they must take into account: nutrient content of foods; availability and price of foods; cultural preferences; cooking habits; and foods eaten by vulnerable groups. Very often, national advice is given in terms of foods and nutrients – for example, ‘eat plenty of fruit’ and ‘need for adequate calcium intake during adolescence’.

In 1998, WHO produced a document ‘Preparation and use of food-based dietary guidelines’ (trs 880), based on a meeting held in 1995 [7]. It describes the process of developing FBDGs. Unfortunately, the consideration given to oral health in this document is slightly and incorrect. There was only one dental person referenced – Konig – and his views were not mainstream. There was no expert on oral health on the panel drawing up the document. This highlights an important point: at all levels of discussion and decision-making, you must ensure that there is an expert in oral health. This was corrected in the 2003 WHO document ‘Diet, Nutrition and the Prevention of Chronic Diseases’ (trs 916), where advice is evidence-based and much more balanced [6]. Within a country, to avoid conflicting advice and ensure progress, it is essential that guidelines are agreed by medical, dental and dietetic professions. Following on from the earlier (1998) WHO document [7], SEARO published an 18 page document ‘Development of food-based dietary guidelines for the Asian region’ [20]. It is a balanced document and contains 10 ‘Core Guidelines’. I mention just three. ‘Eat plenty of vegetables and fruits regularly’: in Thailand, this could mean increasing intake from 150 to 200 grams per day, and in India, from 50 to 100 grams per day. Consumption of dietary fat in the Region is 20 to 30 percent of energy and “maintenance at this level was compatible with good health”. Regarding sugars intake, written in 1998, it recommended: “Despite the generally low consumption levels of sugar in this region, with increasing prevalence of obesity sugar consumption levels of populations in the Asian region should not increase beyond present levels and hence this could be a specific guideline.”

A more comprehensive document was published by SEARO in 2011: ‘Regional Nutrition Strategy: addressing malnutrition and micronutrient deficiencies (2011-2015)’ [21]. This 56 page document pointed out that “about one fourth of the global population lives in the Region”, but it “contains over 70% of the world’s malnourished children”, and, “over the last decade, countries in this region have also witnessed a relative rapid increase in overnutrition and obesity”. It noted that countries “have abundant vegetables and fruits, many of which are not expensive.” “The increase in vegetable consumption in developing countries, especially Asian countries, has been nearly two-fold while consumption in developed countries remained unaltered.” However, it noted that “the increase has mainly occurred in the middle and high-income groups while the consumption patterns among the poorest segments of population remains low as before.” This current Regional Nutrition Strategy has four core elements: (1) Developing a country-driven, outcome-oriented integrated multisectoral nutrition policy and plan of action; (2) Addressing malnutrition and micronutrient deficiencies through a multisectoral approach and involvement of all relevant sectors; (3) Addressing obesity and dietary prevention of chronic diseases; and (4) Developing effective and functional nutrition surveillance systems.

GUIDELINES IN SOME COUNTRIES IN SOUTH AND SOUTH-EAST ASIA

Countries in south and south-east Asia have published food-based dietary guidelines, and I will mention a few. Many of these have been published in the Asia Pacific Journal of Clinical Nutrition.

First, **Thailand** [22-24]. The FBDGs promote nine dietary guidelines: (1) Eat a variety of foods from each the five food groups and maintain proper weight; (2) Eat adequate rice, or alternate carbohydrate; (3) Eat plenty of vegetables and fruits regularly; (4) Eat fish, lean meats, eggs, legumes and pulses regularly; (5) Drink sufficient amount of milk every day; (6) Take moderate amounts of fat; (7) Avoid excessive intake of sweet and salty foods; (8) Eat clean and uncontaminated foods; and (9) Avoid or reduce consumption of alcoholic beverages. The five food groups mentioned in (1) above have been increased to six: cereal, meat, vegetable, fruit, milk, and fat, oil and sweet. These apply to age 6 years and over. There are specific guidelines for infants and young children. Much thought has been given to their promotion. Importantly, they were launched by the Prime Minister. Two food guide models were considered – a ‘folding fan’ and a ‘hanging flag’ (the ‘Nutrition Flag’). In an article in 2008 [22], the same authors mentioned “Some activities related to Thai FBDG”. These included:

campaign programme for lowering sugar consumption through the 'Sweet enough campaign network' since 2002; Thai FDA passed a law prohibiting sugar addition in follow-on formula for infants in November 2004; Health snacks for children with friendly nutrition labelling; School lunch program – menu development; Nutrition education training for teachers and health volunteers. A publication this year stated: "Thailand is known for its successful nationwide community-based nutrition program implemented during the 1980s to mid-1990s" [24]. Undernutrition has reduced markedly since the first national nutrition survey in 1960, but the recent rise in obesity is of considerable concern.

FBDGs are a crucial tool for nutrition education and communication in **Vietnam** [25]. There have been three versions since the first was launched by the Prime Minister in 1995. Vietnam has chosen the 'Food Guide Pyramid' and 'Food Square' as nutritional education tools. I mention three aspects related to oral health: (1) Use iodized salt. Do not consume too much salt; (2) Eat less sugar. Children and adults should not eat cake, candy, soft drinks before a meal. One person should consume only 500g sugar per month on average; (3) Drink soy milk. Increase consumption of the calcium-rich foods such as milk, dairy products, and small fish. I mention (1) because there is now fluoridated salt in Vietnam. Second, 500 grams of sugar per month equates to 17 grams per day, which is a wonderfully low amount. Third, I have mentioned previously the uncertainty as to whether soy milk is dentally safe [10]. Meals are provided in nearly all kindergarten and elementary schools [26].

The **Malaysian** Dietary Guidelines (MDG) were first published in 1999. The 2010 version contains 14 key messages and 55 recommendations – physical activity was included for the first time [27]. The graphic display is a food pyramid. In Singapore, the latest Dietary Guidelines were published in 2011, using results from the National Nutrition Survey the year before [28]. Guidelines are given for various groups such as children and adolescents, adults, and older persons. The latest Diet Pyramid appeared in 2009; but consideration is being given to replacing this with a 'Healthy Lifestyle Graphic' which will include physical activity. There is a major 'Healthy Eating in Schools' programme [29].

In **South Korea**, the body responsible for nutritional guidelines is the Korea Food and Drug Administration (KFDA) [30]. Guidelines are given for various age groups and include advice on physical activity [31]. The KFDA also advises on nutrition labelling and the National School Lunch Program [32]. School lunches have been provided since

1953 and coverage is now virtually 100%. Nutrition surveys indicate the traditionally high vegetable consumption, which has been maintained despite changes to lifestyle and eating habits (158 gram vegetables per capita per day in 2009) [33]. In contrast, there was an unwelcome 50% increase in sugar-sweetened beverage intake in adolescents from 1998 to 2009 [33].

In **Japan**, ‘Healthy Japan 21’ was launched in 2000 [34]. In 2005, a graphic model was introduced called ‘Japanese Food Guide Spinning Top’ (JFG-ST). The idea is intriguing – first, if the balance of foods is wrong, the top falls over, and, second, the spinning evokes the idea of exercise. Also, in 2005, ‘Shokuiku’ was introduced (Shoku = diet, iku = growth and education) [34,35]. This health and well-being concept is broad-based, incorporating principles of healthy eating. School-based Shokuiku programmes were established in 2007 [35]. A study published this year showed that students with better knowledge of Shokuiku had less dental caries than students with less knowledge [36]. In Japan, not only is there concern about an increase in obesity in men and children, but there is also concern about underweight girls.

In **China**, nutrition surveys from 1991 to 2009 show a growth in snacking, intake of cereals has decreased and consumption of beverages has increased [37]. The proportion of energy provided by drinks increased three-fold during this time period. FBDGs were first introduced in 1989 [38,39]. In 2011, ‘Healthy China 2020’ was launched, choosing the Food Guide Pagoda (FGP) to convey nutritional guidelines. To the side of the pagoda is a walker and cup of water [39].

In **Taiwan**, FBDGs have existed since the early 1980s [40]. Recent guidelines list 8 key points, including eat less sugar and drink more water. A study of over two thousand Taiwanese children revealed that poor performance at school was related to unhealthy eating patterns including high sugar foods and drinks [41]. In the Philippines, Nutritional Guidelines for Filipinos (NGF) have been published – the latest in 2000 [42]. In Indonesia, FBDGs were launched in 1995, containing 13 messages [43]. Food based dietary guidelines exist in India, containing 6 goals and 14 dietary guidelines [44]. There is concern in the Philippines, Indonesia and India about the high and persistent prevalence of undernutrition and the growing consumption of nutritionally poor quality snacks and increasing burden of obesity [45].

ISSUES RELATED TO THE GUIDELINES

There are a number of bright spots in this review. First, all countries appear to have nutritional guidelines. In this, SEARO leads the world [46]. For a review of progress in developing national nutrition policies, by WHO Regions, this 122-page document published earlier this year is recommended [46]. Second, in several countries in SEA, FBDGs have been launched at the highest level of government. They are reviewed frequently and effectiveness has been evaluated in some countries. Third, most of the committees developing guidelines have been multisectoral, since it is important that there is agreement across government departments – health, education, agriculture and industry. There is growing belief that policies should be ‘environmentally sensitive’ [47]. There appears to be an apparent absence of advice from specialists in oral health and nutrition when guidelines were being developed. Were they involved? If I am wrong, please correct me, for I am well aware that I am presenting an external view. I have emphasised before the importance of ensuring that committees developing nutritional guidelines include expertise on oral health. At risk of self-advertising, I comment that there is a WHO Collaborating Centre for Nutrition and Oral Health, and the present Director (Professor Paula Moynihan) would be very prepared to assist people with access to these committees with evidence and other related matters. Fourth, although the need to restrict sugar consumption is mentioned – sugars were at the smallest end of the pyramid and hanging flag (sugars did not seem to be present in the ‘pagoda’) – it appears that targets for sugar consumption were seldom given.

So what effect will these food based dietary guidelines have on oral health in south and south-east Asia? It should be favourable. After all, guidelines emphasise the need for restricted sugar consumption; to drink water instead of sugared drinks; need for continued high consumption of vegetables and fruit, and staple starchy foods; and the need to restrict alcohol consumption. This is, of course, in line with WHO recommendations, aimed at improving general health including oral health [6]. For me, one of the uncertainties is the role of SEARO and WPRO. They issue guidelines, but are there experts on oral health active in these committees? I have emphasised this point rather heavily. You may think that, since the broad principle of sugar restriction is present in guidelines, a high level of expertise in nutrition and oral health is not needed. My experience is that this is not so. There are powerful multinational companies that will oppose restrictions in sugar and alcohol consumption [48], and government departments and committees will expect those that advise them on

nutrition and oral health to have a thorough knowledge of the literature and the ability to present their case effectively. This is necessary at a Regional level and National level.

An increasing population, the move from rural to urban living, the almost universal viewing of television with greater exposure to commercial advertising, and advances in technologies of food production, have meant that our choice of food purchase is now much governed by a powerful food industry [48]. It must be understood that their motivation is profit; their loyalty is to their shareholders. There will be opportunities to make profits from marketing healthy foods – that should be encouraged. But it is the marketing of sugar and sugar-containing foods and drinks, alcoholic drinks, and tobacco, which adversely affect oral health most [6,18].

Manufacturers of sugar-containing drinks and foods have been aggressive in their marketing and you should understand the methods they use. First, their large budgets allow extensive and sophisticated advertising. Second, they will lobby decision-makers. These decision-makers are unlikely to be experts in nutrition and oral health, and will rely on you to provide detailed counter-arguments. Third, they may find some professional prepared to support their views: in which case, they will announce that professional opinion is divided, so no decisions on sugar restriction should be made. This is thoroughly unfair as the vast majority of professional opinion is united in their call for sugar restriction. Fourth, they may fund scientific institutions. I give as an example the 'International Life Sciences Institute' which active in most regions of the world. This institute has funded several dental conferences and people may well attend not knowing that ILSI is largely funded by industry. In India and Korea, for example, funders include Coca-Cola, Mars, and PepsiCo. That does not mean that such conferences do not contain good science, but we cannot be certain that they are free of commercial pressures.

But there is much going in your favour. First – health. People prefer health to disease. Second, governments understand this, and appreciate that prevention is usually cheaper than cure. Third, scientific literature is firmly on your side. Fourth, because of the important health issues I have discussed, and the strength of the scientific literature, the highest health authorities have issued unequivocal guidelines on nutrition and health. Fifth, medical, dental and dietetic opinion is united on scientific advice and the need to act to improve diet and nutrition.

Regrettably, in order to assist people, particularly children, in choosing a better diet, it has proved necessary to legislate. I will mention three areas. First -- advertising. In many countries there are restrictions on advertising: advertisements should not encourage frequent eating of high sugar foods and drinks, and not encourage their consumption before bedtime; such advertisements are banned from TV during children's peak viewing times. Second -- labelling of foods and drinks. Nutrient labelling should display sugars content [49]. To help the food purchaser and consumer, traffic-light guidance is put on the front of packs – red for high sugar content etc. Third, food and drink in the school environment. There has been great progress in providing nutritious meals in schools – these may be provided free or at a subsidised cost. The sugared drinks industries were aggressive at putting drinks vending machines into schools and sponsoring school activities such as provision of sports kits [50]. Such activities are now banned in many countries: vending machines in school can only provide water, milk, and pure fruit juice [51]. It is important that these health-promoting initiatives are evaluated so that authorities and the public can be aware of the benefits, although the nutritional benefits of school meals are pretty well documented. Public opinion is very powerful – it should be measured, and used appropriately to encourage further progress. This article from Australia is one example [52]. Lastly, a tax on sugar-containing beverages is being considered in some countries [53-55].

SUMMARY

So, in summary, much progress has been made. There are big challenges ahead but the rewards in reducing the burden of oral disease are considerable. The causes of the major oral diseases are very well known. Much of oral disease is preventable through improved nutrition and diet. The risk factors for oral diseases are common to most chronic lifestyle diseases, which should strengthen the case for prevention. It is essential that those advising government and other public authorities know the scientific literature so that guidelines, policies and educational programmes are soundly based. Lastly, I am very aware that I present an 'outside view' of nutrition and oral health in south and south-east Asia. I hope that you will have the opportunity to put forward your view on this topic.

REFERENCES

1. WHO. (2011) *Global status report on noncommunicable diseases 2010*. Geneva: World Health Organization.
2. Petersen PE. (2008) *World Health Organization global policy for improvement of oral health – World Health Assembly 2007*. *Int Dent J* 58:115-121.
3. SEARO. (2008) *Formulating oral health strategy for South-East Asia*. SEA-NCD-81. WHO Regional Office for South-East Asia.
4. Petersen PE. (2009) *Oral cancer prevention and control – the approach of the World Health Organization*. *Oral Oncol* 45:454-460.
5. Rugg-Gunn AJ. (1993) *Nutrition and dental health*. Oxford:OUP.
6. WHO. (2003) *Diet, nutrition and the prevention of chronic diseases*. WHO trs 916. Geneva: World Health Organization.
7. WHO. (1998) *Preparation and use of food-based dietary guidelines*. WHO trs 880. Geneva: World Health Organization.
8. Marthaler TM (1990) *Changes in the prevalence of dental caries: how much can be attributed to changes in diet?* *Caries Res* 24(Suppl. 1):3-15.
9. Moynihan PJ (1998) *Update on the nomenclature of carbohydrates and their dental effects*. *J Dent* 26:209-218.
10. Dashper SG, Saion BN, Stacey MA, Manton NJ, Cochrane NJ, Stanton DP, Yuan Y, Reynolds EC. (2012) *Acidogenic potential of soy and bovine milk beverages*. *J Dent* 40:736-741.
11. Twetman S, Stecksén-Blicks C. (2008) *Probiotics and oral health effects in children*. *Int J Paed Dent* 18:3-10.
12. Stecksén-Blicks C, Sjöström I, Twetman S. (2009) *Effect of long-term consumption of milk supplemented with probiotic lactobacilli and fluoride on dental caries and general health in preschool children: a cluster-randomized study*. *Caries Res* 43:374-381.
13. Petersson LG, Magnusson K, Hakestam U, Baigi A, Twetman S. (2001) *Reversal of primary root caries lesions after daily intake of milk supplemented with fluoride and probiotic lactobacilli in older adults*. *Acta Odontol Scand* 69:321-327.
14. Moynihan PJ. (2005) *Dental disease*. In: *Human nutrition* (eds. Geissler CA, Powers HJ). 11th edit. Edinburgh: Elsevier. Pp 461-476.

15. Wood N, Johnson RB, Streckfus CF. (2003) Comparison of body composition and periodontal disease using nutritional assessment techniques: third National Health and Nutrition Examination Survey (NHANES III). *J Clin Periodontol* 30:321-327.
16. Iwasaki M, Moynihan P, Manz MC, Taylor GW, Yoshihara A, Muramatsu K, Watanabe R, Miyazaki H. (2013) Dietary antioxidants and periodontal disease in community-based older Japanese: a 2-year follow-up study. *Publ Health Nutr* 16:330-338.
17. Iwasaki M, Yoshihara A, Moynihan P, Watanabe R, Taylor GW, Miyazaki H. (2010) Longitudinal relationship between dietary ω -3 fatty acids and periodontal disease. *Nutrition* 26:1105-1109.
18. World Cancer Research Fund / American Institute for Cancer Research. (2007) Food, nutrition, physical activity, and the prevention of cancer. Washington DC: AICR.
19. Department of Health (1991) Dietary reference values for food energy and nutrients for the United Kingdom. Report on health and social subjects 41. London:HMSO.
20. SEARO. (1998) Development of food based dietary guidelines for the Asian Region. SEA/NUT/Met/Inf. 1. WHO Regional Office for South-East Asia.
21. SEARO. (2011) Regional nutrition strategy: addressing malnutrition and micronutrient deficiencies (2011-2015). SEA-NUT-181. WHO Regional Office for South-East Asia.
22. Sirichakwal PP, Sranacharoenpong K. (2008) Practical experience in development and promotion of food-based dietary guidelines in Thailand. *Asia Pac J Clin Nutr* 17(suppl 1): 63-65.
23. Sirichakwal PP, Sranacharoenpong K, Tontisirin K. (2011) Food based dietary guidelines (FBDGs) development and promotion in Thailand. *Asia Pac J Clin Nutr* 20:477-483.
24. Winichagoon P. (2013) Thailand nutrition in transition: situation and challenges of maternal and child nutrition. *Asia Pac J Clin Nutr* 22:6-15.
25. Hop leT, Van TK, Thanh HK. (2011) Food based dietary guidelines in Vietnam: progress and lessons learnt. *Asia Pac J Clin Nutr* 20:495-499.
26. Le DSN. School meal program in Ho Chi Minh city, Vietnam: reality and future plan. *Asia Pac J Clin Nutr* 21:139-143.
27. Tee ES. (2011) Development and promotion of Malaysian dietary guidelines. *Asia Pac J Clin Nutr* 20:455-461.

28. Lee BL. (2011) Dietary guidelines in Singapore. *Asia Pac J Clin Nutr* 20:472-476.
29. Shiu LK, Loke WM, Vijaya K, Sandhu NK. (2012) Nurturing healthy dietary habits among children and youth in Singapore. *Asia Pac J Clin Nutr* 21:144-150.
30. Park HK. (2008) Nutrition policy in South Korea. *Asia Pac J Clin Nutr* 17(suppl 1):343-345.
31. Jang YA, Lee HS, Kim BH, Lee HJ, Moon JJ, Kim CI. (2008) Revised dietary guidelines for Koreans. *Asia Pac J Clin Nutr* 17(suppl 1):55-58.
32. Yoon J, Kwon S, Shim JE. Present status and issues of school nutrition programs in Korea. *Asia Pac J Clin Nutr* 21:128-133.
33. Lee H-S, Duffey KJ, Popkin BM. (2012) South Korea's entry to the global food economy: shifts in consumption of food between 1998 and 2009. *Asia Pac J Clin Nutr* 21:618-629.
34. Nakamura T. (2001) Nutritional policies and dietary guidelines in Japan. *Asia Pac J Clin Nutr* 20:452-454.
35. Miyoshi M, Tsuboyama-Kasaoka N, Nishi N. (2012) School-based "Shokuiku" program in Japan: application to nutrition education in Asian countries. *Asia Pac J Clin Nutr* 21:159-162.
36. Ekuni D, Tomofuji T, Mizutani S, Furuta M, Irie K, Azuma T, Kojima A, Iwasaki Y, Morita M. (2013) Dental caries is correlated with knowledge of comprehensive food education in Japanese university students. *Asia Pac J Clin Nutr* 22:312-318.
37. Wang Z, Zhai F, Zhang B, Popkin BM. (2012) Trends in Chinese snacking behaviours and patterns and the social-demographic role between 1991 and 2009. *Asia Pac J Clin Nutr* 21:253-262.
38. Hu FB, Liu Y, Willett WC. (2011) Preventing chronic diseases by promoting healthy diet and lifestyle: public policy implications for China. *Obes Rev* 12:552-559.
39. Ge K. (2011) The transition of Chinese dietary guidelines and food guide pagoda. *Asia Pac J Clin Nutr* 20:439-446.
40. Tzeng MS. (2008) From dietary guidelines to daily food guide: the Taiwanese experience. *Asia Pac J Clin Nutr* 17(suppl 1):59-62.
41. Fu M-L, Cheng L, Tu S-H, Pan W-H. (2007) Association between unhealthful eating patterns and unfavourable overall school performance in children. *J Am Diet Assoc* 107:1935-1943.

42. *Tanchoco CC. (2011) Food-based dietary guidelines for Filipinos: retrospects and prospects. Asia Pac J Clin Nutr 20:462-471.*
43. *Sekiyama M, Roosita K, Ohtsuka R. (2012) Snack foods consumption contributes to poor nutrition of rural children in West Java, Indonesia. Asia Pac J Clin Nutr 21:558-567.*
44. *Krishnaswamy K. (2008) Developing and implementing dietary guidelines in India. Asia Pac J Clin Nutr 17(suppl 1):66-69.*
45. *Popkin BM, Adair LS, Ng SW. (2012) Global transition and the pandemic of obesity in developing countries. Nutr Rev 70:3-21.*
46. *WHO. (2013) Global nutrition policy review: what does it take to scale up nutrition action? Geneva: World Health Organization.*
47. *Watanabe S, Wahlqvist ML, Li D. (2013) Tokyo declaration: food, mild and body. Asia Pac J Clin Nutr 22:504.*
48. *Brownell KD, Warner KE. (2009) The perils of ignoring history: Big Tobacco played dirty and millions died. How similar is Big Food? Milbank Q 87:259-294.*
49. *Roodenburg AJ, Popkin BM, Seidell JC. (2001) Development of international criteria for a front of package food labelling system: the international choices programme. Eur J Clin Nutr 65:1190-1200.*
50. *Maliderou M, Reeves S, Noble C. (2006) The effect of social demographic factors, snack consumption and vending machine use on oral health of children living in London. Br Dent J 201:441-444.*
51. *Loughridge JL, Barratt J. (2005) Does the provision of cooled filtered water in secondary school cafeterias increase water drinking and decrease the purchase of soft drinks? J Hum Nutr Diet 18:281-286.*
52. *Pettigrew S, Pescud M, Rosenberg M, Ferguson R, Houghton S. (2012) Public support for restrictions on fast food company sponsorship of community events. Asia Pac J Clin Nutr 21:609-617.*
53. *Claro RM, Levy RB, Popkin BM, Monteiro CA. (2012) Sugar-sweetened beverage taxes in Brazil. Am J Public Health 102:178-183.*
54. *Utela A. (2013) Health in all policies: a call for effective governance for health and equity. Presented at the World Congress on Preventive Dentistry, Budapest, 9-12 October.*

55. *Hackett A, Rugg-Gunn A, Moynihan P. (2007) Nutrition, dietary guidelines and food policy. In: Community Oral Health. (eds. Pine C, Harris R.) 2nd edit. London: Quintessence. pp 333-356.*

CARIES CONTROL IN ELDERLY

Hiroshi OGAWA

CARIES CONTROL IN ELDERLY

Hiroshi OGAWA⁹

INTRODUCTION

The world population is rapidly aging. Between 2000 and 2050, the proportion of the world's population over 60 years will double from about 11% to 22%. The absolute number of people aged 60 years and over is expected to increase from 605 million to 2 billion over the same period. Asia's elderly population is projected to reach 922.7 million by the middle of this century. As a result, Asia is on track in the next few decades to become the oldest region in the world (WHO 2011).

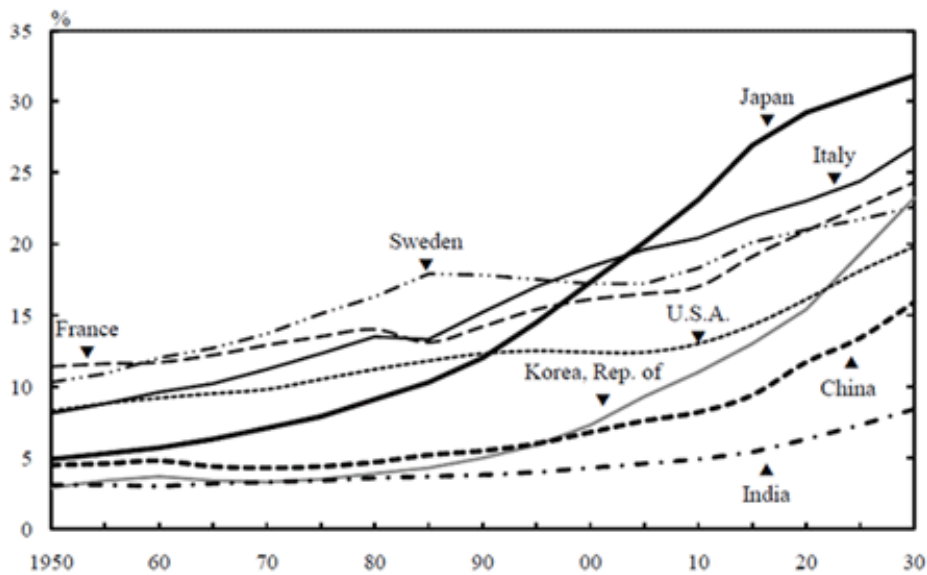


Figure 1: Proportion of elderly population by some selected countries.

⁹ Associate Professor, Faculty of Dentistry, Niigata University, Japan.
Email: Hiroshi Ogawa <ogahpre@dent.niigata-u.ac.jp>

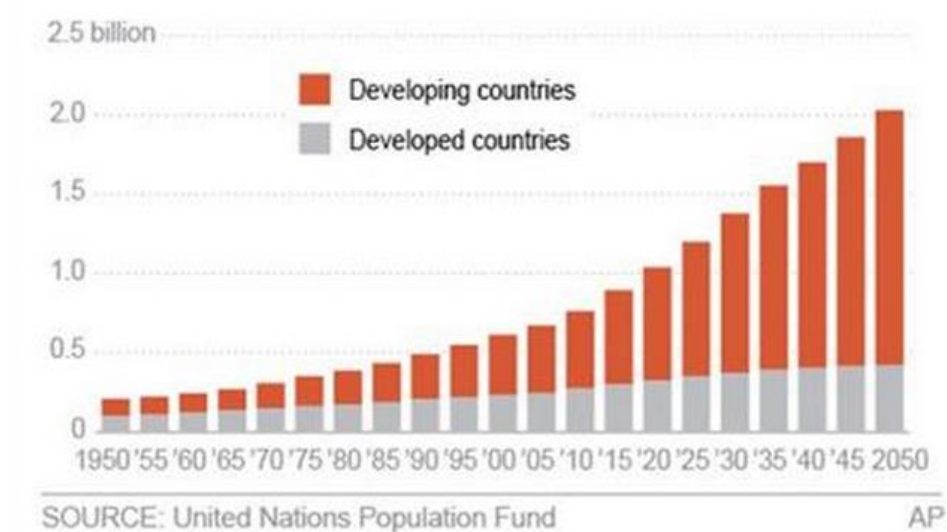


Figure 2: Total population aged 60 or more.

PREVALENCE

Dental caries is one of the most significant health problems facing older adults. More than half of the elderly who are dentate are affected with either coronal or root caries, and caries are the primary cause of tooth loss in this population. Over the past two decades, 13 studies conducted in nine countries (i.e., the United States, Canada, Brazil, Germany, Finland, Sweden, Japan, India and Sri Lanka) have reported a relatively wide range of root caries prevalence in older adults ranging from 29 to 89%, with most of those studies reporting within the narrower prevalence range of 30–60%. Annual root caries increments of 0.47–1.0 surfaces per year per adult with a prevalence rate of ~45% suggests that the prevention of root caries in adults should be a high national oral health priority (Gluzman et al., 2013).

The available data shows that dental caries is closely linked to social and behavioural factors. The pattern is mostly that persons of low income, those who do not visit a dentist regularly, do not brush their teeth frequently, consume many sugars and smoke, tend to suffer from dental caries (Petersen et al., 2005). For institutionalized elderly, the oral health status is generally poorer, with high levels of untreated dental caries (Chalmers et al., 2002; Lo et al., 2004; Simunkovic et al., 2005). There is a need to prevent caries among elderly people, especially those who are in long-term care facilities (Tan et al., 2010).

DIAGNOSIS OF ROOT CARIES

The diagnosis of the present root caries is not usually difficult, as the condition often presents at exposed root sites where gingival recession has taken place and so may be directly visible. The diagnosis can, however, sometimes be difficult at inaccessible sites such as posterior, interproximal areas and lingually on the lower molars. Vertical bitewing radiographs can aid diagnosis at interproximal sites. The decision as to whether a root caries lesion is active or arrested can be problematic. Lesion colour could be a poor indicator of root caries lesion activity (Lynch et al., 1994, Curzon et al., 2004).

ETIOLOGY OF ROOT CARIES

The primary factors involved in root caries are the same as for any caries process. These are the factors that must be present in order for the condition to be initiated and are plaque bacteria, a tooth (root) surface, ingested fermentable carbohydrate and time. Certainly, plaque removal is often a difficulty in elderly patients, due to a lack of manual dexterity (especially in cases of rheumatoid arthritis and stroke).

Elderly people may also have difficulty in comprehending oral hygiene advice and a loss of muscle tone around the oral musculature may also contribute to food and plaque stagnation. Poorly designed or ill-fitting partial dentures will not help the oral hygiene of an elderly patient and so may contribute to the caries risk.

For the specific condition of root surface caries, the pre-diagnosing factor of periodontal disease must be present in order for the process to be initiated. Root caries is most commonly seen at sites of gingival recession. If loss of periodontal attachment can be prevented, then root caries will, by definition, also be prevented.

The most important secondary factors that govern the rate which a root caries lesion may progress are saliva and fluoride. It has been said that saliva is a much neglected medium, in terms of how it is regarded in its importance to oral health. This is most dramatically appreciated in cases of xerostomia. The number of elderly individuals suffering from some degree of dry mouth appears to be increasing. This is most significantly due to the fact that several hundred regularly prescribed medications have the potential side effect of causing reduced salivary flow (Sreebny et al., 1997). In addition, more elderly are under polypharmacy regimes, such that they have many

medications to take each day, thus increasing the risk of drug-induced hyposalivation. The anti-caries properties of saliva are well known and include acid and sugar clearance action, buffering systems and fluoride, calcium and phosphate content. When saliva flow is reduced, the effect on caries rates can be dramatic, especially on susceptible root surface sites, where carious lesions can progress with alarming rapidity.

The importance of the topical effects of fluoride on the enamel carious lesions is generally accepted. There is now evidence that topical fluoride may also have potential remineralization promoting and demineralization inhibiting effects on root dentine (Curzon et al., 2004).

OTHER RISK FACTORS

Diet

Diet is a very important factor in preventing caries since certain foods and snacks can greatly increase the number of bacteria that forms the decay-causing plaque. The more sweetened snacks consumed and the more frequently they are consumed increase the risk for developing caries. The frequency of sugar intake is more important than the amount of sugar consumed in the development of caries (Burt et al., 1988). Therefore, minimizing snacking is recommended since snacking creates a continual supply of nutrition for acid-creating bacteria in the mouth. Also, chewy and sticky foods (such as dried fruit or candy) tend to adhere to teeth longer and consequently are best eaten as part of a meal.

It is beneficial to look at other factors such as diet, which together with decreased salivary flow make one more susceptible to root caries. When dietary habits, microbial factors, and salivary factors were analyzed together in older adults who had root caries compared to adults who did not have root caries, individuals with root caries ate a greater number of meals a day and had a higher sugar intake (Finn et al., 1992). Root caries subjects had significantly higher lactobacilli counts and less salivary buffering capacity suggesting that higher microbial counts and less salivary flow may be risk factors associated with root caries in older adults.

Bacteria

Plaque consists of bacteria and an extracellular matrix that contains lipids, proteins, and polysaccharides. Teeth are more vulnerable to an increase in bacterial plaque when carbohydrates in the food are left on teeth after every meal. In the presence of sugar and other carbohydrates, bacteria in the mouth produce acids that can demineralize enamel, dentin, and cementum. The more frequently teeth are exposed to this environment, the more likely caries are to occur. The bacterial profiles associated with root caries in the elderly subjects exhibit reduced diversity (Preza et al., 2008). Certain bacterial species appear to be strongly associated with health, as they are rarely detected or are absent from root caries carriers but are commonly found in healthy subjects. In root caries, *Veillonella parvula*, *Veillonella dispar*, *Selenomonas noxia*, *Campylobacter gracilis*, *Streptococcus mutans*, *Selenomonas putigena*, and *Fusobacterium nucleatum* are found at high levels. *Lactobacilli* appears to be associated with the disease, as they are common in carious lesions, while rare or absent in healthy teeth. In individuals with no caries, *Streptococcus mutans* are less common and *lactobacilli* are absent, while for individuals with root caries, levels of *Streptococcus mutans* and *lactobacilli* are increased.

The prevalence of *Streptococcus mutans* alone or in combination with *lactobacilli* is similar in root caries lesions. *Lactobacilli* are absent in healthy subjects but highly present in carious dentin, supporting the suggestion that *lactobacilli* might play a significant role in the progression of root caries. Bacterial species typically associated with root caries can be detected, such as *Streptococcus mutans*, *lactobacilli*, and *Actinomyces* (Preza et al., 2008).

Oral Hygiene

Oral hygiene is a major component of oral disease susceptibility. The relationship between oral health and oral behaviors is widely recognized (Levin et al., 2004). Although many variables influence the production and progression of oral disease, the one variable that shows an immediate and long lasting significant effect on one's oral health is oral hygiene. The purpose of oral hygiene (brushing and flossing daily) is to minimize, remove, and prevent the formation of plaque. Efficient oral hygiene practices have positive effects on

root caries (Nyvad et al., 1986).

Systemic Diseases

One of the most groundbreaking studies of oral disease today is examining the associations between oral and systemic diseases. Data showed that individuals with rheumatoid arthritis, diabetes, or a liver condition were twice as likely to have an urgent need for dental treatment (Griffin et al., 2009). The data also showed that arthritis, cardiovascular diseases, diabetes, emphysema, hepatitis C, obesity, and stroke were all associated with dental disease. Unmet dental care needs were observed among participants with chronic diseases. These results suggested that some chronic diseases increase the risk of developing dental disease. Others may interpret this association as meaning that those with systemic disease tend to neglect their oral health and so show a higher incidence of oral disease.

Cardiovascular diseases have also been associated with higher caries experience, particularly in individuals 80 years or older (Holm-Pedersen et al., 2005). Individuals with three or more active root caries lesions have more than twice the odds of cardiac arrhythmias than ones without active root caries. These results did not notably change after adjusting for age, medications that reduce saliva, and number of teeth. The findings indicate that there may be a link between active root caries and cardiac arrhythmias in those aged 80 and older. One explanation for these findings is that both cardiac arrhythmias and caries are simply markers of declining general health (Gati et al., 2011).

CLINICAL INTERVENTION

As for other age groups, use of fluoride is effective in prevention of dental caries in elderly. Topical fluoride applications are shown to reduce the number of root surface caries lesions, both in active old-age people (Wallace et al., 1993) and in seniors in long-term care facilities (Wyatt et al., 2004). Fluoride containing dentifrices is also effective in preventing both coronal and root surface caries (Jensen et al., 1988). Topical application of fluoride can additionally prevent tooth mortality in older people when combined with chlorhexidine rinsing (Wyatt et al., 2004). Rinsing with a chlorhexidine solution tends to reduce gingival inflammation, pocket depth, and incidence of

denture stomatitis (Persson et al., 1991). The addition of chlorhexidine rinses to usual dental care resulted in a 15% reduction in tooth mortality in a group of older people (Hujoel et al., 1997). Clinical studies suggest that oral health education for elderly patients is effective (Schou, 1995). A randomized clinical trial for older patients revealed that group-based behaviour modification intervention helped patients improve their self-care skills such as brushing and flossing (Little et al, 1997).

COMMUNITY-BASED HEALTH PROMOTION AND ORAL DISEASE PREVENTION

Oral health programmes have been designed to improve the oral health status of the institutionalized elderly. For example, an oral health care programme which was established for residents of nursing homes or long-term care facilities, provided oral examination, dental treatment, oral prophylaxis, and instructions to both nursing staff and residents and the programme demonstrated a reduction in the number of teeth with decay and prevalence of denture stomatitis, and improved denture hygiene (Vigild et al., 1998, Budtz-Jørgensen et al., 2000). Toothbrushing by nurses and caregivers combined with professional oral care by dentists or dental hygienists were associated with decreased pneumonia, febrile days, death from pneumonia and improved daily living activities and cognitive functions of institutionalized older people (Yoneyama et al., 2002).

RECOMMENDATION FOR THE PREVENTION OF ROOT CARIES FOR ELDERLY

According to a systematic review on the effectiveness of the seven leading preventive agents for root caries, specifically: fluoride, chlorhexidine, xylitol, amorphous calcium phosphate, sealants, saliva stimulators, and silver diamine fluoride (Table 1), four agents (fluoride, chlorhexidine, amorphous calcium phosphate and silver diamine fluoride) in various either formulations or/and concentrations or/and various routes of administration have been found to be effective in the primary prevention of root caries and can be recommended for use with all older adults (Tan et al., 2010, Gluzman et al., 2013).

Table 1: Abbreviations and brand names of effective agents or combination of agents for Root Caries Prevention (Extracted Gluzuman et al., 2013)

CHX = Chlorhexidine; Fl = Fluoride, NaF = Sodium Fluoride; SDF = Silver diamine fluoride;
SnF₂ = Stannous Fluoride; ACP = Amorphous Calcium Phosphate.
Cervitec varnish = 1% CHX
EC 40 varnish = 40% CHX, sandarac, ethanol
Saforide = 38% SDF
Duraphat varnish = 22, 500 ppm NaF
Colgate toothpaste = 1100 ppm NaF
Dentan rinse = 225 ppm NaF
Colgate Total toothpaste = 1,100 ppm NaF + Triclosan
Enamelon toothpaste = ACP = 5mM Ca, 3mM PO ₄ , 0.25 mM Fluoride stabilized by NaCl at Ph 7.0
Prevident Plus toothpaste = 5000 ppm NaF
Colgate Palmolive Duraphat toothpaste = 5000 ppm NaF

Table 2: Recommendations for use of the effective root caries preventive agents or combination of agents in elderly population in ascending order of effectiveness (Extracted Gluzuman et al., 2013)

<i>1° Preventive Agents or combination of Agents for Root Caries Prevention</i>				
Agents or combination of agents ^{ref}	# & Types of Studies	Strength of Evidence	1° Prevention (% reduction)	Comments
1% or 10% or 40% CHX varnish ^{18,20,21,30} 1-3 mo interval	4 RCTs	Moderate strengths, with 4 well done studies	41-57% (vs placebos)	highly effective vs placebo
22,500 ppm Na F varnish ^{21,30} Every 3 mo	2 RCTs	thin, but strong and consistent	56% - 64% (vs no active agent)	highly effective vs placebo
1,100 ppm NaF toothpaste ³ Daily	1 RCT	very thin, a single well done study	67% (vs no active agent)	highly effective vs placebo
38% SDF solution ³⁰ Annually	1 RCT	very thin, a single well done study	72% (vs a near placebo: OHI only)	very highly effective vs a near placebo
225 ppm NaF rinse ¹⁰ Daily	1 RCT	very thin, a single well done study	36% (vs 22,500 ppm NaF varnish)	1/3 more effective vs an agent that was itself highly effective compared to a placebo
960 ppm SnF ₂ gel ¹⁰ Every 3 mo	1 RCT	very thin, a single well done study	35% (vs 22,500 ppm NaF varnish)	1/3 more effective vs an agent that was itself highly effective compared to a placebo
1,110 ppm NaF + Triclosan toothpaste ¹⁶ Daily	1 RCT	very thin, a single well done study	90% (vs 1,100 ppm NaF toothpaste)	nearly 2-fold the effectiveness vs an agent that was itself highly effective compared to a placebo
ACP toothpaste + 250 ppm NaF rinse ²⁹ Daily	1 RCT	very thin, a single well done study	98% (vs 1,100 ppm NaF toothpaste + 250 ppm NaF rinse)	2-fold the effectiveness vs an agent that was itself highly effective compared to a placebo
<i>2° Preventive Agents or combination of Agents for Root Caries Prevention</i>				
Agents or combination of agents ^{ref}	# & Types of Studies	Strength of Evidence	2° Prevention (% arrested)	Comments
4,500-5,000 ppm NaF toothpaste/gel ^{11,12,15} Daily	2 RCTs 1 case-series	a growing and solid body of evidence	52%-82% (μ = 67%)	highly effective
22,500 ppm Na F varnish ^{2,15,17,21,27} Every 1- 3 mo	3 RCTs 2 case-series	solid and consistent body of evidence	54% - 92% (μ = 80%)	very highly effective

Table 2 shows that use of CHX varnish, a 22,500 ppm NaF varnish, a 1100 ppm NaF toothpaste, and a 38% solution of SDF (the first four listed in the table) resulted in reductions of 41–57%, 56–64%, 67%, and 72%, respectively, as compared to a placebo group. The two most effective agents or combination of agents for the primary prevention of root caries incidence were a 1110 ppm NaF+ triclosan toothpaste self-applied daily and a ACP + 250 ppm NaF toothpaste applied daily, both of which nearly doubled the reduction of root caries when compared to an already proven effective root caries prevention products.

Only fluoride in two concentrations and in different routes of administration was found to be effective in the secondary prevention of root caries: a 4,500–5,000 ppm NaF toothpaste gel self-applied daily and a 22,500 ppm NaF varnish professionally applied every 1–3 months. While the range reported for arresting lesions was similar (52–100% for the self-applied NaF toothpaste and 54–95% for the professional applied NaF varnish with or without supplementation of NaF toothpastes and rinses), the mean reported arrested lesion rate was higher for the NaF varnish (78% vs. 64%) (Gluzuman et al., 2013).

RECOMMENDATION FOR THE PREVENTION OF ROOT CARIES FOR INSTITUTIONALIZED ELDERLY

Table 3: Recommendations for use of root caries preventive agents or combination of agents in institutionalized elderly (Extracted Gluzuman et al., 2013).

1° Prevention				
Agents or combination of agents ^{ref}	EFFECTIVENESS in Preventing Root Caries	FEASIBILITY for use in Vulnerable Elderly	Current Cautions	Overall Rating
38% SDF solution ³⁰ Annually	72% ↓ vs placebo for 1° root caries	Very High: professionally applied annually	only 1 study on root caries*	BEST CHOICE for 1° prevention
ACP toothpaste + 250 ppm NaF rinse ²⁹ Daily	98% ↓ vs NaF toothpaste + NaF rinse combination	requires daily use by patient	only 1 study	best alternative if no professional application possible
2° Prevention				
Agents or/and their combinations ^{ref}	EFFECTIVENESS in Preventing Root Caries	FEASIBILITY for use in Vulnerable Elderly	Current Cautions	Overall Rating
22,500 ppm NaF varnish ^{6,15,17,21,27} Every 3 mo with or without NaF rinse or toothpaste	~ 78% arrested	Moderately High: professionally applied at 1–3 mo	none	BEST CHOICE for 2° prevention
4,500–5,000 ppm NaF toothpaste/gel ^{1,12,15} Daily	~ 64% arrested	requires daily use by patient	none	best alternative if no professional application possible

Table 3 shows the recommended choices for use with particular attention to vulnerable elderly and introduces the consideration of feasibility for use of these effective agents or combination of agents within a vulnerable population, that is, the required frequency of application and the capability of vulnerable elderly to self apply. For the primary prevention of root caries the recommended “best choice” agent is the 38% SDF solution professionally applied annually. If no

professional application is possible, the recommendation for “best alternative” for the primary prevention of root caries is the use of a self-applied ACP + 250 ppm NaF toothpaste daily.

For the secondary prevention of root caries (i.e., arresting lesions), the recommended “best choice” is fluoride in a form of 22,500 ppm NaF varnish professionally applied every 3 months. If no professional application is possible, the recommendation for “best alternative” for the secondary prevention of root caries is the use fluoride, as well, but in a form of a 4,500–5,000 ppm NaF toothpaste/gel self-applied daily (Gluzuman et al., 2013).

CONCLUSION

As the global population ages, and more teeth are retained, there will be a higher prevalence of root caries and untreated dental decay. Therefore, the demand for dental services in the population of the oldest elderly people is likely to increase. There are a wide variety of risk factors associated with the development of caries, and although there are differences of opinion regarding the cause of the increase in caries it should be agreed upon that public health strategies are needed to renew the fight against caries and promote prevention of future oral disease. Awareness and promotion of fluoride applications, emphasis on proper tooth brushing with a fluoride dentifrice, flossing, a proper diet, and regular dental office visits can hinder the progression of future caries and can result in an increase in the oral health of all elders.

REFERENCES

Budtz-Jørgensen E, Mojon E, Rentsch A, Deslauriers N: Effects of an oral health program on the occurrence of oral candidosis in a long-term care facility. Community Dent Oral Epidemiol 28: 141-149, 2000.

Burt BA, Eklund SA, Morgan KJ: The effects of sugars intake and frequency of ingestion on dental caries increment in a three-year longitudinal study. J Dent Res 67: 1422-1429, 1988.

Chalmers JM, Hodge C, Fuss JM, Spencer AJ, Carter KD: The prevalence and experience of oral diseases in Adelaide nursing home residents. Aust Dent J 47: 123-130, 2002.

Curzon ME, Preston AJ: Risk groups: nursing bottle caries/caries in the elderly. Caries Res 38 (Suppl1): 24-33, 2004.

Faine MP, Allender D, Baab D, Persson R, Lamont RJ: Dietary and salivary factors associated with root caries. Spec Care Dentist 12: 177-182,1992.

Gati D, Vieira AR: Elderly at greater risk for root caries: a look at the multifactorial risks with emphasis on genetics susceptibility. Int J Dent 647168, 2011.

Gluzman R, katz RV, Frey BJ, McGowan R: Prevention of root caries: a literature review of primary and secondary preventive agents. Spec Care Dentist 33(3): 133-140, 2013.

Griffin SO, Barker LK, Griffin PM, Cleveland JL, Kohn W: Oral health needs among adults in the United States with chronic diseases. JADA 140: 1266-1274, 2009.

Holm-Pedersen P, Avlund K, Morse DE: Dental caries, periodontal disease, and cardiac arrhythmias in community-dwelling older persons aged 80 and older: is there a link?. J Am Geriatr Soc 53: 430-437, 2005.

Hujoel PP, Powell LV, Kiyak HA: The effects of simple interventions on tooth mortality: findings in one trial and implications for future studies. J Dent Res 76: 867-874,1997.

Jensen ME, Kohout F: The effect of a fluoridated dentifrice on root and coronal caries in an older adult population. J Am Dent Assoc 117: 829-832, 1988.

Levin L, Shenkman A: The relationship between dental caries status and oral health attitudes and behavior in young Israeli adults. J Dent Educ 68: 1185-1191, 2004.

Little SJ, Hollis JF, Stevens VJ, Mount K, Mullooly JP, Johnson BD: Effective group behavioral intervention for older periodontal patients. J Periodont Res 32: 315-325,1997.

Lo EC, Luo Y, Dyson JE: Oral health status of institutionalized elderly in Hong Kong. Community Dent Health 21: 224-226, 2004.

Lynch E and Beighton D: A comparison of primary root caries lesions classified according to colour. Caries Res 28: 233-239, 1994.

Nyvad B, Fejerskov O: Active root surface caries converted into inactive caries as a response to oral hygiene. Scand J Dent Res 94: 281-284,1986.

Persson RE, Truelove EL, Leresche L, Robinovitch R: Therapeutic effects of daily or weekly chlorhexidine rinsing on oral health of a geriatric population. Oral Surg Oral Med Oral Pathol 72: 184-191,1991.

Petersen PE and Yamamoto T: Improving the oral health of older people: the approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol 33: 81-92, 2005.

Preza D, Olsen I, Aas JA, Willumsen T, Grinde B, Paster BJ: Bacterial profiles of root caries in elderly patients. J Clin Micro 46: 2015-2021,2008.

Schou L: Oral health, oral health care, and oral health promotion among older adults: social and behavioral dimensions. In: Cohen LK, Gift HC, editors. Disease Prevention and Oral Health Promotion. Copenhagen: Munksgaard; 1995.

Simunkovic SK, Boras VV, Panduric J, Zilic IA: Oral health among institutionalized elderly in Zagreb, Croatia. Gerodontology 22: 238-241, 2005.

Sreebny LM, Schwartz SS: A reference guide to drugs and dry mouth--2nd edition. Gerodontology 14: 33-47, 1997.

Tan HP, Lo EC, Dyson JE, Luo Y, Corber EF: A randomized Trial on root caries prevention in elders. J Dent Res 89: 1086-1090, 2010.

Vigild M, Brinck JJ, Hede B: A one-year follow-up of oral health care programme for residents with severe behavioural disorders at special nursing homes in Denmark. Community Dent Health 15: 88-92, 1998.

Wallace MC, Retief H, Bradley EL: The 48-month increment of root caries in an urban population of older adults participating in a preventive dental program. J Public Health Dent 53: 133-137,1993.

World Health Organization The World Health Report 2011. Geneva, Switzerland: WHO; 2011.

Wyatt CCL, MacEntee MI: Caries management for institutionalized elders using fluoride and chlorhexidine mouthrinses. Community Dent Oral Epidemiol 32: 322-328, 2004.

Yoneyama T, Yoshida M, Ohrui T, Mukaiyama H, Okamoto H, Hoshiba K: Oral care reduces pneumonia in older patients in nursing homes. J Am Geriatr Soc 50: 430-433, 2002.

COUNTRY REPORT

BHUTAN

*Sonam NGEDUP
Dorji PHURPA*

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

BHUTAN

Sonam NGEDUP¹⁰

Dorji PHURPA¹⁰

Introduction

Bhutan, a small landlocked country measuring 38,394 square kilometers in area is situated between China and India. It is mostly mountainous and heavily forested with 70.5% vegetation cover. The country was in self imposed isolation for centuries when it ushered modern development in 1960s as five-year- development plan was launched. The current population is 740,431 derived from 1.8% growth rate of 634,982 counts as baseline in 2005 when internationally accepted census method was adopted for the first time. The life expectancy is 69-years for males and females respectively. About 25% of the populations are youth below 25 years of age. The hydropower export fuelled rapid economic achievement and presently has one of the highest per capita income in SouthAsia region¹⁻².

The health coverage in Bhutan is 90% and the doctor to patient ratio is 3:10,000. There is acute shortage of health professional across all categories, including dental. The oral health situation, therefore, is unexplored and uncared for as the authorities struggle to fight infectious diseases similar to many developing countries in the region. However, health being a social sector, advancement of modern health care services gives great importance. The annual health budget has been increasing exponentially over the years in terms of fiscal outlay³⁻

4

¹⁰ Department of Dentistry, Jigme Dorji Wangchuk National Referral Hospital, Thimphu, Bhutan.
Email: sonam ngedup <gortshom@gmail.com>; Dorji Phurpa <dorjiphurpa21@gmail.com>

DENTAL CARIES EPIDEMIOLOGY

The dental caries prevalence has been declining in most of the developed countries because of the use of various fluoride products. But the same trend is not true for many developing countries, including Bhutan, due to meal component transition to the western form of diets and vigorous campaign by junk food manufacturers that flood the market targeted to vulnerable groups such as children⁵⁻⁹.

The caries situation in the general Bhutanese population especially for adults is not available. The past few studies were conducted in schoolchildren in various age groups. In 1985, the caries prevalence in Thimphu and Paro for the urban and rural areas among 15-19-year-old children was 73% and 76% respectively¹⁰. The WHO goal of 2000 for 12-year olds with 1.4 DMFT had already been achieved 15 years before and still was without significant change at mean 1.2 DMFT in 2008¹¹ after more than two decades of socioeconomic development that was associated with changes in all aspects of lifestyle including diet. In that study by Singh et al, dietary habits, chewing of betel leaves and Areca nut, irregular tooth brushing habits, poverty and lack of knowledge of oral health were some of the attributed contributing factors for poor oral health.

Ngedup S. et al (2008)¹¹ did a cross-sectional study in capital city Thimphu among 461 12-year-olds schoolchildren and found 57.9% caries prevalence. Other details of the findings are presented in Table 1.1 and 1.2

Table 1.1: Percent caries affected and DMFT for different age groups

Age Group in years (N)	% affected	DMFT	D	M	F	Year	Source
12 (461)	58.0	1.2	1.1	0.1	0.1	2008**	Thimphu City
15-19	73.0	2.5	na	na	na	1985*	Urban (Thimphu & Paro)
15-19	76.0	2.6	na	na	na	1985*	Rural (Thimphu & Paro)

Table 1.2: Fluoride levels in some Thimphu drinking waters.

Sl/No.	Source of Water samples	Fluoride Concentration (ppmF)
1	Dechenchholing (North Thimphu)	0.02
2	Taba	0.06
3	Babesa	0.06
4	Changzamtog	0.04

Table 1.3 shows details of the study¹² outcome for Loselling Meddle Secondary School, Thimphu, which was carried out as part of the school oral health program and detected high caries prevalence. Descriptive analysis showed 79% caries in 6-8-year-old and 43% among 13-16-year olds. The caries prevalence was less among older children.

Table 1.3: Caries prevalence with mean DMFT in Loselling Middle Secondary School, Thimphu, 2010.

Age group in years (N)	% Caries affected	% Caries free	Decayed (D)	Missin g (M)	Filled (F)	DMFT
6-8 (247)	79.3	20.7	3.1	0.1	0.4	3.6
9-12 (458)	68.3	31.7	1.5	0.1	0.4	2.0
13-16 (339)	43.4	56.6	3.1	0.1	0.4	3.6

In 2010, Wangchuk S.R et al¹³ initiated a three year longitudinal three pronged study on effectiveness of sodium fluoride mouth rinses, brushing with fluoridated toothpaste and oral health education on caries experience among pre-primary schoolchildren. The study subject comprised 684 5-6 and 7-8-year-old kindergarten children in Thimphu, Zhemgang and Trashing that represents western, central and eastern regions respectively. The study group was 317 (46%) kindergarten children; 367 (54%) grade two children served as controls. The interventions were supervised fluoride mouth rinsing along with brushing (in the presence of the trained health teacher) and a half hour oral health education lecture delivered in the classroom for the intervention group every alternate week for 36 months.

Table 1.4: Regional Mean, SD, decayed, missing filled, dmft and significances

Status	Assessment	
	Pre-intervention (Age 6 years)	Post-intervention (Age 8 years)
<i>Western Region</i>		
Sample (n)	130	88
decayed (Mean), dt	6.0	0.2
Missing, mt	0.2	2.1
Filled, ft	0.1	0.7
dmft	6.3	3
Total caries free [% children (%)]	19 (14.6)	21 (23.9)
Significance	$p < 0.02$	$p < 0.002$
<i>Central Region</i>		
Sample(n)	93	60
decayed (Mean)	2.4	1
missing	0.2	0.08
filled	0	0.05
dmft	2.6	1.1
Total caries free [% children (%)]	31 (33.3)	29 (48.3)
Significance	$p < 0.002$	$p < 0.04$
<i>Eastern Region</i>		
Sample(n)	132	82
decayed (Mean)	4.7	0.2
missing	0.2	2.7
filled	0.2	0.3
dmft	5.1	3.2
Total caries free [% children (%)]	17 (12.9)	16 (19.5)
Significance	$p < 0.001$	$p < 0.001$

After three years, the authors found a less caries incidence among the study group compared to controls from the baseline. Thimphu and Trashigang children had more caries than those from the central region, hypothetically due to exposure to refined diets and parental

affordability for pockets money to children than better oral hygiene measures or more regular dental visits while the central region children had more traditional form of diets, other factors being the same. Table 1.4 represents the overall data of the study.

The oral health scenario for the elderly at the national level is again missing. A slightly bizarre finding from the “Free Health Checkup for the Elderly” conducted in the street in 2012 for 328 elderly, only 9% had normal dentition. Thus it is demonstrated that geriatric dental problems exist among those 65-years and older¹⁴.

The caries data for primary dentitions (dmft) among 5-6-year-old children is not available presently. But the caries reports for some years are alarming as shown in Tabel.1.5 and Figure 1.1. An initiative has been taken towards that end and a proposal for a nationwide oral health survey would come to realize by the coming year if the Borrow Foundation accepts for funding the project proposal. As of now, only clinical experience shows that the majority of children visiting for dental services have rampant caries. It is anticipated that the planned survey data would show the real caries status among children in this age group¹⁵⁻¹⁶.

Table 1.5: Age specific dental caries for 2010.

Age Group (Years)	Male	Female	Total
Under 1	29	39	68
1-4	599	735	1,334
5-14	4,202	4,154	8,347
15-49	9,101	11,797	20,898
50-64	2,140	2,014	4,164
Above 65	955	690	1,645
Total			36,456

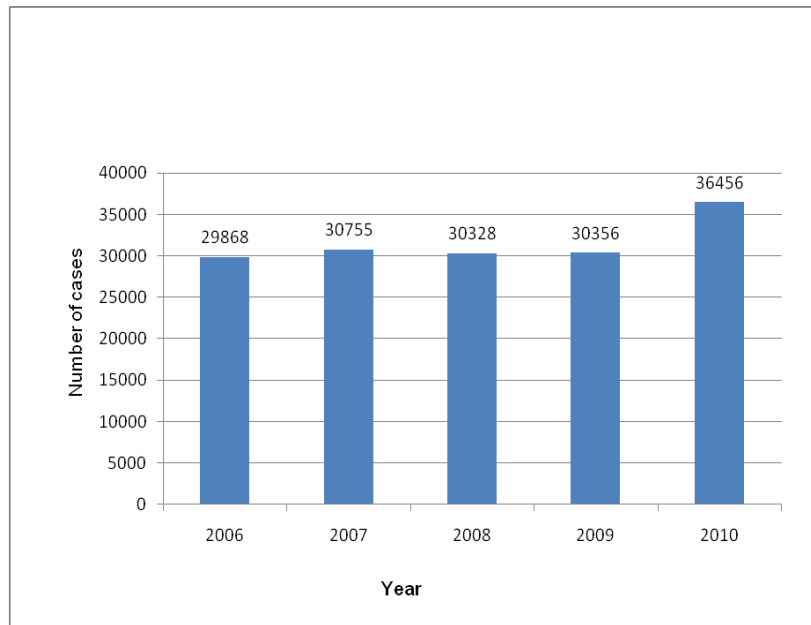


Figure 1.1: Annual dental caries cases

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

Dental caries is one of the top ten most common diseases in Bhutan²¹. The burden of dental diseases in the country is high and expensive. The reported caries cases have been on a gradual rise since 2005 as illustrated in Figure 1.2. Dental caries associated pain, swelling, dysfunction of dietary intakes, missed work or school days still not documented could be enormous.

The need of exposure to 1 *ppm* of fluoride in public drinking water supplies in temperate climate countries has been shown to reduce dental caries experience, especially in children by approximately 50% in several communities²²⁻²⁴.

In a similar context, the WHO has suggested fluoride levels of 0.5-1.0 *ppmF* for best cariostatic effects in hot and cold climates for lower and upper limits respectively²⁵

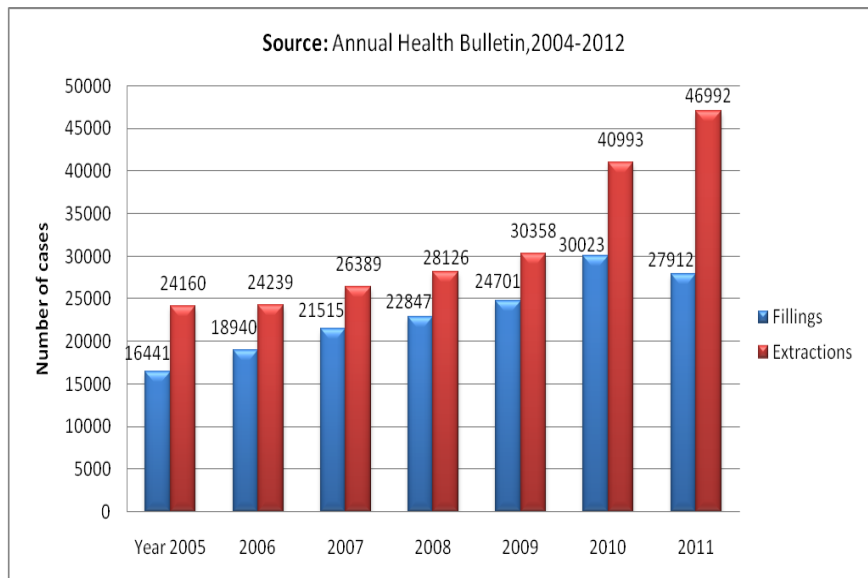


Figure 1.2: Dental caries related treatments 2005-2011.

The oral health program was started in 1988. Schools were annually screened of dental caries and other oral problems, mostly by dental hygienists. Extractions of grossly decayed and primary mobile teeth were extracted after the oral health talk to students. This program still continues today but the regional discrepancy in school visits and lack of monitoring and evaluation of the activity is the hallmark²⁶

The comprehensive school health program jointly conducted and monitored by the education and health ministry was initiated in 1998. But oral health topics are hardly covered to indicate indifference to oral health. Although no health topics including that of oral were there in the old curriculum, it is has now become essential for children to learn health chapters in their sciences and social study books. It is also a universal practice for schools to have a health teacher each who are trained in basic health care and they teach and look after the health issues of the school as a whole or have the authority for referral to hospitals²⁶.

Two successive drinking water fluoride mapping was done in 2013. While the study by Dorji C et al covered all the towns in the country for both wet and dry seasons, the dental team survey of fluoride covered entire urban and semi-urban areas and most villages, including samples from major rivers of Bhutan. Some of the fluoride level data are shown in Figures 1.3 and 1.4. Both studies had found

very low fluoride levels in drinking water across the country in different seasons. The studies have concluded that dental caries levels be high in light of negligible protection from water fluoride and less number of oral health workers²⁷⁻²⁸.

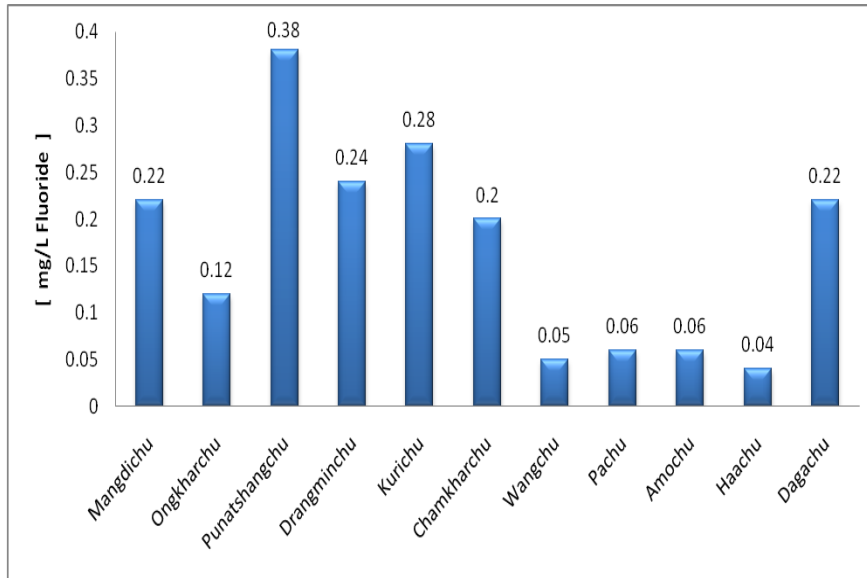


Figure 1.3: Fluoride concentration in major river waters in Bhutan

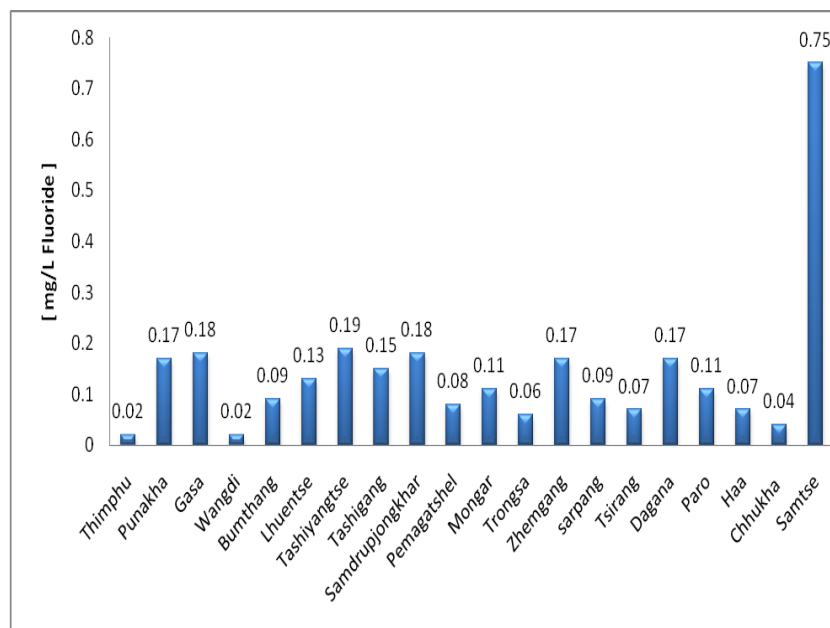


Figure 4.3: Fluoride level in village drinking waters of twenty districts

HOME CARE FOR DENTAL CARIES CONTROL

A study by Ngedup S et al (2008)¹¹ found 95% use of fluoride toothpastes among the participants. The type of toothpastes and their fluoride concentrations were not ascertained. The same study also found that only 40% visited the dentist within the past twelve months, the reasons being toothaches. Less than 50% had the tendency of brushing less than twice a day and before bedtime brushing was done by 40% children. The first ever oral health study in the country by Singh et al. (1985)¹² had also ascribed to poor oral behaviour and low education as the reasons for both poor dental and gingival health.

The use of in-office fluoride is erratic and is practiced at high end clinics in Thimphu only. Even though, 2% acidulated phosphate fluoride (APF) has recently begun to be used for patients, the noncompliance and poor record keeping factors could prove harmful for children. There is no fluoride varnish as well and could be better for the same reasons. Fluoride mouth rinses are hardly prescribed or found in the pharmacy shops unlike antiseptic mouthwashes which are frequently prescribed but not available in the hospital pharmacy²⁹.

While various brands of nylon toothbrushes are vague in towns, more remote areas also use traditional forms of oral cleaning like using charcoal, earth or just chew sticks alone.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

Until 1950s monastic schools were the only form of education with schools in Paro, Haa and Bumthang, and still today it plays an important role in preserving and promoting the tradition and culture of the country. Bhutan's tryst with organized modern education started in 1961 when the development plan was launched. Today there are more than 500 schools including private, vocational and colleges under the Royal University of Bhutan (RUB)^{1,17}.

Construction of a medical university named-University of Medical Sciences of Bhutan (UMSB) is in the advanced stage and would be opened by 2014. When it becomes functional, all the health related studies will be conducted within the country, bringing an end to decades of sending all health professionals for training outside the country. In 1972 the first health school was established in Thimphu: National Health School. It was planned to train national paramedics. The school was renamed as the Royal Institute of Health Sciences

(RIHS) in 1984. Although the school was originally meant to train basic health care workers like health assistants (HA), nurses, basic health workers (BHW), other categories of health professionals were inducted. A two year duration certificate level dental hygiene course was first started in 1984. Two years later, the same duration dental technician course was also inducted¹⁸ The present dental professionals strength in the country is indicated in Table 1.6.

Table 1.6: Bhutan Dental Healthcare personnel

Dental Health Professional	Number of staff	Working Hospital
Pediatric Dentist	1	Thimphu
Orthodontist	1	Thimphu
Oral Surgeon	1	Thimphu
Prosthodontist	1	Thimphu
Dental Surgeon	5	Thimphu & Districts
Dental Hygienist	57	Thimphu (21)
Dental Technician	32	Thimphu(17)
Dental Assistant	2	Thimphu

The dental hygiene course entails a wholesome curriculum including basic sciences and some important tenets of major dental specialty topics. Great care is taken to inculcate among hygienists the sense of prevention and promotion of oral health for the masses. A three year diploma in dental therapy is proposed that would come through once the medical university starts its academic session in the future¹⁸⁻¹⁹

Higher education for health professionals like doctors including dentists were until now trained in foreign countries viz. India, Sri Lanka, Myanmar, Nepal and Thailand among others. Presently Bhutan has 57 dental hygienists, 32 dental technicians and 2 dental assistants. On the other hand, the number of dentist is just 9, including a specialist each in oral surgery, orthodontics, prosthodontics and pediatric density. In having the first national dentist in 1986, it has been a dismal increase to its present number²⁰.

CONCLUSION

Dentistry in Bhutan has made great strides since the first expatriate dentist in 1970 and a national dentist in 1986. The low dentist counts could be numbered when a number of privately sponsored young graduates studying outside the return for practice within a decade

from now. On the other hand, the upgraded diploma in dental hygiene course could make a positive difference as the dental workforce. As the national electrification is complete, dental technology will be used in every nook and corner of the country in delivering oral health services to people.

The present poor oral health attitude of people would likely change for the better as the literacy and globalization impacts their lives. The dental professionals should provide effective oral health messages through various media especially target to children who are easily misled into accepting refined sugar forms that are detrimental to oral health. The final message is that drinking water fluoride concentration is very low and hence the use of fluoridated toothpastes should be encouraged for all.

REFERENCES

1. *National Statistics Bureau (2012). Statistical Year Book, Royal Government of Bhutan.*
2. *Population and Housing census of Bhutan (2005). Royal Government of Bhutan.*
3. *9th FYP document for the Health Sector (2002-2007). Ministry of Health. Royal Government of Bhutan.*
4. *Annual Health Bulletin (2012). Ministry of Health, Thimphu, Bhutan.*
5. *Petersen PE (2003). The World Oral Health Report: continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol. 31(Suppl. 1):3–24.*
6. *Petersen PE, Hoerup N, Watanapa A (2001). Oral health status and oral health behavior of urban and rural schoolchildren in Southern Thailand. Int Dent Journal 51:95-102.*
7. *Koirala S, David J, Khadka R et al.(2003) Dental caries prevalence, experience and treatment needs of 5-6 years old and 12-13 years old and 15 years old school children of Sunsari district, Nepal. Journal of the Nepal Dental Association 5:12-24.*
8. *Ulla M.S., Aleksejuniene,J., Eriksen,H.M.(2002). Oral health of 12-year-old Bangladeshi children. Acta Odontologica Scandanivica 60: 117-122.*

9. *Teng O.(2001). Factors affecting oral health status among 12-year-old children in primary school participating in oral health preventive program in Phnom Penh City, Cambodia [MSc. Thesis, Mahidol University] Thailand.*
10. *Singh D.(1985). Dental caries and periodontal disease prevalence in schoolchildren of Bhutan.*
11. *Ngedup S, Leelatataweewud P, Lexomboon D.(2009) Oral health status and associated factors in 12 years old children in Thimphu city, Bhutan. Int Dent J Paed Dent 9 (suppl.1): 36.*
12. *Ngedup S., Phurpa D., Karchu (2011). Prevalence of dental caries among children in Loselling Middle Secondary School, Thimphu, Bhutan.*
13. *Wangchuk SR, Phurpa D, Dorji T et al.(2012). Effectiveness of supervised fluoride mouth rinse and oral health education on caries incidence among kindergarten pupils in three regions of Bhutan: a Pilot Project.*
14. *Department of Dentistry (2012). Jigme Dorji Wangchuk National Referral Hospital, Thimphu.*
15. *Ngedup S, Phurpa D. (2013). Oral Health Survey in 6- and 12-year-old Bhutanese schoolchildren: A proposal for Borrow Foundation, USA.*
16. *Dental Monthly Report (2012). Department of Dentistry, Jigme Dorji Wangchuk National Referral Hospital, Thimphu.*
17. *Education in Bhutan. Full version at: <http://countrystudies.us/bhutan/29.htm>. (Accesses on October 9, 2013).*
18. *Tamang S Pratap. (1990). Dental Hygiene and Technician Certificate Course Curriculum, Royal Institute of Health Sciences, Thimphu.*
19. *Ngedup S, Phurpa D, Jamtsho L.(2012). Dental Hygiene and Technician Diploma Course Curriculum, Department of Dentistry, Jigme Dorji Wangchuk National Referral Hospital, Thimphu.*
20. *Master Plan (2012). Human Resources Division, , Ministry of Health, Thimphu.*
21. *Dental Services (2012). Annual Health Bulletin, A window to health Sector Performance. Ministry of Health, Bhutan.*
22. *Dean HT, Arnold FA, Evolve E.(1942). Domestic water and dental caries. V. Additional studies of the relation of fluoride in domestic water to dental caries experience in 4,425 white*

children aged 12 – 14 years, of 13 cities in 14 states. Public Health Reports 1155–1179.

23. *Murray JJ, Rugg-Gunn AJ.(1982). Fluoride in Caries Prevention. Dental Practitioner's Handbook No. 20.2nd edition. Boston: Wright PSG; Modes of action of fluoride in reducing caries; pp. 222–223.*
24. *O'Mullane DM, Clarson J, Holland T et al. (1988). Effectiveness of water fluoridation in the prevention of dental caries in Irish children. Community Dental Health 5:331–334.*
25. *World Health Organization (1994). Expert Committee on Oral Health Status and Fluoride Use, author. Fluorides and Oral Health. Geneva: World Health Organization. WHO Technical Report. Series No. 846.*
26. *Oral Health Program (1990). Ministry of Health, Thimphu Bhutan.*
27. *Dorji C, Wangchuk R. (2012). Fluoride mapping of drinking water in urban and suburban areas in Bhutan, Water Quality Section, Public Health Laboratory, Ministry of Health, Bhutan.*
28. *Ngedup S, Phurpa D. (2013). Fluoride mapping for dental caries prevention. Oral Health Program, Ministry of Health, WHO support.*
29. *Standard Treatment Guide (2012). Department of Medical Servicers, Ministry of Health, Thimphu Bhutan.*

BRUNEI DARUSSALAM

Mary Cheong Poh HUA

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

BRUNEI DARUSSALAM

Mary Cheong Poh HUA¹¹

DENTAL CARIES EPIDEMIOLOGY

Data from Dental screening in schools and "Parents and young children programme" 2012

- Caries free 5 year old 41% (1999 caries free 11%)
- Caries free 3 year old 60.8%
- Dmft 5 year olds 3.9 (1999 dmft 7) d=3.7, m=0.06, f=0.05
- dmft 3 year olds 2 (d=2, m=0, f=0)
- DMFT 12 year olds 0.6 (1999 DMFT 5)

COMMUNITY DENTAL CARIES PREVENTION PROGRAMME

Current programmes and activities conducted by Oral Health Promotion Division

1. Water Fluoridation
 - almost 100% supply /coverage from water treatment plants
 - 2012 fluoride level in water 0.5 to 0.7 ppm
2. Oral Health Promotion through television promotion
 - Infant diet – promoting breastfeeding, stopping bottle feeding with infant formula, prevent sweet snacking
 - Oral hygiene – toothbrushing education
 - Prevention of cross infection from mother to child

¹¹ Department of Dental services, Ministry of Health, Brunei Darussalam.
Email: Mary Cheong <markusdawat@yahoo.com>

- 2012 study showed 7% of mothers who watched the promos have started brushing their childrens' teeth with fluoridated toothpaste.

3. Antenatal programmes

- Comprehensive dental treatment
- Oral health education for mother and infant to be born
- Oral health promotion booklet and pamphlet
- 2012 data showed coverage of 25% of antenatal mothers

4. Parents and Young Childrens Oral Health Promotion and Prevention programme for 5 year olds and below in community health centres providing:-

4.1 *Oral health education.*

4.2 *Fluoride varnish 2x a year until 5 years old.*

4.3 *Interventive oral health promotion programme for 9 months old babies*

- Giving of a bag with fluoridated toothpaste, toothbrush, feeder cup and oral health education booklet and pamphlets.
- Follow up every 6 months - giving toothbrush and fluoridated toothpastes) till 5 years of age.
- Collection of data for 5 year olds and below – caries free % for 3, 5 year olds, dmft for 3,5 year olds.
- Percentage of total number of 9 months old babies attended was 24%.
- Percentage of total number of children under 5 year olds attended was 98%.

5. Health Promoting School Programme

- Collaboration with Department of Schools, Ministry of Education.
- Teams from various Departments inspect schools & monitor all health aspects of schools (Medical; Dental; Sick bay; hygiene and cleanliness of school premises, compound, toilets, drains; nutrition and healthy diet in canteen/tuckshop, food brought from home.)
- All schools visited once a year and reports given

6. Daily Fluoridated Tooth Brushing Programme

- Introduced in Government primary schools (Total 119)
- Tooth brushing activity is carried out 10 min before the end of break, by the whole school under teachers' supervision, every school day.
- 1 toothbrush per year and Pollypaste (1450 ppmF) are provided by the Ministry of Health
- Conducted by Oral Health Promotion Division.
- All government primary schools visited by oral health promotion division 2x a year.

7. National Dental Song Competition for all primary schoolchildren aged 6-9 years old.

- 58 primary schools competed in 2012

8. National Tooth brushing Competition for Primary schoolchildren to be conducted in 2014.

9. Current programs & activities conducted by School Dental Services Division

- Static Dental Clinics
- 45 dental surgeries in schools throughout the country
- Mobile Dental Squads
- Started in 2007 where teams of 2-6 dental nurses treating school children using portable equipment
- Move to another school upon 80% completion
- Currently ⇒ 12 Mobile Dental Squads
- 2012: 99 schools covered

10. Current programs & activities conducted by Paediatric Dentistry Unit

- A Special Oral Health Promotion programme in schools to both children with special needs & their carers.
- Paediatric Dental Specialists & Therapists also provide specialised & comprehensive dental care for children with special needs & medically compromised.

HOME CARE FOR DENTAL CARIES CONTROL

Fluoridated toothpaste – 1450ppm fluoride.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

- No dental school at present.
- 2014 September starting dental school education at the University of Brunei twinning with UK University.
- Cariology teaching and learning and clinical practice in Diploma in Dental Hygiene and Therapy course conducted by the Department of Dental Services, Ministry of Health with King's College, London.
- Contents : Dental Caries – Aetiology and microbiology of dental caries in relation to dental plaque; the epidemiology of caries; features of enamel, dentine and root caries (both microscopically and macroscopically); Diagnostic methods of dental caries; management of dental caries; histopathology of pulpitis; abscess formation.

CAMBODIA

*Sopharith SOEUN
Callum DURWARD
Sithan HAK
Tepirou CHER
Chhnoeum TIENG*

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

CAMBODIA

*Sopharith SOEUN¹²
Callum DURWARD¹³
Sithan HAK¹²
Tepirou CHHER¹²
Chhnoeum TIENG¹⁴*

INTRODUCTION

Oral health is now accepted as being an important part of general health. Not only can poor oral health lead to pain and infection, but it can also have an adverse effect on a person’s general health and quality of life. Studies have shown an association between oral health and conditions such as cardiovascular disease, premature birth, and diabetes (Barnett, 2006). This report will describe the dental health status of Cambodians from ages 6 to over 60 years, the teaching of Cariology in the undergraduate curriculum, public health measures to address the problem of dental caries, and preventive dental products available in Cambodia.

DENTAL CARIES EPIDEMIOLOGY

Unfortunately, most Cambodians experience dental problems from an early age. This is evidenced in several studies that have been conducted on the epidemiology of dental caries in Cambodia since 1990 (Durward *et al.*, 1991; Todd *et al.*, 1994; Shidara *et al.*, 2007; Chu *et al.*, 2008; Teng *et al.*, 2004). The most recent national oral health survey shows high levels of dental caries in all age groups, although caries in children is more severe (Table 1) (Ministry of Health, 2011^a). The mean dmft of 6 year old children was 9.0, with very few

¹² Oral Health Office, Preventive Medicine Department, Ministry of Health, Cambodia.
Email: Sopharith Soeun <rithisambath@yahoo.com>; Sithan Hak <sithan_hak@yahoo.com>;
Tepirou Chher <tepirou@yahoo.com>

¹³ Faculty of Health Sciences, University of Puthisastra, Cambodia, Email: Callum Durward
<callumspencerdurward@gmail.com>

¹⁴ Cambodian Dental Association. Email: Chhnoeum Tieng <chhnoeum@yahoo.com>

primary teeth having been restored or extracted. Only 6.9% of these children were caries-free. The mean pufa (pulpally involved, ulceration due to trauma, fistula or abscess) index (Monse *et al.*, 2010^a) was 2.7. This indicates that an average of almost 3 teeth had deep decay affected the dental pulp. In addition, 60% of mothers of the children in the 6 year old age group indicated that their child had suffered from dental pain in the past 6 months. The mean DMFT for the 12 year old age group was 3.5, with few permanent teeth having been restored or extracted, and with a mean PUFA score of 0.9. Only 21.7% of 12 year olds were caries-free. The adolescent group (aged 14-15) had a mean DMFT of 4.2, with little evidence of treatment, and a caries-free rate of only 20.9%. In the 35-44 year old age group, the DMFT was 5.6, with almost half of the affected teeth being either restored or extracted. 28.9% of this age group was caries-free. And in the over 60 years group, the DMFT rose to 8.1, and the PUFA score was 2.6.

Table 1: Dental caries epidemiology in Cambodia.

Age Grp	Caries free (%)	dt	mt	ft	dmft	pufa	DT	MT	FT	DMFT	PUFA
5-6	6.9	8.9	0.1	0.0	9.0	2.7	0.2	0.0	0.0	0.2	-
12	21.7	-	-	-	-	-	3.4	0.1	0.1	3.5	0.9
14-15	20.9	-	-	-	-	-	3.8	0.1	0.2	4.1	0.9
35-44	28.9	-	-	-	-	-	3.8	1.3	0.5	5.6	1.9
>60	31.7	-	-	-	-	-	3.9	4.1	0.1	8.1	2.6

COMMUNITY DENTAL CARIES PREVENTION PROGRAMS

1. Community fluoride administration in Cambodia

So far, although most water supplies in Cambodia are deficient in fluoride, there have been no community fluoride administration programs. The Oral Health Office, Preventive Medicine Department, Ministry of Health (MOH), has investigated salt and water fluoridation, but these have not been implemented due to technical challenges, and resistance from some stakeholders. However, the Oral Health Office is continuing to promote fluoridation as a safe and cost-effective means of caries prevention. In the meantime, the Oral Health

Office has focused on promoting the use of fluoride toothpastes, and ensuring that all toothpastes have adequate levels of fluoride. In January 2007, a meeting was organized by the MOH on the topic “The Future Direction for Fluoride Toothpaste in Cambodia” (Ministry of Health, 2007^b). All importers of toothpaste were invited to attend (presently Cambodia has no local toothpaste manufacturers).

The objectives of this first meeting were: to provide information on the effectiveness and affordability of fluoride toothpaste; to present the situation of fluoride toothpaste in some ASEAN countries and Cambodia; and to draft a strategic plan aimed at improving the quality and affordability of fluoride toothpaste in Cambodia.

This was followed by two other meetings on “Fluoride Levels in Good Quality Toothpaste” in June 2010 and May 2011. The objectives of these meetings were: to give information to the toothpaste import companies on the level of the fluoride in toothpaste which can prevent tooth decay; to give information on the results of fluoride toothpaste analysis; to discuss ways of improving of quality of toothpaste in the Cambodian market and achieve international standards of fluoride; and to increase the cooperation between Preventive Medicine Department, Ministry of Health, other public partners, and private companies, with the aim of improving the oral health of all Cambodians (Ministry of Health, 2010 and 2011^b).

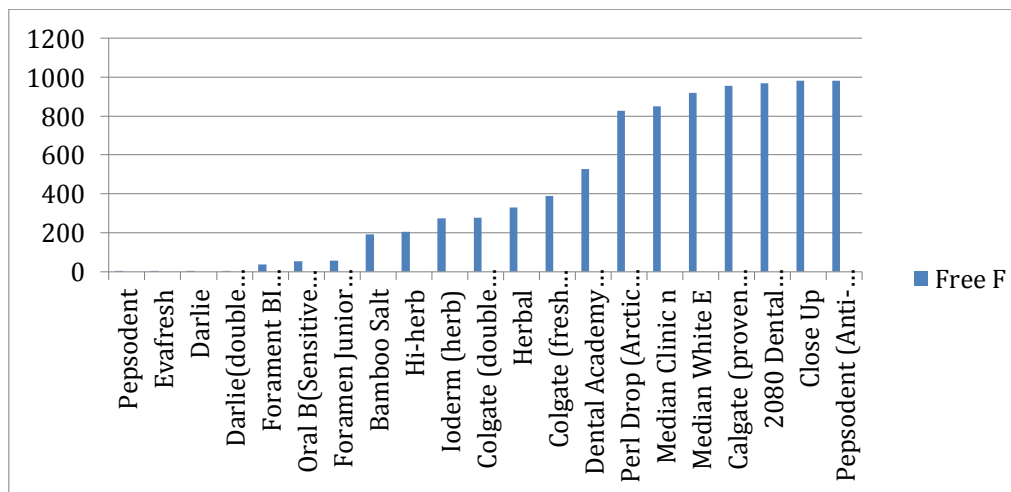


Figure 1: Fluoride content of selected toothpaste samples in Cambodia 2004.

As part of this project, the Oral Health Office carried out several surveys of toothpastes available in the Cambodian market. Only very few brands of toothpaste had fluoride levels close to international recommendations. However, over time there has been an improvement in this situation (Figures 1, 2, 3) (Ministry of Health, 2004, 2008 and 2013).

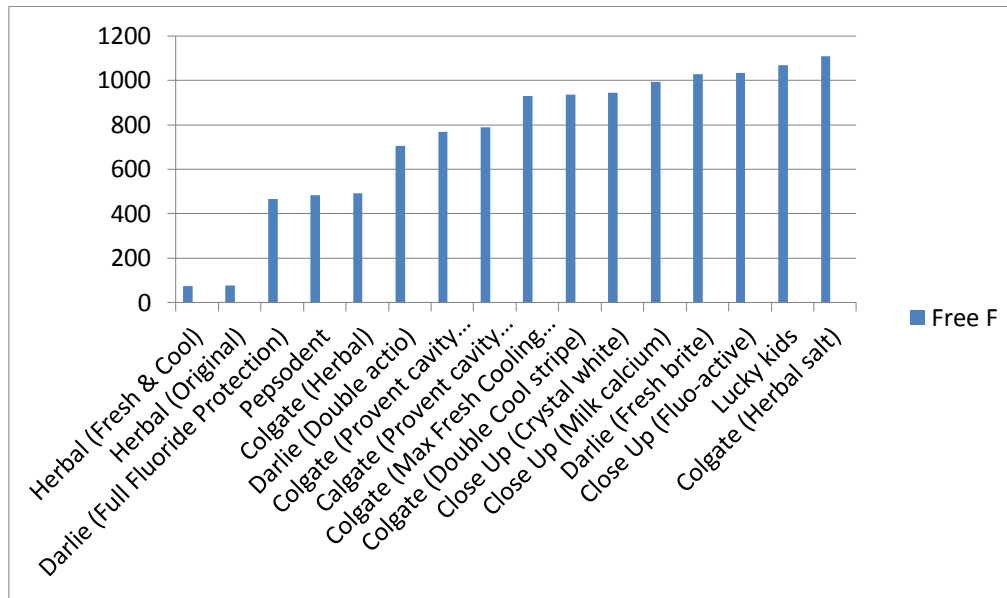


Figure 2: Fluoride content of selected toothpaste samples in Cambodia in 2008.

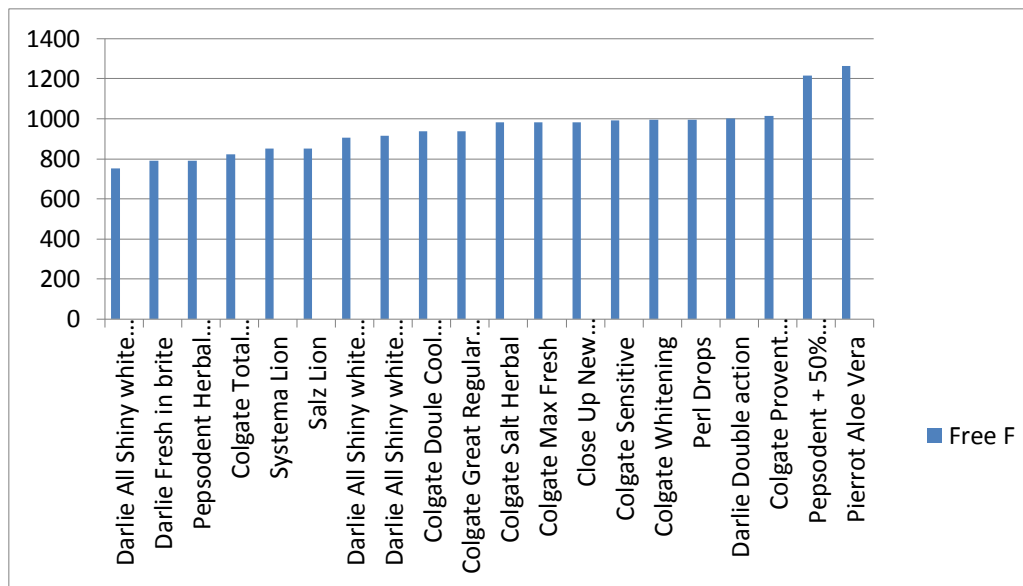


Figure 3: Fluoride content of selected toothpaste samples in Cambodia in 2013.

2. Community oral health programs for caries prevention in children.

Cambodia has several community oral health programs for caries prevention in children. These include:

Bright SmilesBright Futures (BSBF)

Since 2008, BSBF has operated in Cambodia with the support of the Colgate Palmolive Company. The program in Cambodia includes the provision of toothpaste, toothbrushes, and educational materials (eg. tooth brushing models and posters) to approximately 500 primary schools. BSBF is a collaboration between: the Oral Health Office, Preventive Medicine Department, Ministry of Health; the School Health Department, Ministry of Education Youth and Sport; and the Colgate Palmolive Company. The program started in Phnom Penh, but has now spread to 10 provinces. It focuses mainly on children in Grades 3 and 4 with brushing instruction and oral health education. Apart from the preventive dental interventions, the BSBF also includes hand-washing instruction. These activities are introduced through a "train the trainers" (TOT) approach involving schoolteachers and health workers. To date over 300,000 children have participated in this program.

Fit for School (FFS)

Fit for School is a program which focuses on improving both general and oral health. It originated in the Philippines, and is now also operating as a pilot project in Cambodia, Laos and Indonesia. The FFS Essential Health Care Package (EHCP) consists of three components: daily hand washing with soap; daily tooth brushing with fluoride toothpaste; and biannual de-worming. Both hand hygiene and tooth brushing are carried out as group activities so that children will develop both good habits and a good attitude toward their health. The toothpaste used in this program has 1450ppm fluoride (Monse *et al.*, 2010^b).

One of the key elements of the program is to create a supportive environment through:

- 1) *Improving access to water*- Schools which implement the program need to have running water for students to do hand washing and tooth brushing. If there is no water system, schools can use simple water containers to

make running water for students to use. The amount of water that is used is approximately half a liter per child per day.

- 2) *The construction of handwashing and toothbrushing facilities* - The words “Fit for School” do not only imply good health for school children, but also that the program “fits” to the real context of the school’s situation. So building hand washing and tooth brushing facilities must “fit” to the situation of the school and the community, no matter how rich or how poor they are. If the school Principal and Parent Teacher Association are willing to help, the facilities can be built and the program supported on an ongoing basis. In some situations, not only the school children but also other children in the community can use the facilities to wash their hands while playing in the school grounds.
- 3) *Tippy tap wash stations*—FFS includes daily group hand washing and tooth brushing at school, and building a “tippy tap” wash station is very useful for group activities. Moreover, they are designed is to save water from dripping or being used in a wasteful way.
- 4) *Health corner*- within to the policy of the Ministry of Education Youth and Sport called “Child Friendly Schools”, the third component focuses on Health, Safety and Child Protection, and promotes the concepts of Good Eating, Good Drinking, and Good Living(Ministry of Education, Youth and Sport, 2007). The FFS Health Corner therefore supports “Child Friendly Schools” policy. This corner is designed to keep students’ toothbrushes, toothpaste, and soap, along with other items such as first aid kits and analgesics.

The FFS program is a collaboration between the Oral Health Office, Preventive Medicine Department, Ministry of Health, the School Health Department, Ministry of Education Youth and Sport, Parent Teacher Association (PTA), local authorities, and the German International Cooperation (GIZ) based in Phnom Penh, Cambodia.

Seal Cambodia

Seal Cambodia is a 3-year school-based project to protect the teeth of 60,000 Grade 2 children by placing GIC fissure “sealants” (Fuji VII) on their first permanent molars (Durward, 2013). The project also aims to: demonstrate how partner organizations (including NGOs) can work together in a dental public health program, to improve child oral health; demonstrate the success of the project through a longitudinal prospective research study.

The local partners of this project are: the Oral Health Office of the Ministry of Health; the School Health Department of the Ministry of Education Youth and Sport; the Cambodian Dental Association; the Faculty of Dentistry, International University; the Dental Nurses School at the Regional Training Center, Kampong Cham province; the NGO *Cambodia World Family*; the NGO *One-2-One Cambodia*; and the NGO *Cambodia Buddhist Library Project*. The project is primarily sponsored by the Global Child Dental Fund (GCDF), CamKids—the Cambodian Children’s Charity, and GC (Asia).

In the first 7 months of the project, over 11,000 Grade 2 children were sealed on-site at the primary schools. A very basic set of dental instruments and materials is used, and children usually lie on a school table to be sealed. In addition to the local Cambodian teams, a number of overseas volunteer dental personnel and dental students are involved. It is expected that the research will demonstrate a very large reduction in dental caries in the first permanent molars.

Cambodia Smile

This is a One2One Cambodia (NGO) initiative focusing on mothers and pre-schoolers. An initial baseline survey of several hundred infants and caregivers showed that caries was prevalent in most preschool children. A number of risk indicators were identified, including: lack of oral hygiene; lack of fluoride exposure; and almost universal night-time on-demand breast-feeding often continuing for several years. Interventions are being developed which will focus on a common risk factor approach, and will include: health and oral health education for mothers, early introduction of brushing with a fluoride toothpaste, intermittent topical fluoride

applications, the use of silver diamine fluoride to arrest caries, de-worming, nail clipping, hand washing, and de-licing.

Live Learn Laugh (LLL)

This is a unique global partnership between Unilever Oral Care and the FDI World Dental Federation aims to measurably improve oral health on a global scale through encouraging students to brush their teeth twice a day with fluoride toothpaste. The Cambodian Dental Association was one of the National Dental Associations' partners that has run this project in Cambodia since the beginning of the phase I in 2005. The project is running well until now, however Live Learn Laugh (LLL) is restricted to 8 primary schools in Phnom Penh.

3. Oral Health Office (OHO), Preventive Medicine Department, MOHInitiatives

The MoH has developed a policy to integrate the activities of the OHO with other areas of health, particularly Maternal Child Health programs. This has included conducting training about oral health for nurses and midwives who work in the public sector. These health workers should now be capable of transmitting important oral health messages to people living in their communities, focusing especially on pregnant women and mothers of young children.

Table 2: Tooth brushing habits of primary school children

Tooth brushing	Frequency	%
Never	53	6.6
<1 time per day	53	6.6
1 time per day	151	18.8
twice per day	322	40.3
>twice per day	222	27.8
Total	801	100

The Oral Health Office has also produced flip charts and leaflets promoting oral health. The staff of the OHO takes these educational resources to the field and use them when training

the health workers. Thou has also produced a second flip chart targeting school children which focuses on the importance of good oral health for general health. The staff of the OHO also has its own school oral health program targeting children's oral hygiene, hand washing, and dietary habits. As part of the school program, the OHO conducted a survey to investigate primary school children's attitudes and practices relating to toothbrushing. The results are shown in Table 2.

4. Home care for dental caries control

The NOHS (Ministry of Health, 2011) found that at the age of 6, 28% of children had still not started to brush, and by age 1, only 3% were brushing (Table 3). This is far below international recommendations.

Table 3: The age of commencement of tooth brushing (NOHS, 2011).

	N	%
When teeth first erupted	3	0.7
At age 1	10	2.5
At age 2	32	7.9
At age 3	57	14.1
At age 4	52	12.9
At age 5	64	15.9
At age 6	72	17.9
Not yet brushing	113	28.0
Total	403	100

However, almost all (97%) of the children in the older age groups brushed their teeth. 22% brushed once a day, and 72% two or more times per day (Table 4).

Table 4: Distribution of children’s habit of their daily frequency of tooth brushing (NOHS, 2011).

Frequency of daily tooth brushing	Age group					
	12-13		15-17		All	
	N	%	N	%	N	%
Never	15	3.6	12	3.0	27	3.3
Less than once a day	12	2.9	6	1.3	18	2.1
Once a day	117	28.3	65	16.0	182	22.2
Twice a day	200	48.4	241	59.2	441	53.8
3 times or more/day	69	16.7	83	20.4	152	18.5
Total	413		407		820	

Among the two adult age groups, 2% of the 35-44 year olds, and 9% of the over 60 year olds said they brushed less than once per day (Table 5).

Table 5: Frequency of daily tooth brushing by age group (NOHS, 2011).

Frequency of daily tooth brushing	Age group					
	35-44		Over 60		All	
	N	%	N	%	N	%
Less than once a day	9	2.3	31	9.5	40	5.5
Once a day	103	25.9	97	29.7	200	27.6
Twice a day	237	59.5	171	52.3	408	56.3
3 times or more/day	49	12.3	28	8.5	77	10.6
Total	398		327		7250	

These data from the recent National Oral Health Survey indicate that for many people, home care for dental caries control is less than optimal. The Oral Health Office, Preventive Medicine Department, Ministry of Health of Cambodia has recommended that the appropriate fluoride concentration in toothpaste is 1000-1500ppm, and that teeth should be

brushed at least two times per day. For preschool children, a smear of adult toothpaste is recommended. The use of children’s toothpastes with a lower fluoride concentration is not recommended. However, Cambodia has a free market which permits private companies to import many brands of toothpaste. As previously mentioned, the Oral Health Office has analysed the concentration of fluoride in toothpastes sold in Cambodia since 2004, and the situation is improving thanks to good communication with the companies, and their understanding of what levels of fluoride are recommended by the Ministry of Health.

In addition to fluoride toothpastes, there are many different types of preventive agents available in Cambodia at the present time. These include:

Fluoride tablets and drops (NaF)

These are usually available through some pharmacies, but are not widely used. This is probably because most people are not aware of the benefits of fluoride supplements, and many would not be able to afford to purchase them.

Fluoride varnish (NaF)

Fluoride varnish is generally not used by Cambodian dentists to prevent dental caries. Until recently fluoride varnish could not be purchased locally, and the product has only recently been approved for sale by the government. One dental school and some NGOs currently use a lot of fluoride varnish in their work with children, thanks for donations from abroad. At a conference for Cambodian dentists in September 2013 the use of fluoride varnish was promoted in a lecture by the Head of the Oral Health Office of the MOH. One company has recently started selling fluoride varnish to dentists, and Colgate Palmolive hope to be selling Duraphat by the end of 2013. The cost is still prohibitive for most dentists and patients.

Fluoride mouthrinse (0.05% NaF)

This dental caries prevention agent was introduced to Cambodian schools around 1991 by the NGO “World Concern” working in the collaboration with the Faculty of Dentistry, University of Health Science. Today the school daily mouth rinsing program no longer exists, however fluoride mouth

rinses can be purchased by the public from supermarkets in the larger cities.

Chlorhexidine mouthwash

Private companies sell chlorhexidine mouth rinse in Cambodia, and some dental clinics also sell it to patients.

Resin sealants

These are seldom used in Cambodia, and most dental supply companies do not sell resin sealants to dentists.

GIC for fissure protection

This is the most popular type of “fissure sealant”. It is used in the SEAL CAMBODIA project, in some NGO projects, at the dental schools, and in many private clinics.

Tooth mousse (CCP / ACP)

This is available in some private dental clinics, and is purchased by the more affluent patients.

Traditional medicines are sometimes used to treat dental problems, however these are becoming less popular over time.

CARIOLOGY EDUCATION IN DENTAL SCHOOLS

In Cambodia there are four dental schools, and one school for dental nurses. The oldest dental school is the Faculty of Odontostomatology, University of Health Sciences, which is a governmental school. There is also the Faculty of Dentistry, Health and Science Institute of the Royal Cambodian Armed Forces (established in 2012), and two private dental schools -the Faculty of Dentistry at International University (established in 2004), and the Department of Dentistry of the University of Puthisastra (established in 2011). The dental nurse school was established in late 1996 in Kampong Cham province. It trains a unique type of bi-functional dental/general nurse, who can carry out ART restorations, extract teeth, and provide basic periodontal and preventive care.

None of the dental schools have a Cariology department. Cambodia lacks expertise in this area, and so far there are no Cambodian specialists in Cariology, Restorative Dentistry, Pediatric Dentistry or Endodontics. There are however specialists in Dental Public Health

(13), Prosthodontics (2), Orthodontics (8), and Oral Maxillofacial Surgery (2). There are also several Cambodian postgraduate students currently studying in Japan, Korea and Thailand, as well as postgraduate students studying in Cambodia in Endodontics, OMF Surgery and Orthodontics. There are approximately 700 university-trained dentists in Cambodia, and probably an equal number of traditional dentists, who have no formal training.

All dental schools in Cambodia must follow a National Dental Curriculum, and Cariology is part of this curriculum (Ministry of Health, 2007^a).

Cariology Teaching

University of Health Science (UHS): Cariology is mainly taught in Oral Biology, Community Dentistry, Operative Dentistry, Paediatric Dentistry and Dental Pathology. Clinical teaching in Cariology takes place in the appropriate clinical departments.

International University (IU): This is a one department private university in which Cariology is taught mainly in Oral Biology, with some lectures in Dental Pathology and Community Dentistry. Applied Cariology is taught in Operative Dentistry, Pediatric Dentistry, Radiography and Endodontics. All clinical treatment is provided in the one general practice dental clinic at IU.

University of Puthisastra (UP): This new private University presently has students studying in years 1-3. A dental clinic is under construction and will be ready for the students to begin their dental practicum in late 2014. The University of Puthisastra has no Cariology Department. Cariology is mainly taught in Oral Biology, with some lectures in Dental Pathology and Community Dentistry. Applied Cariology will be taught in Operative Dentistry, Pediatric Dentistry, Radiography and Endodontics.

Military Dental School: This government school is one department within the Military Institute of Health and Science. The curriculum and teaching of cariology is the same as at the University of Health Science.

CONCLUSIONS

Dental caries is very prevalent in all age groups in Cambodia, but is especially severe among children. Early Childhood Caries is almost universal, possibly related to a lack of oral hygiene in preschoolers, and the almost universal practice of on-demand night-time breast-feeding which often continues for several years. A range of school-based dental public health programs have been implemented by the Ministry of Health, NGOs and dental companies to address the problem, however these do not have universal reach, and cannot address the rampant decay in the primary dentition which develops before the children reach school. There are presently no community fluoride programs in Cambodia, although the MOH has had some success in promoting the sale of fluoride toothpastes through its advocacy with toothpaste importers. As a developing country with limited resources and a limited workforce, preventive dental programs are the only sensible way to address the significant public health problem of dental caries in Cambodia.

REFERENCES

Barnett ML. (2006): The oral-systemic disease connection, J Am Dent Assoc 137(suppl 2):5S-6S.

Chu CH; Wong AWY; Lo ECM, Courtel F. (2008): Oral health status and behaviours of children in rural districts of Cambodia. International Dental Journal 58:15-22.

Durward CS (2013). NGO Initiatives and Impacts on the Oral Health of School Children in SE Asia. The 7th Asian Conference of Oral Health Promotion for School Children, Sept 12-14, 2013, Bali, Indonesia, pp 50.

Durward CS; So PK, Cheng S, Kiet S, Uy KC, Im P. (1991). Cambodian National Oral Health Survey 1991, in Report of the Cambodian National Conference on Oral Health, September 1991.

Ministry of Education Youth and Sport (2007): “Child Friendly Schools” the third component.

Ministry of Health (2004). Preventive Medicine Dept, Oral Health Office.

Ministry of Health, Cambodia (2007^a). National Program of Doctor of Dental Surgery, Department of Human Resource Development.

Ministry of Health, Cambodia (2007^b). Report of meeting on “The Future Direction for Fluoride Toothpaste in Cambodia”, Oral Health Office, Preventive Medicine Department.

Ministry of Health (2008). Preventive Medicine Dept, Oral Health Office. Ministry of Health, Cambodia (2010, 2011^b): Minutes of Meetings on “Fluoride Levels in Good Quality Toothpaste”.

Ministry of Health, Cambodia (2011^a). National Oral Health Survey, 2011.

Ministry of Health (2013). Preventive Medicine Dept, Oral Health Office.

Monse B, Heinrich-Weltzien R, Benzian H, Holmgren C, van Palenstein-Helderman W. (2010), PUFA – An index of clinical consequences of untreated dental caries. Community Dent Oral Epidemiol 38:77-82.

Monse B, Naliponguit E, Belizario V, Benzian H, van Palenstein-Helderman W. (2010). Essential health care package for children - the ‘Fit for School’ program in the Philippines. International Dental Journal 60:85-93.

Shidara EK, McGlothlin JD, Kobayashi S. (2007). A vicious cycle in the oral health status of schoolchildren in a primary school in rural Cambodia. International Journal of Dental Hygiene 5:165-173.

Teng O, Narksawat K, Podang J, Pacheun O. (2004). Oral health status among 12-year-old children in primary schools participating in an oral health preventive school program in Phnom Penh City, Cambodia, 2002. Southeast Asian Tropical Medicine and Public Health 35:458-462.

Todd RV, Durward CS, Chot C, So PK, Im P. (1994): The dental caries experience, oral hygiene and dietary practices of preschool children of factory workers in Phnom Penh, Cambodia. International Journal of Paediatric Dentistry 4: 173-178.

CHINA

Xiangyu SUN

Yan SI

Xuenan LIU

Shuguo ZHENG

Tao XU

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

CHINA

Xiangyu SUN¹⁵

Yan SI¹⁵

Xuenan LIU¹⁵

Shuguo ZHENG¹⁵

Tao XU¹⁵

DENTAL CARIES EPIDEMIOLOGY

According to the latest data in the third national epidemiological survey in China, the caries prevalence rate of 5 and 12 year-old-children, adult and senior population were 66.0%, 28.9%, 88.1% and 98.4%, respectively.

In this survey, the mean dmft value of 5-year-old children was 3.50, and the average dt, mt and ft value was 3.39, 0.02 and 0.10, respectively.

The mean DMFT value of 12, 35-44 and 65-74 years-old population was 0.54, 4.51 and 14.65, separately. And the average DT, MT and FT value was 0.48, 0.00 and 0.06 in 12-year-old group, while in 35-44 year-old group this data was 1.53, 2.60 and 0.38, whereas in 65-74 year-old group the datum was 3.34, 11.03 and 0.29 respectively. Data related to Mean dmft/DMFT et al were shown in Table 1.

Currently, the fourth national oral health survey is being considered potential in the next few years.

¹⁵ Department of Preventive Dentistry, Peking University School of Stomatology, Beijing 100081, P.R.China. Email: Xiangyu Sun <allon627@163.com>, Yan Si <siyanyu@163.com>, Xuenan Liu <lxn1968@163.com>, Shuguo Zheng <zhengsq86@gmail.com>, Tao Xu <taoxu@bjmu.edu.cn>.

Table 1: Prevalence of dental caries and the mean of caries components by age group, the 3rd National Oral Health Survey, 2005

Age Group (year)	% Prevalence	dmft/DMFT	dt/DT	mt/MT	ft/FT
5	66.0	3.50	3.39	0.02	0.10
12	28.9	0.54	0.48	0.00	0.06
35-44	88.1	4.51	1.53	2.60	0.38
65-74	98.4	14.65	3.34	11.03	0.29

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

The guidelines of oral health care were that “prevention is priority, integrate of prevention and treatment” in China. The models of oral health care were “supported by government, cooperated by specialists, joined by the public”. Here we established the “National Teeth Love Day”, which was a campaign program of oral health education held annually since September 20th, 1989.

In order to promote caries prevention, we had applied comprehensive oral health intervention program for children in central and western regions of China in recent years. The technical methods included fissure sealing for first molars in school-age population and topical fluoride application for primary dentition in pre-school-age population. By the year 2012, this program was carried out in 392 cities with the government investment up to 137.25 million Chinese Yuan, and the total of 4.8 million first molars in 2 million children were fissure-sealed for free. Some relevant data from this program were shown in Table 2.

Table 2: The national comprehensive oral health intervention program in China.

Caries preventive methods	Year	National investment (Chinese Yuan)	Number of cities involved	Number of teeth projected
Fissure sealing	2008	8,800,000	80	528,000
	2009	10,000,000	112	586,000
	2010	33,480,000	267	1,860,000
	2011	33,480,000	297	1,860,000
	2012	46,490,000	392	2,305,000
Fluoride application	2012	5,000,000	72	200,000 children

Furthermore, national dental health education and promotion were developed in many areas in China, and the awareness of oral health care habit and knowledge was increasing in most of the population. Moreover, many people could also benefit from regular oral-health examination.

HOME CARE AND PROFESSIONAL CARE FOR DENTAL CARIES CONTROL

In China, alternative fluoride using for a diverse population had been performed. In most of the Chinese population, toothpastes with fluoride were used in daily oral health care individually. The 1000 ppm fluoride toothpastes were used for adults and the 500 ppm fluoride toothpastes were used for adolescents and children.

Besides brushing with fluoride toothpaste at home, professionally applied topical fluoride was also carried out in many kindergartens and elementary schools by dental professionals. The same application was also conducted after clinical procedures in many dental clinics and hospitals in China.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

There were 286 specialized hospitals of Stomatology in China by 2009. Most of the general hospitals also had the department of stomatology, and some traditional Chinese medical hospitals were also planning to establish the department of Stomatology. The number of dental health

personnel was 136,520 and there was 1 dentistry personnel per 10,000 populations in China (2000-2009), while the proportion was only 1:25,000 in 2002.

The teaching of Cariology theory course mainly contained microbiology and pathology of caries, while some parts of the course were included in the teaching of oral medicine such as Endodontics, Pediatric Dentistry and Preventive Dentistry. Clinical practice was also done in the department of Endodontics, Pediatric Dentistry and Preventive Dentistry.

In addition, Chinese WHOCC in preventive dentistry played a significant role and led the responsibility to do more in the field of prevention and oral health promotion by training of professionals in dental public health in China.

REFERENCES

Xiaoqiu Qi, Boxue Zhang, et al. Report for the third national epidemiological investigation in China. Beijing, People's Medical Publishing House, 2008.

Shuguo Zheng, Yan Si, Tao Xu. Oral Health Status and Oral Health Care Model in China.

HONG KONG, SAR

*Frankie HC SO
Joseph CY CHAN*

“Caries Control throughout Life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

HONG KONG, SAR

*Frankie HC SO¹⁶
Joseph CY CHAN¹⁶*

DENTAL CARIES EPIDEMIOLOGY

In the early days, dental surveys in Hong Kong were focused on primary school children mostly due to the ease in sampling (Chan et al., 1997; Medical and Health Department, 1960; 1962; 1980; Wong, 1968). With the standardisation and specification by the World Health Organization, more recent dental surveys focused on the 5 and 12 year old children (Department of Health, 2002) as well as adults and older persons (Department of Health, 2002; Lind et al., 1987; Lo and Schwarz, 1994). Due to variations in samples and methods, direct comparison of results may not be possible but the declining trend of dental caries level over time can still be observed. The Department of Health has completed another Oral Health Survey in 2011 and the final report will be published at the end of this year.

Dental caries among children and adult age groups has been slowly declining during the period 1968 to 2001. This may be attributed to the increased awareness in dental care due to the establishment of the Faculty of Dentistry in the University of Hong Kong, and the Oral Health Education Unit (OHEU) and School Dental Care Service (SDCS) under the Department of Health.

1. Caries in primary dentition among 6 to 8 year old children

There was more than 50% reduction in the mean number of primary teeth affected by caries among 6 to 8 year old children from 1960 to 1995 as a result of the community water fluoridation started in 1961 (Table 1). The Oral Health Survey conducted in 2001 targeted at 5 year old children. The mean dmft in 2001 was 2.3 (dt=2.1, mt=0.0, ft=0.2) and the

¹⁶ Department of Health, The Government of Hong Kong Special Administrative Region.
Email: Frankie HC SO <Frankie_so@dh.gov.hk>; Joseph CHAN <joseph_chan@dh.gov.hk>

percentage of children with dmft >0 was 51%. The caries level of 5 year old children in 2011 will be published soon but no dramatic change is anticipated.

Table 1: Dental caries epidemiology of primary teeth of 6 to 8 year old children in Hong Kong

Year	Percentage with dmft >0	dmft	dt	mt	ft
1960	97	9.2	8.0	1.2	0.0
1962	96	8.4	7.4	1.0	0.0
1980	77	5.0	4.7	0.2	0.1
1986 *	63	3.1	2.4	0.1	0.7
1995 *	66	3.0	2.3	0.2	0.5

* 6-year old children only

2. Caries in permanent dentition among 9 to 11 year old children

Table 2: Dental caries epidemiology of permanent teeth of 9 to 11 year old children in Hong Kong

Year	Percentage with DMFT >0	DMFT	DT	MT	FT
1960	93	4.4	4.1	0.1	0.1
1962	90	3.5	3.3	0.1	0.1
1980	52	1.3	1.2	0.0	0.1
1986 *	54	1.2	0.3	0.0	0.9

* 11-year old children only

There was also more than 50% reduction in the mean number of permanent teeth affected by caries among 9 to 11 year old children from 1960 to 1980 (Table 2). The mean DMFT of 12 year old primary school children in 1995 was 1.0 (DT=0.2, MT=0.0, FT=0.7) and the percentage of children with DMFT > 0 was 48%. The DMFT of this age group declined further to 0.8 (DT=0.1, MT=0.1, FT=0.6) in 2001 and further reduction is anticipated at the Oral Health Survey conducted in 2011.

3. Caries in 35 to 44 year old adults

Table 3: Dental caries epidemiology of permanent teeth of 35 to 44 year old children in Hong Kong

Year	Percentage with DMFT >0	DMFT	DT	MT	FT
1984 *	90	7.3	1.0	2.7	3.5
1991	98	8.7	1.0	4.5	3.2
2001	98	7.4	0.7	3.9	2.8

* used a different diagnostic criteria for MT

Table 3 should be interpreted with caution as the diagnostic criteria for missing teeth was different in the dental survey conducted in 1984. If the same method used in 1991 and 2001 was used, the prevalence of caries and the mean DMFT should be higher and the downward trend of dental caries among the adult population would be more obvious.

4. Caries in 65 to 74 year old non-institutionalised older persons

Table 4: Dental caries epidemiology of permanent teeth of 65 to 74 year old children in Hong Kong

Year	Percentage with DMFT >0	DMFT	DT	MT	FT
1991	100	18.9	1.4	17.0	0.5
2001	99	17.6	1.3	15.1	1.2

Only two representative oral health surveys on the non-institutionalised older person group were conducted. No dramatic change should be expected as older persons in the same age group in 2011 were all born before the start of water fluoridation.

COMMUNITY DENTAL CARIES PREVENTION PROGRAMME

1. Community water fluoridation

The introduction of water fluoridation was proposed during the early 1950s and the Hong Kong Government allocated funds for the installation of fluoridation facilities in 1957. The domestic water supplies in the major metropolitan areas were fluoridated during 1961 and practically all other urban areas were supplied with fluoridated water soon afterwards (Evans et al.,

1987).

The fluoride concentration was originally set at 0.9 *ppm* during the cooler months and at 0.7 *ppm* during the summer. There was some concern that these levels were sub-optimal. The fluoride level was increased to 1.0 *ppm* in May 1967 on a year round basis. In June 1978, the fluoride level was reduced to 0.7 *ppm* on a year round basis in response to the emergence of signs of dental fluorosis. With substantial decrease in the extent and severity of dental caries in the population after 25 years of water fluoridation, the water fluoride level was further reduced in 1988 to 0.5 *ppm* throughout the year.

A Water Fluoridation Monitoring Committee was set up in the Department of Health to closely monitor the caries and fluorosis levels after the lowering of water fluoride level. Since its formation, the volume of water treated, the weight of chemical applied and the average fluoride concentration in water samples at all 19 water treatment stations were scrutinized on a monthly basis. The caries status and level of dental fluorosis are being monitored by representative surveys in 1995, 2001 and 2011.

2. School Dental Care Service (SDCS)

The SDCS is a primary dental health care programme administered by the Department of Health for all primary school children in Hong Kong. Children receive service at one of our eight school dental clinics near their schools. A group of dedicated and well-trained dental therapists provide the service under the direct supervision of government dental officers. It has a 24-hour interactive voice response system and homepage (www.school dental.gov.hk) to provide information on SDCS and oral health care for the general public.

The objectives of the SDCS are to promote good oral hygiene and prevent common dental diseases. The service emphasizes on yearly dental check-up, oral health education, and preventive dental treatment such as pit and fissure sealant.

3. Oral Health Education Unit

OHEU promotes oral health to all sectors of the community by producing oral health education materials and organising publicity campaigns, and engaging in collaborative projects with non-governmental organisations and professional bodies.

In addition to supporting other health service units, OHEU continues the Oral Health Promotion Programmes for kindergarten children, primary students, secondary students and students with mild and moderate intellectual disabilities. There is also an 'Oral Health information Hotline' and a website (www.toothclub.gov.hk) to provide information on oral health care for the general public.

HOME CARE FOR DENTAL CARIES CONTROL

The Department of Health promotes the use of fluoride toothpaste in daily toothbrushing for people of all ages except the very young children who are not yet able to spit. However, the use of a mouthrinse including fluoride mouth rinse should only be used under the instruction of dentists.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

There is only one dental school in Hong Kong under the University of Hong Kong (HKU), which was established in 1982. Cariology has been incorporated in the teaching of undergraduate students by various disciplines including Paediatric Dentistry, Dental Public Health and Operative Dentistry. There is a recent update of the teaching of Cariology to the second year dental student (*at HKU the dental students have clinical teaching from second year onwards*) by introducing a series of lecture/presentations by experts, in addition to the PBL tutorials, on the following topics: basics of dental caries and the ICDAS recording system; caries risk assessment; patterns of caries in the population; home/self-care in caries prevention; and root caries. In addition, there are practical sessions on the following activities: ICDAS learning program; plaque disclosure and tooth brushing; saliva tests; and use of Cariogram.

ACKNOWLEDGEMENT

The authors are grateful to Prof Edward Lo for providing comments and input on Cariology education in dental school.

REFERENCES

Chan JCY, So FHC, Yu YSH (1997). Oral health survey on primary school children in Hong Kong. Hong Kong: Department of Health.

Department of Health (2002). Oral health survey 2001. Common dental diseases and oral health related behaviour Hong Kong: Department of Health, Hong Kong.

Evans RW, Lo ECM, Lind OP (1987). Changes in dental health in Hong Kong after 25 years of water fluoridation. Comm Dent Health 4:383-394.

Lind OP, Holmgren CJ, Evans RW, Corbet EF, Lim LP, Davies WIR (1987). Hong Kong survey of adult oral health. Part 1. Clinical findings. Comm Dent Health 4:351-356.

Lo ECM, Schwarz E (1994). Tooth and root conditions in the middle-aged and the elderly in Hong Kong. Community Dentistry and Oral Epidemiology 22(5):381-385.

Medical and Health Department (1960). Report on the 1st (pre-fluoridation) dental survey of primary school children in Hong Kong.

Medical and Health Department (1962). Report of the 2nd fluoridation dental survey of school children in Hong Kong.

Medical and Health Department (1980). Final report on the fluoridation dental survey of primary school children in Hong Kong.

Wong KK (1968). Report of a dental survey in Hong Kong 1968. Hong Kong: the Government Dental Service and the World Health Organization.

INDIA

Naseem SHAH

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

INDIA

Naseem SHAH¹⁷

INTRODUCTION

Dental caries is universal, affecting all regions, both sexes and all age-groups, though the prevalence and severity of disease may vary from region to region. There are several factors that affect caries experience of an individual, society or a nation: i) heredity (ii) structure, morphology and alignment of teeth, iii) dietary and iv) oral hygiene practices etc. Apart from these, the determinants of health, such as socio-economic status, cultural and religious beliefs, water, soil and vegetation quality, sanitation, awareness regarding health and diseases and accessibility to health care facility. Dental caries is therefore, to a large extent, a lifestyle related disease and preventable to a large extent.

The dental caries activity also differs in different age-groups. Teeth, immediately after the eruption in the oral cavity, are not fully mineralized and the enamel is porous. As it ages in the mouth, it acquires minerals from saliva. Hence, tooth susceptibility to caries is more, immediately after the eruption, both in deciduous and permanent teeth. Very young children in the age range of 2-5 years are affected with early childhood caries. (ECC) Caries susceptibility/experience is high till the age of 12-15 years i.e. in mixed dentition and till the completion of permanent dentition in the mouth. Thereafter, it slows down, to again increase in 35 and above age group and later in 60+ age group, when the prevalence of root caries is more due to concurrent periodontal disease, gingival recession and cervical defects caused by abrasion, erosion and abfraction. WHO has therefore given index ages at which dental caries should be measured. It coincides with dental caries experience at

¹⁷ Professor & Head, Department of Conservative Dentistry & Endodontics and Chief, Centre for Dental Education & Research, All India Institute of Medical Sciences, New Delhi, INDIA.
Email: Naseem Shah <naseemys@gmail.com>

these specified age groups and also allows comparison of data from across the globe.

Control of dental caries, therefore, demands measures to be taken throughout life. However, in all the countries of the world, the maximum emphasis is to prevent caries in children. As the population ageing is a trend observed in all the countries of the world, oral health issues of the elderly have now gained importance and attention of policy makers and dental professionals.

Dental caries is one of the major causes for tooth loss with various adverse negative impacts on physical and psychological well-being of persons. It is therefore imperative that caries preventive measures are taken in all age groups.

EPIDEMIOLOGY OF DENTAL CARIES IN INDIA

India is a vast country of over 1.24 billion people. It has 28 states and 6 union territories. More than 72% of its population reside in rural areas. In terms of religion, culture, languages, India shows vast diversity. Geographically, its terrain as well as weather conditions are vastly different from region to region.

As an emerging economic state, India faces many challenges. In the Health Sector, the major challenges include sanitation, drinking water infections and communicable diseases are emerging epidemic of non-communicable diseases. Its infant and maternal mortality rates are high in comparison to many other developing countries. Against these challenges, India spends a meager 1.4% of its GDP on health which is very low in comparison to developed country. In this scenario, it is natural that Oral Health receives the least attention of the government and attracts only a paltry budget to finance oral health, which is mainly utilized for health care delivery and school oral health care programme.

Systemic epidemiological studies on a vast population of India, added to the vast diversity of its terrain and people is a gigantic task and would require a huge budget, which in the given scenario of government priority on other health issues, appears to be very difficult. Isolated studies from different parts of the country, reported on different age group of population cannot be relied on to project the dental caries prevalence of the country. Therefore, an attempt was made to pool-in all available studies on dental caries in the specified age group of the Indian population as recommended by WHO and

bring out the average figures for the prevalence of dental caries in the country. This work was commissioned by the National Commission on Macro-economics and Health under the Ministry of Finance and Ministry of Health, Government of India in 2005. This is presented in Table 1.

Table 1: Prevalence of dental caries in different age groups

Age group (years)	Urban	Rural	Average	DMFT
5-6	67.23	46.22	56.72	2.1
12	57.94	36.90	47.39	1.6
15	55.97	43.28	49.69	1.37
30-35	46.21	39.27	42.24	1.39
60-75	79.40	61.90	70.65	

Based on this data, a statistical model was prepared to predict the burden of dental caries by 2015, which is 6231.8 lakh by 2015, if caries prevalence in all age-groups combined is taken as 50%.

In 2007, a Government of India – WHO collaborative project was undertaken to study the magnitude of various oral and dental problems at seven representative Centres in India namely – Delhi, Mumbai, Cuttack, Pondicherry, Jaipur, Lucknow and Arunachal Pradesh. The proper sampling methodology was used and sample size was calculated. Four index age groups, as recommended by WHO (12, 15, 35-44 and 65-74 yrs age groups) equally distributed in urban and rural areas were selected. (n=3200/Centre, Total=22,400). Modified Oral Health Survey Proforma 2004 and Modified Questionnaires on Oral Health for children and adult population (WHO) were used. The data thus generated was arranged and analyzed for prevalence of oral diseases and oral health attitude, practices and behavior. Though the data was specific for each state and there were wide variations between the dental caries prevalence between different states and they could not be pooled together for statistical analysis, they were combined and average and mean was calculated to indicate the trend of dental caries prevalence in the country. The result of pooled data is given below in Table 2.

Table 2: Dental caries prevalence and DMFT scores

Age	Range	Average	DMFT
12	23.0-71.5	48.7	1.33
15	24.3-83.4	53.9	1.79
35-44	48.1-86.4	72.25	3.53
65-74	51.6-95.1	67.88	6.14

The data from both the above review indicate similar trends, except for 35-44 year age group. A very wide variation was found for average prevalence of dental caries as well as DMFT score of 35-44 year age group in these two analyses, which is difficult to explain.

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

1. Fluoride administration in the country

Fluoride as a trace element is established for its caries preventive effect since 1930s. There are many success stories of fluoridation of drinking water with fluoride supplement to bring it to an optimal level of 1 *ppm*, ranging from 0.7-1.1. However, India has endemic zones of high fluoride, spread over 220 districts of the total 609 districts. It is estimated that high fluoride level affects approximately 6% of the population. Therefore, there is strong opposition to use of systemic fluoride in the country. Also, there are several other reasons for not adopting fluoridation programme in the country as follows.

As mentioned earlier, over 70% of the population resides in rural India, where pipe water supply is not available. Even among the urban area, it is not uniformly available. In the absence of such supply, it is not possible to fluoridate the water supply. Fluoridation of water supply is considered a violation of ethics as it is construed as forced medication, without the consent of the consumer. Though other form of systemic administration of fluoride such as fluoride tablets, drops, milk and salt fluoridation are available, these also meet with stiff resistance, besides involving cost and other logistic issues.

2. Community oral health program for caries prevention in children and in elderly

India has a very strong, wide-reaching network of public health delivery system. From the village level upwards, it has sub-centers, PHCs, CHCs, sub-district and district level hospitals. There are more than 320 medical colleges and 294 Dental colleges for tertiary care provision. Moreover, in the recent past, a large number of private, corporate hospitals have been started which provide world-class tertiary care not only to Indians but also attract foreign nations (medical tourism).

In 1999, the GOI launched a pilot project on "National Oral Health Care Programme" for which, All India Institute of Medical Sciences at Delhi was made the Nodal agency. The programme aimed to create oral health awareness through development of IEC materials, training of the trainers and dissemination till the grass-root level, utilizing the existing health manpower of the public health delivery network as outlined above. The programme was conducted successfully in 12 states of the country for 6 years.

In 2005, the GOI launched National Rural Health Mission (NRHM) with the aim of providing basic health care to all, especially to the rural masses and to improve the reach, integrate various system of medicine. The oral health programme was merged with NRHM. For this, literate women from the community, after training was made ASHA (accredited social health activist) for door-to-door health care surveillance and carrying health information and awareness generation. These ASHAs report to male and female health care workers and health guides, which in turn report to PHCs, (which is the first contact point with a medical doctor). These trained workforces carry health promotive and disease preventive messages to the community, including oral health messages, i.e. oral hygiene maintenance and ill-effects of tobacco and alcohol consumption etc.

Under school health programme, there is an oral health component. The school dental health programme runs in major cities and at district level; however, at village level, it has almost no presence, where over 70% of the population reside.

The major effort towards community health programme for children and elderly in recent years can be attributed to the department of Public Health Dentistry in over 290 dental schools across the country. As a mandatory requirement for training, both graduate and postgraduate students in the Public Health subject, each dental school must have a mobile dental van which has to go to the community in remote, under-served areas and conduct dental camps and provide services to the population at their doorstep. Many dental schools in semi-urban areas adopt 2-5 villages and provide oral care on a regular basis. Another initiative by the DCI which will have an impact on community dental and oral health is mandatory 3 months' rural posting during the internship of graduate students.

In addition to the above, few individual efforts from different parts of the country towards the provision of oral health care are reported from time to time. Few of these are listed below:

3. Indian Dental Association:

A professional National body of registered Dentists conducts various oral health activities at regional, state and national level. IDA represents more than 50,000 dental professionals and has 30 state and 350 local branches. It collaborates with multinational companies to conduct various oral health care related activities, such as create awareness regarding oral health and hygiene maintenance. It also runs a Rural Oral Health programme through mobile dental vans to provide free oral health care services to rural populations and to train primary health care workers. October month every year is observed as Oral Health month, during which rallies, folk dances, exhibitions, smile contest, free dental checkups etc. are conducted through a vast network of volunteer dental surgeons.

Its school health programme, which it conducts in collaboration with Colgate is very popular. In this, IDA conducts free dental checks, distributes free toothpaste and toothbrush and educational leaflets on oral health among school children between 9-14 years of age. It also conducts training programme on oral health for teachers and parents.

4. Aurovillae Oral Health Project:

This project has been in operation since 1996. It runs a dental clinic at the health centre located in Aurovillae, which is a local community residing at Pudducherry in South India. It runs outreach services in 10 sub-centres, where oral health education and ART for treatment and prevention of dental caries are being provided to local school children with minimal equipment. The manpower for this is women selected from the local community, who are trained for 3 weeks in caries diagnosis and technique of ART. It is a unique and very effective community-based programme for control of dental caries.

5. Chitrakut Health Project:

It is a charity project aimed at providing health care services to the under-privileged population. It is located at the border of MP and UP, where the socio-economic condition of its population is very low and health care facility is almost non-existent. There are around 500 villages to which this project caters to. Volunteers for this project include University Professors, NHS Consultants, Harley Street Practitioners and Royal College of Surgeons Tutors. Various services are provided, including cleft lip and palate surgery. It also provides treatment for dental caries at the health centre as well as through mobile vans.

HOME CARE FOR DENTAL CARIES CONTROL

In urban India, the usage of toothpaste and toothbrush is the most common practice of oral hygiene. However, brushing twice /day is less common than once/day. However, even in urban areas, use of indigenous methods of oral hygiene, such as tooth-powder, use of bark of various trees, tobacco, charcoal etc. are also observed in about 20% of the population. In rural area, where >72% of the population reside, use of toothpaste and a toothbrush is much lower than in rural areas, though the trend is now changing with increasing awareness through radio and television. Almost 50% of rural population use toothpaste and brush.

The use of toothpaste consumption in India was calculated and compared with the developed world. It was found that use of toothpaste/person/year in India was just 190 gms, whereas in developed countries such as USA and other European countries, the toothpaste usage was 375 gms/person/year.

CARIOLOGY EDUCATION IN DENTAL SCHOOLS

India has 294 Dental Schools, the highest in the world. Of these, only 35 are government-run, rest all are run by private players. Most of these dental schools have 100 annual admissions; making a total of more than 25,000 admissions/year. Of these, over 150 dental schools run postgraduate MDS degree programme of 3 years' duration in all or multiple disciplines of dentistry, making over 1500 seats available in a Postgraduate (PG) degree programme. The Government of India estimates that dental manpower, including specialists, needs to be

increased, to improve the dentist: population ratio in the country, to provide oral health care to its people, especially in rural areas. Hence in the past 5 years, PG seats have been increased exponentially in various institutions, mostly in the private sector (which suits their commercial interest).

There is no separate department of Cariology in the country. Cariology is taught under the discipline of Oral Pathology, Oral Medicine and Radiology, Pediatric and Preventive Dentistry and Public Health Dentistry but most importantly, under the discipline of Conservative Dentistry and Endodontics. Pediatric Dentistry and Conservative Dentistry provide comprehensive promotive, preventive and curative treatment for dental caries and its sequelae in clinical settings, while the discipline of Public Health Dentistry provides services using the community approach for dental caries prevention and control at the community level. Oral health promotion and prevention of dental caries measures, which can be instituted at both clinical and community level include i) Health education, including diet counseling and use of fluoridated toothpaste and correct method and frequency of tooth brushing, flossing, inter-dental brushing, use of mouth washes etc. ii) topical application of fluoride or chlorhexidine varnish or silver diamine fluoride, iii) pit and fissure sealing and vi) Atraumatic Restoration Treatment (ART).

CONCLUSIONS

Tooth loss and dental caries related pain, loss of productive man-days and other morbidities are high in India. Due to the size of the population, in actual number, the treatment needs for dental caries is enormous and not practical to meet. The total budget allocation for health is meager and for oral health it is only a fraction of the total health budget. There is as yet no oral health policy adopted by the government of India. There is no policy for systemic use of fluoride; in fact, there are several misconceptions and opposition to use of fluoride in the country.

Improved socio-economic status in urban India with expendable income has led to increased consumption of junk foods, sweets, colas etc., increasing the caries susceptibility. On the other hand, people in lower socio-economic status and lower literacy level, due to low awareness regarding oral health and health care facilities also suffer from increased caries susceptibility. Use of toothpaste and toothbrush in rural area is low as compared to urban areas. For people with low income, toothpaste and toothbrush is not affordable as these

products are categorized under cosmetic products and hence levied higher tax.

As health is a state subject, each state makes its own policies and programmes and hence there is a lack of uniformity. There are no well-planned systematic, community-based programmes for dental caries prevention and early intervention.

In view of all above, there is an urgent need to adopt and integrate national oral health policy into the Health policy of India. All-out effort needs to be made to curtail the burden of dental caries in all age-groups to prevent the morbidity and tooth loss and improve the productivity and QOL of people.

REFERENCES

Report of the Steering Committee on Health for 12th Five-year Plan. Health Division, Planning Commission, February, 2012

Shah N. Oral and Dental Diseases: Causes, prevention and treatment strategies. In Burden of Disease in India. National Commission on Macroeconomics and Health, Ministry of Health & Family Welfare & Ministry of Finance, Government of India, 2005

Shah N, Pandey RM, Duggal R, Mathur VP and Rajan K. "Oral Health in India: a report of the multicentre study" Directorate General of Health Services, Ministry of Health & Family Welfare. Govt. of India & World Health Organization Collaborative Program Dec. 2007.

Toothpaste Industry: An Overview.

<http://www.allprojectreports.com/MBA-Projects/Marketing-Project-Report/consumer-buying-behaviour-toothpaste-brands/toothpaste-industry-in-india-an-overview.htm> (accessed on 23-09-2013)

INDONESIA

*Dewi Kartini SARI
ZAURA Kiswarina Anggraeni*

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

The Upstream and Downstream Perspectives of Caries Control Efforts in INDONESIA

Dewi Kartini SARI¹⁸

ZAURA Kiswarina Anggraeni¹⁹

INTRODUCTION

The success of the caries intervention in a country depends very much on the upstream efforts beginning of the understanding of the science of Cariology and the technology of caries treatment, as well as the downstream efforts being the clinical and community preventive and curative programs for individuals and the community at large. This paper discusses the above mentioned topic in a systematic presentation of the profile of the caries problem in Indonesia, the profile of Dental Schools, the distribution of dental graduates, the teaching and learning process of Cariology, as well as an overview of dental caries prevention program in Indonesia.

THE PROFILE OF CARIES PROBLEM IN INDONESIA

Being the 1th most experience health problems suffered by the Indonesian community, oral health problem has also become a major health burden globally. Since 1995, national dental researches were done periodically every 5 years by the National Oral Health Research Center. Data of the latest national survey year 2013 as a part of a comprehensive National Basic Health Research (NBHR), are still in the process of analysis. Therefore, the data presented in this paper were taken from the year 2007 National Basic Research (NBHR, 2007). The DMF-T score by age group is shown on Table 1.

The average national score of DMFT for all age groups is 5.42; comprising of score of Decay index 1.24; Missing index 4.1; Filled

¹⁸ Ministry of Health, Republic of Indonesia. Email: Dewi Kartini Sari <sariaswin@yahoo.com>

¹⁹ Indonesia Dental Association. Professor, Faculty of Dentistry, University of Indonesia.
Email: Zaura Rini Anggraeni <rinizaura@yahoo.com>

index was 0.08. However, the profile of DMF-T index score by age groups can be seen in the following Tables.

Table 1: DMFT by age groups, Indonesia, 2007

Age group (WHO)/years	D	M	F	DMFT
12	0.56	0.32	0.01	0.88
15	0.75	1.23	0.02	2.00
35-44	1.45	2.82	0.08	4.35
65+	1.22	17.05	0.15	18.42

DMFT score for the in 12 years old group was found to be less than 1 DMF-T was perceived as an underestimation due to the clinical competence of the survey examiner being non-dental manpower. The D was recorded as obvious decayed teeth.

Further data were collected as active caries (untreated caries) and caries history (treated/filled teeth or extracted tooth due to caries (Table 2).

Active Caries and Experience Caries Prevalence

Table 2: Prevalence of active caries and caries experience by age groups, Indonesia, 2007

Age group (WHO)/years	Active caries (%)	Caries experience (%)
12	29.3	36.0
15	36.5	62.1
18	41.9	53.0
35-44	54.3	81.4
65+	34.2	95.7

Reference: Kristanti ChM, Hapsari D, Sintawati FX, Jovina TA (2012); Mapping on Oral Health Status in Indonesia – Ministry of Health of Republic of Indonesia

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

1. Community fluoride administration in the country

Indonesia has a diversity geographic condition, although Indonesia has many volcanoes, Kalimantan (Borneo) has none. A research done in late 80's on fluoride content in Indonesia, few areas in Borneo have zero fluoride content in water. In early 2000's South Kalimantan government establish a water fluoridation program, but it has to stop due to the lack of budgeting.

The most effective fluoride administration in Indonesia is daily tooth brushing using fluoride containing toothpaste. Ministry of Health Republic of Indonesia has adopted Basic Package of Oral Care to a national guidance of oral health services in Primary Health, one of the obligatory statements is affordable fluoride toothpaste.

2. Community oral health program for caries prevention in children

Daily toothbrushing using fluoride toothpaste and fissure sealant in school is amongst the main activities of School Dental Health Program. Since (year) West Java Province is the first pilot project of Fit For School which one of the program is daily tooth brushing in school. On September 2013, SD 3 Legian in Bali became one of the schools visited by delegates from 21 countries that attended Asian Conference of Oral Health Promotion for School Children.

3. In elderly the prevention program are screening and guidance to brushing properly.

HOME CARE FOR DENTAL CARIES CONTROL

Fluoride toothpaste used, percentage, formula, how to use effectively

More than 90% of toothpaste in Indonesia's market contained fluoride, the fluoride content is varied between 1,000 to 1,600 ppm and free Fluoride range between 338 to 995 ppm. Ministry of Health Republic of Indonesia and other stake holder (toothpaste company) continues to campaign daily tooth

brushing twice a day for two minutes, after breakfast and before bedtime.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

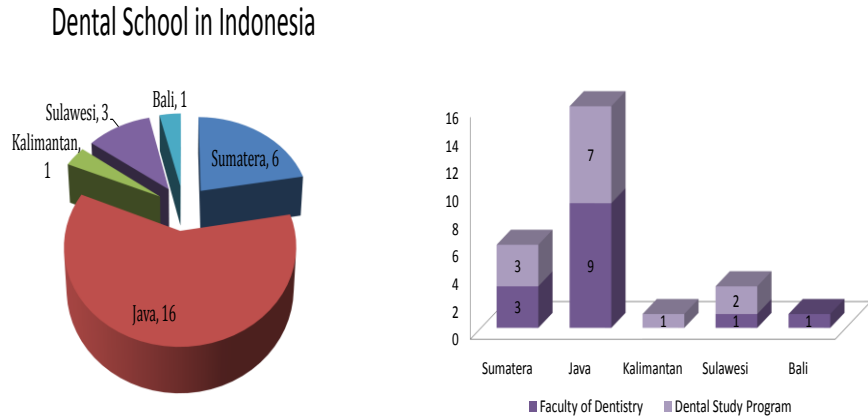


Figure 1: Data Distribution of Faculty of Dentistry and Dental Study Program in Indonesia

Until today Indonesia own 15 universities with faculty of dentistry as well as 12 Dental Study Program (source: Indonesian Dental Collegian)

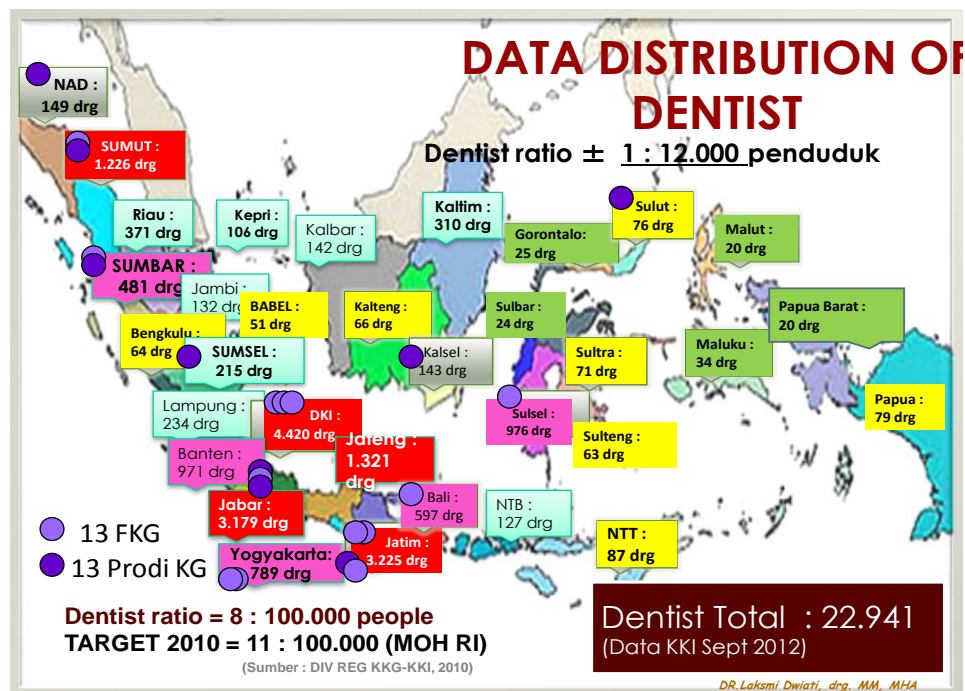


Figure 2: Data Distribution of Dentist

The disparity of distribution is significantly contributed by uneven of dental school by region in Indonesia that condition has an impact to unequal availability of dental service and dental care in the country. Therefore caries as major oral health problem together with periodontal disease was not to able optimal control.

On the other side in the context of the upstream profile of dental education, especially the topic of caries and the dental aspect of caries has not fully standardize within the curriculum. Related to condition, the Indonesian Dental Association through collegian dentistry is making is the process of stabilization in as curriculum of dental education in Indonesia. In the area downstream Indonesia Dental Association have a responsibility to carry out competency examination that is compulsory for all dental graduates from all dental school in Indonesia as a mechanism to obtain standardize quality of dentist from every dental school. This role and function is mandatory by law under the dental act of the Republic of Indonesia under the Medical Practice Act No. 29 year 2004 the ultimate goal is to give quality insurance of dental graduate of lifelong quality control for every dentist who practice in Indonesia. The teaching and learning Cariology should the standardize.

Caries management education in Indonesia is given in various departments, not specified in a single department as Cariology department. Teaching material limitations of each department to some extent influenced by the level of therapy based on the formation and development of caries severity. As an illustration, when viewed by age, related teaching materials in primary teeth given in Pedodontia Department while the permanent teeth are given in the department of Conservation. Meanwhile society preventive and promotive approach were given more focus in public health departments, although individual approach given in the Conservation Department.

Clinical practice with Cariology teaching material covering the stages of caries diagnosis, treatment planning for hard and soft tissue of dental and periapical tissues, as well as the management of the reference made in the Conservation Department.

Competency Base Curriculum was done by using the tutorial where a thorough and comprehensive examination conducted by each student for each patient under faculty lecturer supervision and assessment. The examination results are discussed in the teaching groups. Improving skills through clinical practice given in each laboratory department. These could be either graduate education levels or professions, and also specific caries management teaching material given in specialist levels at the Department of Conservation. In the

Base Curriculum Competency assessment it is done in terms of cognitive, affective and psychomotor.

Promotion and prevention in individual and society oral health improvement done through Public Health teaching in the classroom as well as direct practice on the field. Content of public health teaching includes health-related knowledge and demography, practice management, individual and community approaches, ethics, and so forth. More specific clinical material provided through program specialist in the department of Conservation. In Department of conservation there are three subspecialist or specialist consultant such as Cariology, restoration and endodontic. Specialist consultant in Cariology is awarded to those who hold a PhD in Cariology.

CONCLUSION

Active caries prevalence shows that the estimated need of total dental treatment in Indonesia is still high. Decaying Teeth in Indonesia are correlated with tooth extraction because of the late treatment.

The uneven distribution of dentist is among one of the causes of incapability of handling early detection of caries. This is also caused by limited dental health appliances and dental material as Indonesia is an archipelago country which accessibility to dental health sources is limited in the remote regions.

One of the easiest ways to control caries, easy to distribute, affordable and accessible is to utilize fluoride toothpaste. Empowerment of tooth brushing habit as a fluoridation program in a community with a program target is for children since their earliest age.

REFERENCES

Benzian H, Holmgren C, Buijs M, Vab Loveren C, Van der Weijden F, Helderma, WP (2012). Total and free available fluoride in toothpastes in Brunei, Cambodia, Laos, the Netherlands and Suriname. International Dental Journal 62: 213-221.

Kristanti ChM, Hapsari D, Sintawati FX, Jovina TA, Mapping on Oral Health Status in Indonesia - Ministry of Health of Republic of Indonesia, Jakarta, 2013.

Laskmi Dwiati, Division Registration of Council of Dentistry, Jakarta 2012.

*Ministry of Health Republic of Indonesia, Basic Health Research 2007,
Jakarta, 200.*

*Ministry of Health Republic of Indonesia, Guidance of school dental
health program, Jakarta, 2012.*

*Sinthawati, Evaluation of study water fluoridation at Banjarmasin<
South Kalimantan, Center of Health Research and Development,
Jakarta, 2003.*

JAPAN

Masaki KAMBARA

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

JAPAN

Masaki KAMBARA²⁰

DENTAL CARIES EPIDEMIOLOGY

1. Caries free at 3, 6 and 12 years old children

Table 1: Caries free at 3, 6 and 12 years old children

Age Group (yrs)	Year	% Caries free
3	2010 ^①	78.5
	2011 ^②	75.0
6	2012 ^①	49.4
	2011 ^②	57.9
12	2012 ^①	57.2
	2011 ^②	57.9

Source: ^① Statistical Survey of Maternal and Child Health;

^② Report on the Survey of Dental Diseases (2011)

2. dmft at 3, 6(5) years old children, with d,m,f component breakdown

Table 2: dmft at 3, 6(5) years old children

Age Group (yrs)	Year	dmft	dt	mt	ft
3	2010 ^①	0.80			
	2011 ^②	0.63	0.63	0	0
5	2011 ^②	2.77	1.53	0	1.23
6	2011 ^②	1.84	0.89	0	0.95

Source: ^① Statistical Survey of Maternal and Child Health;

^② Report on the Survey of Dental Diseases (2011)

²⁰ Professor, Osaka Dental University Faculty of Dentistry, Department of Preventive and Community Dentistry. Email: Masaki Kambara <kambara@cc.osaka-dent.ac.jp>.

3. DMFT at 12, 15, 35-44, >60 years population, with D,M,F component breakdown

Table 3: DMFT at 12, 15, 35-44, >60 years population

Age Group (yrs)	Year	DMFT	DT	MT	FT
12	2011 [Ⓢ]	1.35	0.32	0	1.03
15	2011 [Ⓢ]	2.96	1.50	0	1.46
35-44	2011 [Ⓢ]	12.28	0.95	0.64	10.68
≥60	2011 [Ⓢ]	17.91	1.03	10.4	9.50

Source: [Ⓢ] Report on the Survey of Dental Diseases (2011)

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

1. Community fluoride administration in the country
by Ministry of Health, Labour and Welfare
2. Community oral health program for caries prevention in children, in elderly

In children: annual oral examination by the law of school health

In elderly: oral examination by the law of health promotion and oral health

3. Success story of the community caries prevention in the country

Oral health system through life

HOME CARE FOR DENTAL CARIES CONTROL

1. Fluoride toothpaste used, percentage, formula, how to use effectively

Fluoride toothpaste is used over 95% in Japanese market. Several types of formula are there. Any usage of tooth paste is available.

2. Fluoride mouth-rinse used, children or school, adult or elderly, how to use

Fluoride mouth wash is used in many elementary schools. DMFT at 12 years of age in the prefecture with F mouth wash school showed a quarter compared to prefecture without F mouthwash. There is big inequality. There are two types of F mouth wash daily and once per week.

3. Any other home care dental caries control in children, adult and elderly

Use of Fluoridated dentifrice in the house is available in all generations. Times of brushing per day increase from one to two or three, therefor it increase the contact to fluoride with dentifrice.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

1. Number of dental schools in the country

There are 29 dental schools in the country.

2. Cariology department in dental school

There is Cariology Deparmtent in dental school.

3. Cariology teaching and learning

Cariology teaching is in the following department: Preventive and Community Dentistry, Operative Dentistry, Biochemistry, Bacteriology and Biomaterials

4. Cariology contents

These are history of cariology, epidemiology, cause of dental caries, the risk factor of dental caries, prevention, fluoride, preventive treatment, instruction of oral health, index, brushing, dentifrice, preventive methods by generation, oral examination, strategy for caries prevention in public health, oral health system through life

5. Cariology in clinical practice

Cariology practice is in the Operative Department.

6. Speciality or specialist in Cariology

Authorization by Japanese Society for Oral Health and Japanese Society of Conservative Dentistry.

REFERENCES (Japanese)

Statistical Survey of Maternal and Child Health, Ministry of Health, Labour and welfare. <http://www.mhlw.go.jp/stf/shingi/2r9852000001oujo-att/2r9852000001oumv.pdf>

Report on the survey of dental diseases (2011), Japanese Society for Oral Health. <http://www.mhlw.go.jp/toukei/list/dl/62-23-02.pdf>

Statistical Survey of School Health (2012), Ministry of Education, Culture, Sports, Science and Technology. <http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001046936&cycode=0>

National health and nutrition survey 2009, Ministry of Health, Labour and Welfare. <http://www.mhlw.go.jp/bunya/kenkou/eiyou/dl/h21-houkoku-01.pdf>

Statistical Survey of School Health (2012), Ministry of Education, Culture, Sports, Science and Technology. <http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001046937&cycode=0>

KOREA

Deok-Young PARK

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

KOREA

Deok-Young PARK²¹

DENTAL CARIES EPIDEMIOLOGY

1. Source of National Data: The national data is comprised of two surveys.
 - a. *National Oral Health Survey (NOHS)*

This survey is being done in every 3 years under the legislative support by "Oral Health Act". This was started from 2000. Until now, there have been 5 surveys (2000, 2003, 2006, 2010, 2012). This survey mainly focuses on surveying children's oral health status. The sampling frame is a school (primary, middle, high) and kindergarten-based.
 - b. *Korean National Health and Nutrition Examination Survey (KNHANES)*

This survey is conducted every year under the legislative support by "National Health Promotion Act". The three-year result is grouped as 1 period. Oral Examination was included from year 2007. Sampling is based on a household. Four trailers with the dental unit chair are moving to sampled town in every week. About 200 towns are sampled in a year.

2. Caries free rate of Korean children

Although dft index of 5-year-olds is decreasing, rate of 5-year-olds who never experienced caries, is showing a somewhat static trend recently. This implies there are needs to develop an oral health program for children aged 5 years or under. Until now, the main focus of an oral health program for caries

²¹ Professor, Department of Preventive and Public Health Dentistry, College of Dentistry, Gangneung-Wonju National University, Korea. Email: Deok-Young Park <jguitar@gwnu.ac.kr>

prevention is on primary schools. Compared to deciduous teeth, rate of caries-free 12-year-olds is increasing continuously.

Table 1: The percentage of caries-free 5-year-olds in Korea, 2000-2012.

Year	Total	Boys	Girls
2000	16.71	17.46	15.86
2003	22.70	22.41	23.00
2006	32.30	29.70	35.50
2010	38.47	36.52	40.57
2012	37.78	36.48	39.14

Source: National Oral Health Survey 2000-2012

Table 2: The rate of caries-free 12-year-olds in Korea, 2000-2012.

Year	Total	Boys	Girls
2000	22.86	25.29	20.19
2003	24.12	30.00	18.18
2006	38.90	43.10	34.20
2010	39.53	44.22	34.22
2012	42.67	46.53	38.44

Source: National Oral Health Survey 2000-2012

3 dft index of Korean children

Table 3: Mean (SE) of dt, ft and dft index of 5 year-olds children in Korea, 2000-2012.

Year	N	dt		ft		dft	
		Mean	SE	Mean	SE	Mean	SE
2000	202	2.57		2.91		5.48	
2003	599	1.57		2.55		4.12	
2006	151	0.89	0.11	1.95	0.16	2.85	0.20
2010	6,255	1.13	0.04	1.86	0.05	2.99	0.06
2012	4,800	0.97	0.08	1.83	0.08	2.79	0.09

Source: National Oral Health Survey 2000-2012

Caries experience of deciduous teeth is decreasing, but the slope of decreasing is getting somewhat flattened recently. A birth rate of Korea is decreasing continuously, and caregivers are giving more attention and concern to their children's overall health. Access to dental care is getting better and better by increased number of dentists and dental clinics. Market share of fluoride toothpaste went up over 90% in middle 1990s, and popular toothpastes didn't contain fluoride before then. Because oral health program related to caries prevention of deciduous teeth is not that prominent compared to that of permanent teeth, those factors may have taken important roles in reduction of dft index.

4 DMFT index of Korean

Table 4: Mean (SE) of DT, MT, FT and DMFT index of 12 year-olds in Korea, 2000-2012.

Year	N	DT	MT	FT	DMFT
2000	1,203	1.01	0.03	2.26	3.30
2003	597	1.53	0.02	1.72	3.25
2006	1,755	0.58 (0.10)	0.01 (0.01)	1.58 (0.15)	2.17 (0.17)
2010	6,251	0.43 (0.03)	0.01	1.64 (0.05)	2.08 (0.06)
2012	5,222	0.21 (0.02)	0	1.63 (0.08)	1.84 (0.08)

Source: National Oral Health Survey 2000-2012

Table 5: Mean (SE) of DT, MT, FT and DMFT index at 35-44 year-olds in Korea, 2000-2012.

Year	N	DT	MT	FT	DMFT
2007	589	0.96 (0.09)	0.86 (0.08)	3.72 (0.18)	5.52 (0.19)
2011	1,190	0.68 (0.06)	0.77 (0.06)	4.03 (0.15)	5.45 (0.15)

Source: Korean National Health and Nutrition Examination Survey (yearly)

Dental caries of the permanent teeth has been reduced dramatically during the last decade. DMFT index of 12-year-

olds was reduced its value more than 1.0 during 2000 to 2010. Compared to 2000, DMFT index in 2012 is reduced more than 40%. Compared to 12-year-olds, DMFT index of adults is not showing significant reduction. This implies school-based oral health programs for children were effective, and reduction of DMFT index for adults would take significant time unless oral health programs for them are developed.

Table 6: Mean (SE) of DT, MT, FT and DMFT index at >60 year-olds in Korea, 2000-2012.

Year	N	DT	MT	FT	DMFT
2007	937	0.84 (0.06)	5.82 (0.39)	1.79 (0.11)	8.43 (0.37)
2011	2,067	0.66 (0.05)	5.82 (0.31)	2.19 (0.10)	8.66 (0.30)

Source: Korean National Health and Nutrition Examination Survey (yearly)

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

1. Community fluoride administration in the country

Community water fluoridation started in the year 1984 as a pilot program. It was suggested by professionals in preventive dentistry field and was driven by government level. However, this pilot program was not expanded for 10 years. In year 1994, one city was fluoridated by a citizen's petition.

In late 1997, Department of Oral Health was founded in the Ministry of Health and Welfare. According to this administrative achievement, 'Oral Health Act' was legislated, and water fluoridation with various oral health programs was promoted.

After middle of 2000s, anti-fluoridation activists' activities were strengthened and water fluoridation went into static phase. Administrative system changed from centralism to the local autonomous system from 1990s, and the central government's will to promote water fluoridation became more difficult to be accepted from local government.

Also, Department of Oral Health was merged with another department and lost its independent function in late 2000s,

and this makes expansion of the water fluoridation program more difficult.

Table 8: Water fluoridation in Korea

Year	Area number (N)	Water purification Plant (N)	Benefited Population	
			(N)	(%)
1984	1	1	120,000	0.3
1985	2	3	310,000	0.8
1994	2	3	260,000	0.6
1995	2	3	260,000	0.6
1996	4	5	520,000	1.1
1997	9	11	1,380,000	3.0
1998	13	18	2,990,000	6.5
1999	26	30	3,380,000	7.3
2000	30	35	3,660,000	7.8
2001	31	36	4,430,000	9.4
2002	32	36	4,250,000	8.9
2003	30	34	3,840,000	8.0
2004	24	27	2,810,000	5.8
2005	22	25	2,780,000	5.6
2006	21	24	2,770,000	5.6
2007	19	23	2,290,000	4.4
2008	21	26	2,970,000	6.9
2009	21	26	3,090,000	6.3
2010	20	25	3,080,000	6.3
2011	23	25	3,080,000	6.3
2012	22	24	3,220,000	6.4

Source: Report from Korea Health Promotion Foundation

2. Community oral health program for caries prevention in children and elderly

Community oral health programs are being done by Community Health Centers. Oral health programs are more actively implemented in rural areas because there are more

dental hygienists or public dental health practitioners compared to urban areas. The list of programs is as follows.

- Oral health education program in schools
 - Mainly for primary school students
- School-based Fluoride mouth rinsing program
 - The 1st and 2nd graders of primary schools in the area where water fluoridation is not being implemented.
 - One time/day with 0.05% Sodium fluoride solution or one time/week with 0.2% Sodium fluoride solution.
 - Sodium fluoride powder is stored by dental hygienists working in community health center and delivered to schools. Fluoride solution is distributed by a nurse-teacher in a school for students.
- Fluoride Topical Application program
 - For children aged 15 or younger.
 - Priority of benefit is given to children in poor family, with high caries risk, and who have multiple caries lesions
 - Fluoride gel or varnish is used
- Pit and Fissure Sealing program for children in poor families
 - Pit and fissure sealing for permanent 1st and 2nd molars are covered by National Health Insurance with some out-of-pocket money. But, children in poor family have the benefit of this program for free.
- School oral health care center program for primary schools
 - The dental unit chair is installed in primary schools and various oral health programs are being done in this facility.
 - There are 468 schools with this facility in 2012.
- School oral health care center program in schools for handicapped students
 - The dental unit chair is installed and oral examination, fluoride topical application, pit and fissure sealing, and extraction of deciduous teeth is being provided.
 - There are 51 schools with this facility in 2012.
- School tooth brushing facility installation program
 - Facility with washbasin, water and sewage, mirror is installed in primary schools to promote tooth brushing after lunch
 - There are 61 primary schools with this facility in 2012.

- Oral examination program for primary school students
 - Students are required to visit the nearby dental clinic and get examination periodically.
 - Examination fee for some designated ages is paid by National Health Insurance, and others are paid by the schools.
- Fluoride Topical application and scaling program for elderly
 - For the aged 65 or older
 - Priority of benefit is given to poor persons

3. Success story of the community caries prevention

Dental caries of 12-year-olds has been decreased more than 40% during the past decade like as shown in the following graph.

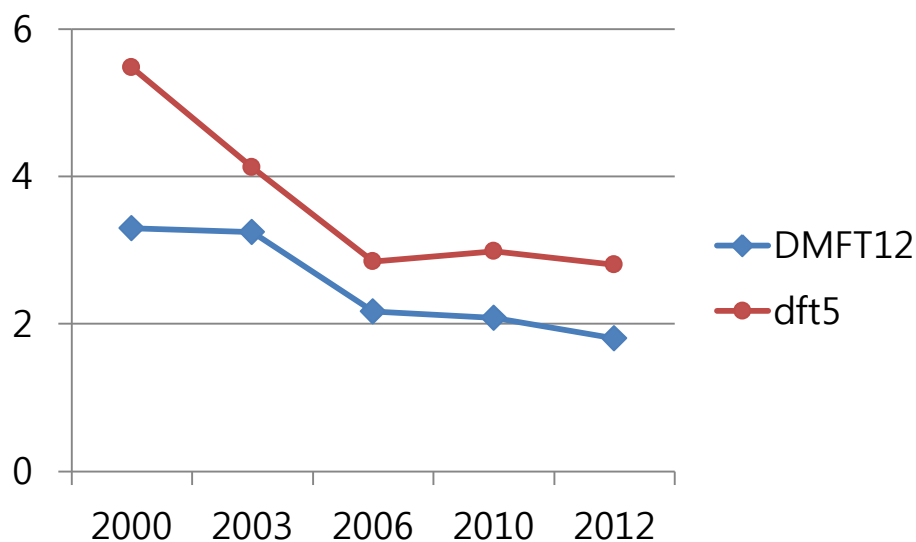


Figure 1: Reduction trend of dental caries in Korea

4. What made this caries reduction possible?

Decreased birth rate and increased concern and care for children with their caregivers may be possible reasons for this phenomenon. Increased access to dental care by increased number of dentists and dental clinics also may be a possible reason. However, it is unreasonable to think that these reasons are main causes regarding the magnitude and duration of caries reduction. Korean professionals agree that the most important impact came from active oral health programs being

implemented.

To understand the phenomenon, giving attention to administrative change in Korea is needed. Department of Oral Health in Ministry of Health and Welfare was founded in late 1990. Before then, there was no independent department taking charge of oral health existed in government. With the foundation of the department, coordinated efforts and systematic evaluation of community health centers' programs started. Especially, strengthening reporting and evaluation process for community health centers make them try to maximize their output of programs.

Water fluoridation program was promoted under the direction of the Department of Oral Health, and this may have taken some role for the success, but the beneficiary of the fluoridation program is still under 10% of the total population. Thus, main reason should be found from other reasons.

School-based pit and fissure sealing program implemented by community health center is supposed to be the most important reason for this success. With the foundation of the Department of Oral Health, every dental staffs in community health centers were required to promote pit and fissure sealing program with various oral health programs. Active implementation of school-based pit and fissure sealing program, especially in rural areas, gave significant impact on increasing the rate of experience of pit and fissure sealing. The impact in rural areas could be proven by the result of the National Oral Health Survey.

School-based fluoride mouth rinse is the second most important program for caries reduction. With pit and fissure sealing program, this program was main contents of community oral health programs implemented by health centers. Those two wheels, pit and fissure sealing and fluoride mouth rinsing, both were rolled simultaneously in primary schools are leading contributors of caries reduction.

According to the evidence of the reduction of caries prevalence and proven role of pit and fissure sealing, government included pit and fissure sealing of permanent molars in a coverage area of National Health Insurance since December 2009. However, this may act as a threat for dental caries prevalence. With inclusion into National Health Insurance, school-based pit and fissure sealing program has to be stopped. With this policy,

accessibility of pit and fissure sealing may be lowered because children should visit the dental clinic instead of being treated in their daily living school, and also students should pay some out-of-pocket money. Impact of this change from school-based program system to insurance coverage system should be assessed later.

As a summary, existence of central administration and policy, the existence of local resources (health centers and human resources like dental hygienists and public dental health practitioners) with powerful oral health programs like school-based pit and fissure sealing and school-based fluoride mouth rinsing made caries reduction possible for the short period of time.

HOME CARE FOR DENTAL CARIES CONTROL

1. Fluoride toothpaste used, percentage, formula, how to use effectively

More than 90% of market share of toothpaste is occupied by Korean domestic companies (LG Household and Healthcare, Amore Pacific Corporation, Aekyung Industry, Bukwang Pharma, Yuhan Corporation), and most of their products contain fluoride.

Fluoride concentrations of all toothpastes are below 1,000 ppm F by the regulation.

Toothpastes with no fluoride comprise less than 5% of total toothpaste market share.

Fluoride used in toothpastes is mainly Sodium monofluorophosphate, and some toothpastes use Sodium fluoride.

From July of 2009, Korean Food and Drug Administration made a regulation to mark a note of attention to the packing of toothpastes made for children as follows.

- *Content of Fluoride in this toothpaste is 000 ppm. (Total contents should be under 1,000 ppm)*
- *When a child, aged 6 or younger, is using this paste, make him/her use pea sized toothpaste per a time, and let him/her use under the management of caregiver to prevent sucking or*

swallowing.

- *If a child aged 6 or under swallowed considerable amount of toothpaste, consult to the doctor or dentist immediately*
- *Keep the toothpaste away from the hands of a child aged 6 or under to use.*

2. Fluoride mouth-rinse used, children or school, adult or elderly, how?

Ready-made fluoride mouth rinse products are on the market. Usually, fluoride concentration of fluoride mouth rinse in the market is 0.02% Sodium fluoride. There are many mouth rinse products that are lack of fluoride. Companies producing mouth rinse solution advertise their product is effective in prevention of dental caries by antibacterial efficacy even in absence of fluoride. It is not easy for people to know whether the product contains fluoride or not unless they check contents printed on the package intentionally.

Besides school-based public mouth rinsing program, private use of mouth rinse is not that popular in Korea, and mouth rinse solution is mainly being used by young generation with the purpose of masking mouth odor, so far.

Status of utilization of oral hygiene products surveyed by KNHANES in 2011 is as follows.

Table 9: Percentage of persons using oral hygiene products by age in 2011.

Age	Mouth rinse	Dental Floss	Interdental brush	Powered Tooth brush
12-14	1.1	0.9	1.0	3.1
15-18	4.1	3.9	0.9	1.5
19-29	8.0	12.1	4.7	2.3
30-39	7.2	21.7	10.6	5.1
40-49	5.2	13.4	11.0	5.0
50-59	2.1	6.9	12.9	3.1
60-69	1.3	4.4	8.6	1.5
>70	0.9	1.1	1.7	0.8

Source: Report of Korean National Health and Nutrition Examination Survey 2011

CARIOLOGY EDUCATION IN DENTAL SCHOOL

1. Number of Dental schools

Table 7: Dental schools of Korea and number of students per year

Name of school	National/ Private	Students /year
Seoul National University	National	90
Gangneung-Wonju National University	National	40
Chonbuk National University	National	40
Kyungpook National University	National	60
Pusan National University	National	80
Chonnam National University	National	70
Yonsei University	Private	60
Kyunghee University	Private	80
Dankook University	Private	70
Wonkwang University	Private	80
Chosun University	Private	80

There are 11 dental schools in Korea. Among them, 6 schools are National and 5 schools are private. The number of dental schools has not been increased since 1992. An accreditation system for dental schools has just started recently which will be difficult to establish a new dental school. Approximately, there are 750 students graduate every year.

2. Cariology department in dental school

Every dental school have the department named 'Preventive dentistry' or 'Preventive and Public Health Dentistry (a few school use the name as 'Social Dentistry' also)'. These departments play major role in Cariology education.

3. Cariology teaching and learning

Most schools have the subject as 'Cariology'. Sometimes it is taught in the subject named 'Preventive dentistry'. Contents are etiology, histology, epidemiologic characteristics, risk assessment, caries activity tests, methods of prevention (Fluoride, Sealant), social approaches (Community water fluoridation, Fluoride use, education, various oral health programs), and so forth.

4. Cariology in clinical practice

Caries treatment is being taught in the Department of pediatric dentistry, and in the Department of Operative (or Conservative) dentistry. Oral health education in clinics, and every preventive therapies and caries risk assessment is done in Department of preventive dentistry (among 11 dental schools, 3 schools' hospitals have Preventive clinic), or Department of pediatric dentistry.

5. Specialty or specialist in Cariology

There are overall 10 Specialists in dentistry by the law in Korea. These are 'Oral and maxillofacial surgery', 'Prosthetic dentistry', 'Orthodontics', 'Preiodontology', 'Operative (Conservative) dentistry', 'Pediatric dentistry', 'Oral medicine', 'Oral pathology', 'Oral radiology', and 'Preventive dentistry' As mentioned above, in the viewpoint of treatment, caries is dealt in 'Operative (Conservative) dentistry' and 'Pediatric dentistry'. But, epidemiology, prevention, community programs are in the area of 'Preventive Dentistry'.

REFERENCES

Ministry of Health and Welfare. National Oral Health Survey Report 2000. Apr. 2001.

Ministry of Health and Welfare. National Oral Health Survey Report 2003. Dec. 2003.

Ministry of Health and Welfare. National Oral Health Survey Report 2006. Aug 2007.

Ministry of Health and Welfare. National Oral Health Survey Report 2010. Sep 2010.

Ministry of Health and Welfare. National Oral Health Survey Report 2012. Mar 2013.

Ministry of Health and Welfare and Korean Centers for Disease Control and Prevention. National Health Statistics 2007: Report of the 1st year of KNHANES IV. Dec 2008.

Ministry of Health and Welfare and Korean Centers for Disease Control and Prevention. National Health Statistics 2011: Report of the 2nd year of KNHANES V. Dec 2012.

*International Dental Conference on “Caries Control throughout Life in Asia”
November 20-22, 2013, Krabi, Thailand*

*Ministry of Health and Welfare and Korea Health Promotion Foundation.
Education material for Water Fluoridation 2012 (electronic data).*

Lao, PDR

*Khamhoung PHOMMAVONGSA
Sakpaseuth SENESOMBATH*

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

Lao, PDR

Khamhoung PHOMMAVONGSA²²
Sakpaseuth SENESOMBATH²³

DENTAL CARIES EPIDEMIOLOGY

According to the last Lao National Oral Health Survey conducted in 2010, the dental caries status of Lao people as shown in the following tables.

1. Caries in primary dentition among 3 to 6 year old children

Table 1: Percentage of caries free children (3, 6 year olds) and mean number of teeth with active caries, filled and missing.

Age (year)	Percentage of caries free children (dmft=0)	dmft	dt	mt	ft
3	21.1	5.91	5.91	0	0
6	11.4	7.95	7.95	0.03	0

²² President, Lao Dental Association, Chief Dental Officer, Mohosod Hospital, Vientiane, Lao PDR. Email: Khamhoung Phommavongsa <laodentist@gmail.com>

²³ Secretary General, Lao Dental Association, Dental Officer, Mohosod Hospital, Vientiane, Lao PDR. Email: Sakpaseuth Senesombath <sakpaseuthkeo@yahoo.com>

2. Caries in permanent dentition

Table 2: Percentage of population with caries and mean number of teeth with caries, filled and missing.

Age (year)	Percentage with DMFT >0	DMFT	DT	MT	FT
12	72.9	2.18	1.50	0.05	0.63
15	79.9	3.20	2.06	0.14	1.00
35-44	76.8	3.65	1.97	1.25	0.43
60+	85.1	7.10	2.80	3.99	0.22

NATIONAL/COMMUNITY DENTAL CARIES PREVENTION PROGRAM

The community fluoride administration in the country operated under the Salt Fluoridation project since 2011. In 2014, another salt factory will be operated.

The community oral health program for caries prevention in children has carried on as follows.

- The activities Simplified and Modified Atraumatic Restorative Treatment (SMART) for caries program has been provided for two for young school children in Vientiane Capital. In 2014, the project will expand to other two provinces.
- Prevention program in primary school children activities such as fluoride APF GEL, Fluoride Ion Tophoresis, toothbrushing with fluoride toothpaste.

Success story of the community caries prevention

- 97.2% of adult knew that tooth brushing or cleaning can prevent the teeth from decay.
- 93.4 % of adult think that go to the dentist prevent from teeth problem.

HOME CARE FOR DENTAL CARIES

Individual home care for dental caries is by tooth brushing with fluoride toothpaste 2 times or more per day.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

There is one dental school in Lao PDR. There is no specific Cariology education per se in the country. However, the etiology, treatment and prevention of dental caries are taught and included in the subject of community dentistry, restorative dentistry and pediatric dentistry.

REFERENCE

Jin BH, Paik DI, Phommavongsa K, Sensombath S, Khounsiri V, Songpaisan Y, Phantumvanit P (2011). A Report on The 2nd Lao PDR National Oral Health Survey 2009.

MALAYSIA

*KHAIRIYAH Abd. Muttalib
WAN MOHD NASIR bin Wan Othman
YAW Siew Lian
Norliza Ismail*

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

MALAYSIA

KHAIRIYAH Abd. Muttalib^{24,25}

WAN MOHD NASIR bin Wan Othman²⁶

YAW Siew Lian²⁷

Norliza Ismail²⁸

There is generalised caries decline in all age groups in Malaysia. Over a 10-year period from 1995 to 2005, caries-free 5-year-old children increased from 12.9% to 23.8%, with a slight decrease in dft of 5.8 to 5.5. Comparing findings from schoolchildren surveys in 1997 and 2007, caries-free children increased in all three age groups; 6-year-olds: 19.1% to 25.5%, 12-year-olds: 39.1% to 58.5% and 16-year-olds: 24.5% to 40.4%. The mean dft of 6-year-olds decreased from 4.1 to 3.6 while the DMFT of 12- and 16-year-olds decreased from 1.9 to 1.1 and 3.3 to 2.1 respectively. There is also caries decline among adults in Malaysia but this has been very slow. There has been an overall decrease in caries prevalence from 94.6% (1990) to 88.9% (2010). Overall mean DMFT, however, show slow decline from 13.2 (1974/75) to 11.7 in 2010.

Factors attributed to the caries decline have been the national water fluoridation programme covering 77.7% of the Malaysian population in 2012, the extensive coverage of children under the School Incremental Dental Care Programme and the use of fluoridated toothpaste. In addition, this paper discusses the political will and government support for oral health in the country that have made possible the large oral health workforce, the outreach delivery, the extensive network of dental facilities, the referral system and the partners in oral health within the oral health programme of

²⁴ *Principal Director for Oral Health Programme, Ministry of Health, Malaysia. Email: Khairiyah Abd. Muttalib <drkay@moh.gov.my>*

²⁵ *Corresponding Author, Oral Health Division, Ministry of Health Malaysia, Level 5, Block E 10, Parcel E, Precinct 1, 62590 Putrajaya, Malaysia. +603 8883 4229.*

²⁶ *Dean, Faculty of Dentistry, Islamic Science University of Malaysia. Email: Wan Mohd Nasir bin Wan Othman <ddwan818@yahoo.com>*

²⁷ *Deputy Director and Head, Section on Oral Health Research & Epidemiology, Oral Health Division, Ministry of Health, Malaysia. Email: Yaw Siew Lian <slyaw@moh.gov.my>*

²⁸ *Senior Principal Assistant Director, Unit for Oral Health Policy, Oral Health Division, Ministry of Health Malaysia. Email: Norliza Ismail <norlizaismail@moh.gov.my>*

the Ministry of Health Malaysia. In spite of these enabling factors, there is still a continuing need to engage the public on the use of fluorides for caries prevention and control.

INTRODUCTION

Dental caries is a preventable disease despite its multi-factorial and complex aetiology. Globally, it remains as a public health issue and a continuing burden despite the wide use of fluoride and other preventive approaches in the management of the disease at both the individual and community level. Over the last few decades, there has been a generalised caries decline in Malaysia in all age groups, particularly among the schoolchildren. However, the disease burden remains substantial among the preschool children and adults. The need to monitor disease trends continue and national oral health surveys are conducted by the Oral Health Division, Ministry of Health Malaysia every ten years, separately for preschool children, schoolchildren and the adult population.

As recommended by the World Health Organisation (WHO), epidemiological data for caries in Malaysia are collected for the index ages of 5-6, 12, 15, 35-44 and 65-74years (WHO, 1997). The first few surveys of schoolchildren in Malaysia included all school-going ages of 6 to 18 years. From 1988 onwards, surveys have focused on ages 6, 12 and 16. With concerns for the oral health status of very young children, the Ministry of Health Malaysia embarked on surveys on 5-year-olds in 1995 (Dental Services Division, 1995). In Malaysia, 5-year-olds are captive in preschool institutions while 6-year-olds enter First Year in primary schools. The country does not have caries data for 3-year-olds.

DENTAL CARIES EPIDEMIOLOGY

1. Caries in 5- and 6-year-olds

Among 5- and 6-year-olds, the rates of caries decline are slower compared to 12- and 16-year-olds. In spite of the decline, there are concerns for younger children who have higher caries experience in deciduous teeth. The majority is the only captive in preschool institutions from age 4 upwards. Hence, population strategies in the country in the last 4 years have increasingly focused on younger children in the community.

Two national surveys on 5-year-olds in Malaysia in 1995 and 2005 (Dental Services Division, 1995, Oral Health Division,

2007) show a twofold increase in caries-free percentages over the 10-year period from 12.9% (1995) to 23.8% in 2005 (Table 1). Mean dft scores declined from 5.8 (1995) to 5.5 (2005). The 'f' component remained low over the 10-year period, indicating an unmet caries treatment need in relation to the high 'd' component.

Table 1: Dental Caries among 5- and 6-year-olds

Variables	5-year-olds		6-year-olds	
	1995	2005	1997	2007
*% Caries-free	12.9	23.8	19.1	25.5
Mean dft	5.8	5.5	4.1	3.6
Mean dmft	na	5.6	na	3.9
d	5.7	5.3	3.7	3.2
m	na	0.1	na	0.3
f	0.2	0.2	0.5	0.5
Mean DMFT	na	na	na	0.1

Source: Oral Health Division, 2007 and 2009

na = not available

*6-year-olds, caries-free is dmft 0 and DMFT 0

Surveys on 6-year-olds are separate. There have been two national surveys on 6-, 12- and 16-year-olds in 1997 and 2007 (Oral Health Division 1998, Oral Health Division, 2009, Oral Health Division, 2010a, Oral Health Division, 2010b). Earlier surveys were conducted by regions.

For 6-year-olds, caries-free percentages (dmft=0, DMFT 0) rose 25% from 19.1% (1997) to 25.5% (2007) (Table 1). Mean dft dropped 12% over the same period. The most recent 2007 findings still show the decayed (d) component as still the highest at 3.2 (Table 1).

2. Caries Status of 12 year-olds

From 1997 to 2007 (Oral Health Division, 2010a) there was a 32% increase in caries-free children among 12-year-olds (Table 2). Overall mean DMFT reduced 42% over the 10-year period.

Table 2: Dental Caries among 12-year-olds

Variable	1997	2007
Caries-free	39.1%	58.5%
Mean DMFT	1.9	1.10
D	0.6	0.40
M	0.1	0.03
F	1.2	0.70
Mean DMFS	3.0	1.6
D	1.1	0.6
M	0.3	0.1
F	1.9	0.9

Source: Oral Health Division, 2010

The World Health Organisation classifies caries rate of 12-year-olds into five categories (Table 3). Malaysia improved from ‘low’ to ‘very low’ caries rate for 12-year-olds from 1997 to 2007.

Table 3: WHO Caries Rate Classification of 12-year-olds

Caries Rate Category	Mean DMFT
Very Low	<1.2
Low	1.2 – 2.6
Moderate	2.7-4.4
High	4.5 – 6.5
Very High	> 6.5

Source: World Health Organisation Country Profile. Information

3. Caries Status in 16-year-olds

In Malaysia, children aged 16 years are proxy for the WHO index age of 15. The choice of 16-year-olds is to avoid a national examination that 15-year-olds have to sit in. Therefore, in the Malaysian context, 16-year-olds represent those leaving organised dental care in schools.

From 1997 to 2007 (Oral Health Division, 2010b) caries-free 16-year-olds increased from 24.5% (1997) to 40.4% (Table 4). The mean DMFT dropped from 3.3 to 2.1.

Table 4: Dental Caries among 16-year-olds

Variable	1997	2007
Caries-free	24.5%	40.4%
Mean DMFT	3.3	2.1
D	1.1	0.8
M	0.3	0.1
F	1.9	1.2
Mean DMFS	5.9	3.5
D	2.2	1.3
M	1.3	0.6
F	2.4	1.6

Source: Oral Health Division, 2010

For the period 2000 to 2010, Malaysia set National Oral Health Goals, in which the country set targets for caries for 2010 (Table 5). Findings from 1997 were used as baseline for 6-, 12- and 16-year-olds. Since then, the standards for caries targets have been raised for the newer NOHP 2011-2020 (Oral Health Division, 2011).

Table 5: National Oral Health Plan Goals for Malaysia, 2010 and 2020

Age group	Goal	2007	Goals for 2020
6	dft <2	3.6	dft ≤2
12	DMFT <1.5	1.1	DMFT ≤1
16	DMFT <2.5	2.1	DMFT ≤2
% person with Caries free			
6	30	25.5	50
12	60	58.5	70
16	40	40.4	50

Source: Oral Health Division, 2011

Overall, for Malaysia, there has been much improvement in caries status among children from the early days of regional surveys begun in 1970. These improvements have been especially marked among the 12- and the 16-year-olds. However, in spite of caries decline, the rates of improvement have been much slower among the younger children, leading to policies of the Ministry of Health to focus more on prevention activities for toddlers and preschool children.

Seen in greater detail, there is better oral health among children in urban areas than in rural, higher caries experience in females in the 12 and 16 age groups, but not in younger children, inverse association of caries experience with Education Level and Monthly Household (HH) Income. Malaysia is a plural society, there is interest in the community for information by ethnic group. As a group, the Indians/Pakistanis persistently exhibited the lowest levels of caries in Malaysia, a phenomenon yet to be explored.

4. Caries among Adults

There have been four adult surveys in Malaysia since 1974 (Dental Division, MOH, 1977, Dental Division, MOH, 1993, Oral Health Division, MOH 2004, Oral Health Division, 2013a). However, national surveys only began in 1990.

There is also caries decline among adults in Malaysia but this has been very slow. There has been an overall decrease in caries prevalence from 94.6% (1990) to 88.9% (2010) (Table 6). Overall mean DMFT, however, show slow decline from 13.2 (1974/75) to 11.7 in 2010.

Table 6: Caries Status in Malaysian Adults

Year of Survey	% Caries Prevalence	Mean DMFT
1974	95.0	13.2
1990	94.6	12.9
2000	90.3	11.3
2010	88.9	11.7

Source: Oral Health Division, 2013

The highest proportions of caries-free adults are among those aged 30 years and below, best shown graphically (Figure 1).

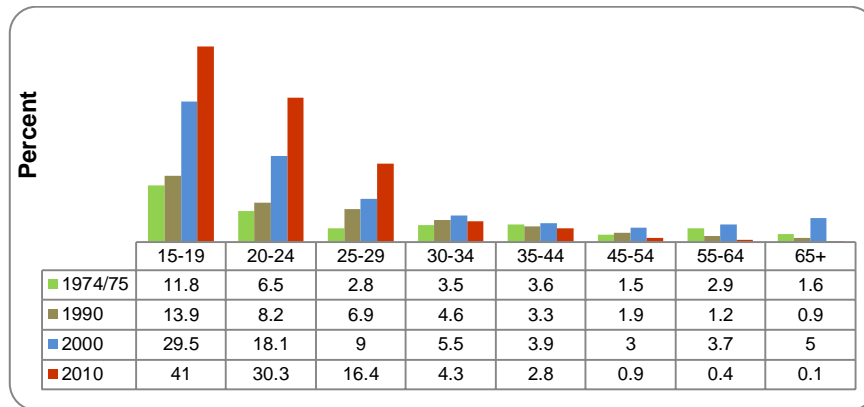


Figure 1: Prevalence of Caries-free Adults by Age Group (1975, 1990, 2000, 2010)

Again, substantial decreases in mean DMFT scores were observed among those aged 30 years and below (Figure 2).

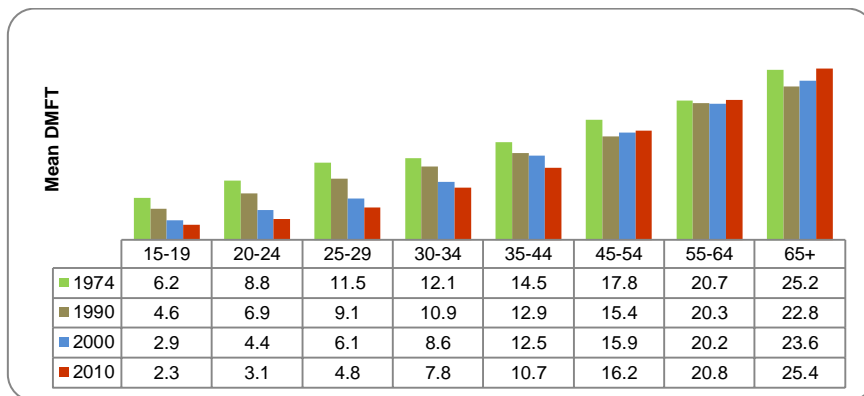


Figure 2: Mean DMFT by Age Group (1974/75, 1990, 2000, 2010)

From the 2010 survey, the largest component was ‘M’ (8.3), showing the magnitude of missing teeth. The ‘F’ component was the highest in DMFT score for the youngest age group of 15-19, while ‘M’ was the highest component for the 35-44 and 65-74 age groups (Table 7).

Table 7: Mean DMFT and Components Index Age Groups

Age Group	Mean DMFT and Components (95% CI)			
	D	M	F	DMFT
15-19	0.9	0.2	1.2	2.3
35-44	2.1	6.4	2.3	10.7
65-74	1.6	22.1	0.7	24.4

Source: Oral Health Division, 2013

From the caries perspective in Malaysia, there are substantial improvements in oral health of children in schools and these have translated into better oral health of younger adults below the age of 30 as these children leave school into the community. This gradual development has led the Ministry of Health Malaysia to now focus more on addressing oral health issues in toddlers and preschool children and older adults aged 60 and above.

Oral health policies in Malaysia see the Ministry of Health Malaysia bearing responsibility for oral healthcare of the younger generation in preschools and schools, antenatal mothers, the elderly, those with special needs, marginalized groups and those who are deemed ‘socially-disadvantaged’. While the Ministry renders oral healthcare to adults who actively seek care at its facilities, there is no structured programme for any other adult group aside from those mentioned above. However, there are programmes rendered on a ‘community’ basis, almost always as outreach services that covers all who seek care in such communities. These are, however, planned according to the local capacity of service providers.

COMMUNITY DENTAL CARIES PREVENTION PROGRAMME

Established fluoridation programmes in several states demonstrate continuing low caries experience among schoolchildren. The water fluoridation programme in Malaysia is considered the cornerstone of the dental public health programmes in the country. Water fluoridation was given Cabinet Committee approval in 1972 following the recommendations of a Commission to institute water fluoridation in Malaysia (Dental Division 1971). The optimal fluoride level was accepted at 0.7 ppm for the years 1972 to 2004, but was

subsequently adjusted to 0.5 ppm in 2004, taking into cognisance other fluoride sources from toothpastes and foods in the country (Tan, 2003) as well as various studies on enamel opacities in the country (Oral Health Division, 2013b). Seen against the global picture for fluoridation, the decision by government in 1972 was bold and sentinel as many countries were still hesitant at the time.

Hence, much of the caries decline is attributed to this nationwide water fluoridation program that now covers 77.7% of the Malaysian population (Oral Health Division, 2013c). There were some setbacks in the 1990s when water fluoridation ceased in some states due to changes in state water management. This led to constraints in achieving optimum coverage and optimum fluoride level of 0.5 ppm at reticulation points in these states. But there has been a turn around of policy decisions in these states since then, due to obvious rising caries among children over the period of fluoridation cessation.

In East Malaysia, more positive government support for the fluoridation program in Sarawak has demonstrated caries severity being twofold higher in Sabah which did not enjoy the same (Mean DMFT 2.93) compared to Sarawak (Mean DMFT 1.4) (Health Informatics Centre, MOH, 2012).

While the majority of children enjoy better oral health, disparities remain among children from different states and socioeconomic backgrounds. However, in spite of the disparities, all states still exhibit a caries reduction.

At the same time, the Ministry of Health Malaysia instituted a comprehensive incremental dental care programme begun in schools in the 1980s. This programme sees the bulk of school services shouldered by dental nurses (therapists) that now account for 2,574 staffs compared to 2,461 dental practitioners in the Ministry. The improvement in dental nurse in children numbers from 1 in 17,855 (1995) to 1 in 3,654 (2012) has seen many states achieving more than 95% coverage of schoolchildren.

Much of this care is rendered on an outreach basis, which sees oral healthcare brought to schools and the community using portable equipment in mobile teams or as 'itinerant' facilities in the form of mobile dental clinics. Undertaking care on an outreach basis has been instrumental in expanding the capacity of the Ministry to increase coverage.

Such structured programmes are reported under the Health Information Management System (HIMS) of the Ministry. HIMS data reports 32% caries-free 6-year-olds (Year 1) in schools 2012, which indicate that ground situation is on track with survey findings of 25.5% caries-free in 2007. HIMS also reports 64.7% of 12-year-olds (Year 6) caries-free with a mean DMFT of 1.1 and 54.6% of 16-year-olds (Fourth Form) caries-free with mean DMFT of 1.4 in 2012 (Oral Health Division b, 2013). The reports seem to be on track for 6- and 12-year-olds albeit a bit optimistic for the 16-year-olds, of which coverage of the latter at about 85% in 2012 is not as good as for primary schoolchildren.

Embodied in the Ministry of Health is also a referral system that enables any child who needs more complex care to be referred by the dental nurse to dental officers to reach dental specialists if there is a need.

As members of the dental team, dental officers and nurses function on a multitasking basis, covering all age groups, and encompassing promotion, prevention and treatment (and rehabilitation for officers) as a continuum of activities that fit their job scope.

There is a need to understand the political will and government support for oral health in Malaysia. Establishment of new facilities, upgrading of current dental facilities, and procurement of materials and equipment are assured over Five-Year Malaysia Plans. The government has ensured policies that support oral healthcare under the Ministry of Health Malaysia. In 2012, more than RM 538 Million in operating expenses and RM 27 Million in development funds were expended for oral health to cover programmes supported by the Ministry of Health for a workforce that now touches on 14,000 comprising close to 10,000 for the dental team (from dentists to dental surgery assistants), and almost 4,000 more of health attendants, clerical staff and drivers. Very few countries have such a system borne by government.

Health Ministry primary care facilities have template designs that cover different sizes and facilities befitting the local population size and needs. Past 5-year Malaysia Plans and now into the 10th Malaysia Plan (2011-2015), Category 1 to 5 health clinics are designed and built with integrated dental components to have 12-chair, 8-chair, 5-chair, 3-chair and 1-chair dental facilities. Mobile dental teams and mobile dental clinics operate out from these 'base' dental clinics to bring oral healthcare into the community.

The widespread school dental service has additionally served as the vehicle for an integrated fissure sealant programme begun in 1999. This followed recommendations of the survey in 1997 and further addressed caries in pits and fissures (Oral Health Division, 2003). Several guidelines have been formulated for toddlers, preschool children, schoolchildren, antenatal, trainee teachers, 'special needs' groups and the elderly. Malaysia shared these guidelines on its webpage www.ohd.moh.gov.my.

At the same time, the country is mindful of the impact of fluoride use. This year 2013 sees the formulation of a protocol and training of examiners for a study on fluoride enamel opacities among 16-year-old children. With this generalised caries decline among children, the Ministry of Health is also considering embarking on a pilot to test variable recall periods for children considered 'low-risk'. While open to the suggestion, it is a project that has to be approached with caution due to the difficulty of determining who constitute 'low-risk' children.

The Health Ministry also enjoys a long-standing collaboration with the Ministry of Education (MOE) Malaysia and the dental industry. The industry provided oral healthcare kits to Year 1 children in primary schools, while the MOE provides rich ground for the implementation of various collaborative efforts such as the 'Doktor Muda' Programme (literally 'young doctors', a peer-led programme for health)

While one might argue that some of the above are adjuncts to the core caries prevention strategies, they help to flesh out the scenario of political will and government support for oral health within the country that have made possible many oral health population strategies.

HOME CARE FOR DENTAL CARIES CONTROL

Past studies in the 1990s reported that 74% of the toothpaste available in the Malaysian market contained fluoride (Musa and Saub, 1998). Another found that fluoride levels in toothpaste in the local market ranged from 20 to 1,970 ppm (Abdul-Kadir and Abdol-Latif, 1998).

In the 2010 survey of adults in Malaysia (Oral Health Division, 2013a), the majority of dentate adults in Malaysia used toothpaste when brushing their teeth (98.9%). Of these, the majority (93.7%) was found to use fluoridated toothpaste, while 5.1% claimed to use non-fluoridated toothpaste. A very small proportion did not use toothpaste

(1.1%). A small proportion (0.1%) did not know whether their toothpaste contained fluoride. The use of fluoridated toothpaste did not differ significantly between urban and rural adults or by gender.

In a study among Malaysian Territorial Army personnel (Jasmin & Jaafar, 2011), 82.0% used fluoridated toothpaste all the time while 4.9% claimed using it 'sometimes'. About 2.1% of the respondents used non-fluoridated toothpaste and about 10.9% were unsure about their use of fluoridated toothpaste.

Among those using fluoridated toothpaste, 53.8% perceived they were using fluoridated toothpaste, 3.5% perceived they were using non-fluoridated toothpaste and 42.7% did not know whether their toothpaste contained fluoride. Among those who used non-fluoridated toothpaste, 20.5% perceived they were using fluoridated and 33.5% knew they were using non-fluoridated toothpaste, while 46.0% did not know whether their toothpaste contained fluoride.

The two most recent studies on fluoride toothpastes serve to show how fluoridated toothpastes have infiltrated the market in Malaysia, and are now accessible to the majority of Malaysians. However, the misperceptions reported from the studies also show that there is still a need to engage and educate the public on the benefits of fluoridated toothpaste and proper home care for caries prevention and control.

Based on concerns for younger preschool children, to this end, the Malaysian oral health programme has formulated guidelines for 'anticipatory guidance' for parents/carers of very young children (Oral Health Division, 2008). Much time has also been put into a pilot on use of fluoride varnish for caries control in young children based on current evidence. This initiative involves individual intervention requiring identification of children 'at-risk' with the attendant difficulties of assessing caries risk. This is new; we are not able at this time to report on its implementation.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

The problem of dental caries has shown significant reduction in prevalence and severity among school children in Malaysia but it continues to remain relatively high among pre-school children, adults and elderly. A number of concerted effort have been put in place to address the problem of dental caries and its impact on health, social, economic and quality of life of the people. This role has principally been the domain of the Ministry of Health Malaysia. Lately, the rapid

increase in dental schools and the number of potential graduates that will be produced, provide an avenue to contribute to a caries-free future through collaboration between the Ministry of Health and dental schools in Malaysia.

1. Number of Dental Schools

Malaysia experienced a phenomenal growth in the number of dental schools and enrollment of students since 2006. Within a period of seven years (2006 to 2013), 12 dental schools were established. This resulted in a total of 15 dental schools in Malaysia, serving a population of 29 million. As of current, these schools are in various stages of development. Graduates from these dental schools and others who registered with the Malaysian Dental Council (MDC) have to serve in the public service for two years as required by the Dental Act 1971. These newly appointed dental officers have to deal with a number of dental public health issues, particularly dental caries and its sequelae. Preventive and restorative therapy for caries will continue to be important tasks for them.

2. Department of Cariology and Speciality in Cariology

None of these 15 dental schools in the country have a Department of Cariology. Nevertheless, the concern for dental caries and the preparation of their graduates to overcome this problem effectively remain high on the agenda of these dental schools.

At present, speciality or specialists in clinical dentistry are confined to the traditional discipline of Oral Surgery, Orthodontics, Periodontics, Paediatric Dentistry, Oral Pathology and Oral Medicine and Restorative Dentistry. There is no specialist or speciality in Cariology. Taking into cognizance that cariology is a multidisciplinary and interdisciplinary subject, issues or problems related to cariology are referred to the relevant speciality or specialists.

Teaching-learning activities related to cariology are mainly carried out by three (3) departments, namely Restorative/Conservative Dentistry, Paediatric Dentistry and Dental Public Health/Community Dentistry. Certain topics related to Cariology are also considered in courses such as Microbiology, Biochemistry, Oral Pathology and Oral Biology.

3. Content

The content may differ in depth and extensiveness among dental schools. Essentially it includes the basic science aspects of cariology, diagnosis, management and prevention of dental caries and to a certain extent the behavioral intervention and related issues in increased risks of dental caries among certain groups of population.

4. Philosophy of Cariology

The Oral Health Division, Ministry of Health Malaysia takes a conservative approach in the control and management of dental caries. It adopts the philosophy of “when in doubt, review”; minimal intervention and minimally invasive dentistry; the application of a preventive strategy in clinical care; and the use of “orally fit” as an outcome measure. These philosophies were incorporated in the design of the curriculum of dental schools in Malaysia. It provides a smooth transition for the graduates from Malaysian dental schools to implement the philosophies of these caries control measures from the dental school environment to the field environment.

5. International Caries Development and Assessment System

An interesting development recently is the interest of dental schools in Malaysia in the International Caries Development and Assessment System (ICDAS). The strategy is to train a core group of faculty members from each dental school who will spearhead the development and implementation of this System in their respective schools. This augurs well with the effort in ensuring a uniform approach in caries diagnosis and management that will strengthen the present oral health care programme in the country. The Deans’ Caucus of Dental Schools in Malaysia will play a major role in this initiative. The close collaboration between the Deans’ Caucus and the Oral Health Division, Ministry of Health Malaysia is envisaged to lead to a seamless implementation of the ICDAS in the diagnosis, control and prevention of dental caries.

CONCLUSION

The caries decline in Malaysia can be largely attributed to the wide coverage of the water fluoridation programme, the extensive network of incremental oral healthcare for schoolchildren and the widespread use of fluoridated toothpaste. Additionally, strong political will and government support, and the increasing momentum of collaborative partnerships with other stakeholders are enabling factors in improving the caries profile of the country. Despite the generalized decline in caries, epidemiological evidence is in support of dental caries as a public health challenge, particularly among the very young children and the adult population.

Future perspectives for further improvement of the caries situation in Malaysia needs to be considered. These include the continuing engagement and empowerment of the population for good oral health, further development of cariology in the dental curriculum and the adoption of the ICDAS in the diagnosis and management of dental caries. These upstream investments will play a major role in bringing about positive trends in the caries profile of Malaysians.

REFERENCES

Abdul-Kadir R, Abdol-Latif L (1998). Fluoride level in dentifrices. Annals Dent Univ Malaya 5:2-5.

Dental Division, Ministry of Health Malaysia (1971). Report of the Committee appointed to inquire into and report upon the fluoridation of public water supplies in West Malaysia.

Dental Division, Ministry of Health Malaysia (1993). Dental Epidemiological Survey of Adults in Malaysia, 1990. Percetakan Nasional Malaysia Berhad.

Dental Services Division, Ministry of Health Malaysia (1995). Dental epidemiological survey of preschool children in Malaysia 1995.

Dental Division, Ministry of Health, Malaysia (1997). Dental Epidemiological Survey of Adults in Peninsular Malaysia, September 1974-April 1975. Ketua Pengarah Percetakan, Kuala Lumpur

Health Informatics Centre, Ministry of Health Malaysia (2012). Health Information Management System, Dental Subsystem 2011.

Jasmin B, Jaafar N (2011). Dental caries and oral health behaviour in the Malaysian Territory Army Personnel. Arch Orofac Sci 6: 19-25

Oral Health Division, Ministry of Health Malaysia (1998). National Oral Health Survey of School Children 1997 (NOHSS '97). MOH/GIG/6.98 (RR).

Oral Health Division, Ministry of Health Malaysia (2003). Guidelines: School-based fissure sealant programme. Second edition.

Oral Health Division, Ministry of Health Malaysia (2004). National Oral Health Survey of Adults 2000 (NOHSA 2000), MOH/K/GIG 13.2004 (RR), November.

Oral Health Division, Ministry of Health Malaysia (2007). National Oral Health Survey of Preschool Children 2005 (NOHPS 2005): Oral health status and treatment needs. MOH/K/GIG 1.2007 (RR).

Oral Health Division, Ministry of Health Malaysia (2008). Guidelines Early childhood oral healthcare. Never too early to start.

Oral Health Division, Ministry of Health Malaysia (2009). National Oral Health Survey of Schoolchildren 2007 (NOHSS 2007): 6-year-olds. August.

Oral Health Division, Ministry of Health Malaysia (2010a). National Oral Health Survey of Schoolchildren 2007 (NOHSS 2007): 12-year-olds. August.

Oral Health Division, Ministry of Health Malaysia (2010b). National Oral Health Survey of Schoolchildren 2007 (NOHSS 2007): 16-year-olds. November.

Oral Health Division, Ministry of Health Malaysia (2011). National Oral Health Plan for Malaysia 2011-2020 MOH/K/GIG/7.2011 (BK).

Oral Health Division, Ministry of Health Malaysia (2012). Oral Health Status, 2011

Oral Health Division, Ministry of Health, Malaysia (2013 a). National Oral Health Survey of Adults 2010 (NOHSA 2010). In print.

Oral Health Division, Ministry of Health Malaysia (2013 b). Protocol : Fluoride enamel opacities among 16-year-old schoolchildren. In print

Oral Health Division, Ministry of Health Malaysia (2013 c). Preliminary draft for Facts that Figure 2012.

S Musa, R Saub (1998). Toothpaste available in the Malaysian market. Annals Dent Univ Malaya 5: 45-48.

Tan BS (2003). Fluorosis and fluoride exposure among Malaysian schoolchildren. Thesis in fulfilment of the requirement for the degree of Doctor of Philosophy, Department of Community Dentistry, Faculty of Dentistry, University of Malaya.

*World Health Organisation (1997). Oral health survey: Basic methods.
Fourth edition. WHO, Geneva.*

*World Health Organisation. Country Profile.
<http://www.whocollab.od.mah.se> (accessed 2009)*

MYANMAR

*AYE AYE MAW
MYINT MYINT SAN
SAW TUN AUNG*

"Caries Control throughout Life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions (1)

MYANMAR

AYE AYE MAW²⁹

DENTAL CARIES EPIDEMIOLOGY

A representative national oral health survey data is not available in Myanmar. Nevertheless, dental caries status data in Yangon Division are shown in Table 1.

Table 1: Dental caries status (% prevalence, mean dmft/DMFT) in Yangon Division representative from Five projected townships

Year	Age group (year)	% Prevalence	dmft	DMFT
2001	6	84.6	4.17	
1993	12	37.7		0.83
1999	12 (Urban)			0.65
	12 (Rural)			1.13

NATIONAL/COMMUNITY DENTAL CARIES PREVENTIVE PROGRAM

Tooth brushing with efficacious fluorides toothpaste is most preventive measure for Myanmar Population. Toothpaste is the most practical self-care measure to control dental caries.

Fluoride varnish and mouth rinsing is limited used.

In collaboration with school health program and UNICEF, Oral Health Unit had developed and integrated oral health news, reduction of

²⁹ Consultant Dental Surgeon, Nay Pyi Taw General Hospital 1000 Bedded, Myanmar.
Email: Aye Maw <aye2maw.mmr@gmail.com>

sugar for prevention of dental caries and self-care oral hygiene measure into the school curriculum of primary and middle standard school children.

Primary oral health care (POHC) project jointly sponsored by the Ministry of Health and Oral Health Organization. Bright Smile Bright Future Project is starting now.

In Myanmar, with the aim to active and healthy aging, health care of the elderly project was implemented since 1992, 1993. It has been implemented in over 90 townships, where the townships and station hospital & rural health centre open clinic for older people every Wednesday. Based on the concept of active and healthy ageing, the project mainly focused on preventive & promotive aspects.

HOME CARE FOR DENTAL CARIES CONTROL

Most of people used fluoride toothpaste various kinds of toothpaste are distributed in Myanmar market, commonly used 17 toothpaste (11 for adults & 6 for children) have up till now examined.

Tooth brushing with fluoride toothpaste is home care dental caries control in children elderly.

Mouth-rinsing is rare.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

There are two dental universities in Myanmar, Yangon and Mandalay. Another military dental university is present but intake is rare. Dental school has Cariology Department. Conservative Department, Paedodontic Department and PCD Department are teaching and learning Cariology education.

"Caries Control throughout Life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions (2)

Caries prevention in Myanmar

MYINT MYINT SAN³⁰

LOCATION OF MYANMAR

The Republic of the Union of Myanmar (formerly Burma) is the westernmost and largest country in mainland South East Asia with a total land area of 676,578 square kilometers, stretches 2200 kilometers from north to south and 925 kilometers from east-west at its widest point. It is approximately the size of France and England combined. It is bounded on the north and northeast by the people's Republic of China, on the east and southeast by the Lao People's Democratic Republic and the Kingdom of Thailand, on the west and south by the Bay of Bengal and Adman Sea, on the west by the 09•32'N and 28•31' N latitudes and 92•10'E and 101•11' E longitudes.



³⁰ Professor, Department of Conservative Dentistry, University of Dental Medicine, Yangon, Myanmar. Email: Myint San <myintmyintsanmya@gmail.com>

INTRODUCTION

Myanmar was known as the Golden Land in ancient and mediaeval times for the wealth of its agriculture and minerals. It has a population of 60 million and situated between two world's great civilizations, China and India. There was no dental public health service in Myanmar before the Second World War. There were a few foreign and local dentists practicing dentistry on a private basis. Nowadays, over 2000 dentists received a BDS degree and nearly half of them practicing in the public health sector such as hospitals and school health teams.

Estimate population (in million) and its structure are shown in Table.1. Table 2, 3 and 4 are the number and distribution of dental professionals in Myanmar.

1. Demography

Table 1: Estimate population (in million) and its structure in (Tin Wai, 2013).

Age group	2000-01		2010-11		2011-12	
	Estimate	%	Estimate	%	Estimate	%
0-14	16.43	32.77	17.06	29.44	17.62	29.19
15-59	29.72	59.29	36.94	61.79	37.45	62.01
≥60	3.98	7.94	5.24	8.77	5.31	8.8
Total	50.13	100	59.78	100	60.38	100

Source: Population Department, Ministry of Immigration and Population, 2013.

**Table 2: Estimate population (in million) and its structure
(Ministry of Immigration and Population, 2013).**

Population Age group (years)	Estimate population in million (%)				
	1990- 1991	2000- 2001	2009- 2010	2010- 2011	2011- 2012
0-14	14.70 (36.05)	16.43 (32.77)	18.84 (31.86)	17.60 (29.44)	17.62 (29.19)
15-59	23.47 (57.55)	29.72 (59.29)	35.06 (59.29)	36.94 (61.97)	37.45 (62.01)
≥60	2.61 (6.4)	3.98 (7.94)	5.23 (8.85)	5.24 (8.77)	5.31 (8.80)
Total	40.78	50.13	59.13	59.78	60.38
Female	20.57 (50.28)	25.22 (50.31)	29.73 (50.28)	30.06 (50.28)	30.53 (50.56)
Male	20.21 (49.72)	24.91 (49.69)	29.40 (49.72)	29.72 (49.72)	29.85 (49.44)
Sex Ratio (M/100F)	98.25	98.77	98.89	98.87	97.77

Table 3: Oral Health Manpower in Myanmar (Tin Wai, 2013)

Dentist	Number
Registered	3,372
Under Department of Health (DoH)	512
University of Dental Medicine (Mandalay)	54
University of Dental Medicine (Yangon)	71
Other Ministries	15
Registered dentist/Pop Ratio	1:17906
Public sector dentist/Pop ratio	1:113851

Table 4: Number and distribution of dental professionals in Myanmar (Tin Wai, 2013)

Health facility	No. of dentists
Central Unit	4
Hospitals	420
Urban Health Centre	39
School Health Teams	49
Prison Department	3
Railway Department	3
Workers' Hospital	3
YCDC	1
UDNR	1
MOGE	1
Others	3
Total	527

2. Role of Dental Universities

Being aware of the need for dental health care of the community, the Ministry of Health and Ministry of Education launched the development of the College of Dental Medicine in Yangon in 1964, which was upgraded into University in 1974. The second Dental University was opened in the second city Mandalay in 1999. The dental public health subject was included in the core curriculum of basic degree (BDS) course, taught in year 4 and year 5 as preventive and community dentistry, division of the Dental Health Department.

In year 4, basic oral health survey methods (WHO, 1997) and the principles and practice of oral health education topics were taught and students were sent to the sub-urban and rural areas annually for 7 days to get exposure for community dental care (Table. 5).

Table 5: Data collection in PCD trip yearly

Division/ State	District	Townships	Mean DMFT	Collection Date
Bago	Pyae	Padaung	0.45	Oct, 1999
Manadalay	Myingyan	Myingyan, Taungthar, NgaHtoeGyi	0.7	Nov, 1999
Ayeyarwaddy	MyaungMya	MyaungMya, WaKha Ma	1.05	Apr, 2000
Mandalay	Pyin Oo Lwin	Pyin Oo Lwin		
Shan (South)	TaungGyi	TaungGyi, NyaungShwe Pindaya	1.5	Apr, 2001
Rakhine	Than Twe	Than Twe, TaungGoke, Gwae	1.28	Nov, 2002
Shan (North)	Kyauk Mae	Kyauk Mae, Lasho, Thipaw		
Magway	Minbu	Minbu, Salin, Sin PhyuKyun	1.11	Nov, 2003
Tennimtharyi	Dawei	Dawei		Apr, 2004

Lectures on oral hygiene, indices epidemiology, prevention, fluoride, ethics and management were taught in both years. Year 5 students need to participate in the school based oral health promotion training program. Presentations of regional oral health data as well as oral health education poster were part of the duty of house surgeon.

Department of preventive and community dentistry taught dental public health not only to dental students but also to undergraduate medical students, health assistants and nurses. Master degree (MDS) 2 years course was opened in 1992 and one to two candidates a year submit a dissertation on the dental public health subject. Some titles related are:

- Relationship between dental fluorosis and intelligence of children in Myinmu township
- Prevalence of traumatic injuries to the permanent incisors among schoolchildren aged 7 – 12 years in Yangon Division
- Epidemiological Characteristics of Dental Caries and Treatment Need among 14-Year-Old Schoolchildren using DMF-T and DMF-S Indices. (Table 9,10,11,12)
- Oral health status of school children and oral health knowledge and awareness of school children and their mothers.

One year Diploma course was started in 2000 for general practitioners and which also include lectures and practical presentation on the dental public health subject. Dr Dent Sc. (Dental Public Health) was started in year 2011.

3. Role of dental health department of Ministry of Health

In order to give oral health care to the grass root level, department of health appointed dentists in township level hospitals and school health teams all over the country. In addition, the department of health in collaboration with the World Health Organization has started Primary Oral Health Care (POHC) project in 1992. The main objective was to develop township oral health personal and basic health personal to perform POHC care services which include giving oral health education, emergency and self care to the community. It also comprises a referral system as well as after lunch tooth brushing drill in primary schools. Now POHC is extended to 120 townships all over Myanmar.

For dissemination of oral health awareness in the community, oral health unit of the department of health produce oral health education pamphlet and oral health education video programs were telecast on the national TV program. Oral health messages are included in the school textbooks for primary school children. Moreover "Best smile" award was contested in Yangon and other cities in collaboration with the Myanmar Dental Association (MDA) around oral health day, on 12th September.

Fluoride related Activities of DOH (Tin Wai, 2013)

- Invitation meeting on Fluoride Exposure for Oral Health in Myanmar- 2002
- Distribution of compatibility of fluoride and abrasive system and user-instruction to local toothpaste manufacturers, 2006-07
- World Oral Health Day , fluoride symposium-2008
- Fluorosis Project

4. Role of Myanmar Dental Association in collaboration with International organizations

The Myanmar Dental Association was established in 1979 in which both governmental and private dentists were actively participated. The Dental public health unit is one of the branches of MDA and it organized dental public health activities such as oral health survey and oral health education in schools and communities. e.g. Field trips in Seasaing, Hopone and Thone kwa.

Dentists from MDA also organized meetings and forum in collaboration with the Myanmar Academy of Medical Sciences (MAMS) to assess and promote the use of fluoride among Myanmar people. Affordable fluoridated toothpaste and fluoride mapping (assessment of fluoride content in drinking water in Myanmar) projects are underway in planning. MDA collaborates with FDI - published oral health care handbook of live, learn and laugh and "Best smile" award contest in Yangon and other cities in collaboration with the Myanmar Dental Association (MDA) around oral health day, 12th September.

International organizations such as JICA, JAICOH, IADR, APDF, AAPD, AOHPF and MDA jointly carried out dental public health activities in Myanmar. The dental public health unit has a plan to carry out National Oral Health survey in future. Therefore, dentists from MDA and Dental Universities organized pathfinder survey in 2006 and 2007 which was sponsored by Asia Oral Health Promotion Fund (AOHPF). The survey team was trained and calibrated in Yangon Dental University and collected oral health data in 4 geographical areas with large city. Summary of oral health status data were presented in Table 6, 7, 8 and 9.

**Table 6: Mean DMFT, Prevalence of dental caries by age group
(Myanmar Pathfinder Oral Health Survey, 2006–2007).**

Year	Age group	Gender	N	Mean DMFT	% Prevalence
2006	5	Male	381	5.27	83.6
		Female	398	5.14	79.8
	12	Male	389	1.39	52.2
		Female	404	1.37	51.7
	35-44	Male	379	2.29	63.3
		Female	404	3.62	75.7
2007	5	Male	424	4.41	66.1
		Female	368	3.84	69.6
	12	Male	429	0.61	27.3
		Female	395	0.50	25.9
	35-44	Male	367	1.82	49.5
		Female	433	3.29	77.8

Table 7: Caries free rate (%) and dmft (Myanmar Pathfinder Oral Health Survey, 2006–2007).

Age year olds	% Caries free	dmft		
		2006	2007	2007
3	n.a	n.a	n.a	n.a
5 (6)	18.3	32.15	5.26	4.13
12	48.05	73.4	1.38	0.56
15	n.a	n.a	n.a	n.a
35-44	n.a	n.a	3.96	2.56
>60	n.a	n.a	n.a	n.a

Table 8: Prevalence of dental caries (%) and mean DMFT
(Myanmar Pathfinder Oral Health Survey, 2006–2007).

2006						
Age Group	% dental caries	DMFT	Gender	N	% dental caries	DMFT
5	81.7	5.21	Male	381	83.6	5.27
			Female	398	79.8	5.14
12	51.95	1.38	Male	389	52.2	1.39
			Female	404	51.7	1.37
35-44	69.5	2.96	Male	379	63.3	2.29
			Female	404	75.7	3.62
2007						
5	67.85	4.13	Male	424	66.1	4.41
			Female	368	69.6	3.84
12	26.6	0.56	Male	429	27.3	0.61
			Female	395	25.9	0.50
35-44	63.65	2.56	Male	367	49.5	1.82
			Female	433	77.8	3.29

Table 9: SEARO Oral Health Indicators, Myanmar 2010.

% caries free (5-6 yrs)	Mean DMFT		% edentulous 65-74 yrs
	12 yrs	35-44 yrs	
5.0	2.3	6.0	n.a.

The national representative data is still unknown and no relevant data on dmft component break-down.

Table 10: Epidemiological characteristics of dental caries and treatment need among 14 year-old school children using DMFT and DMFS indices, Relationship between Gender and DMF-S (N=740), (Thein Tun Oo, 2010)

Gender	% Caries	DT	MT	FT	DMFT	DS	MS	FS	DMFS
Male	28.5	0.47	0.01	0.04	0.52	0.73	0.01	0.07	0.8
Female	34.3	0.55	0.03	0.09	0.66	0.83	0.04	0.13	1.0
Total	31.2	0.51	0.02	0.06	0.59	0.78	0.02	0.1	0.90

Table 11: Epidemiological characteristics of dental caries and treatment need among 14 year-old school children using DMFT and DMFS indices, Relationship between locality and DMF-T (N=740), (Thein Tun Oo, 2010).

Locality	% Caries	DT	MT	FT	DMFT	DS	MS	FS	DMFS
Urban	0.52	0.52	0.02	0.13	0.66	0.86	0.02	0.19	1.07
Rural	0.49	0.49	0.02	0.00	0.51	0.69	0.03	0.00	0.72
Total	0.51	0.51	0.02	0.06	0.59	0.78	0.02	0.1	0.90

The Myanmar Pathfinder Oral Health Survey was conducted in 2006–2007. Nationally representative data is still unknown and no relevant data on dmft component break down.

Table 12: Dental caries status, Myanmar Pathfinder Oral Health Survey, 2006-2007

Status	Age (yrs old)	2006	2007
% Caries free	3	-	-
	5	18.3	32.15
deft	3	-	-
	5	5.21	4.13
DMFT	12	1.38	0.56
	15	-	-
	35-44	3.96	2.56
	≥60	-	-

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

1. Fluoridation in Myanmar
 - Pipe public water system- None
 - Affordable tooth paste
 - Mouth rinse- No special program school children, adult and elderly
 - Topical – professional/ homecare (no special program)

2. Community oral health program for caries prevention in children
 - School health teams-examination, basic treatment, referral to appropriate centre, Health education

- Directorate of Health (Myanmar) collaborate with Colgate-Pulmolive (Thailand)
- Bright Smile- Bright Future Program on Grade 4 students (started from 1991-92)
- POHC services in project, effective fluoride tooth paste and brush, distribution of IEC materials

3. Community oral health program for caries prevention in elderly

- Routine oral health care delivery in fixed stations
- Outreach activities cooperate with Myanmar Dental Council, Myanmar Dental Association, Myanmar Maternal and Child-care Welfare Association, Non-Government Association
- New approach to oral health care system for Elderly-oral health survey for elderly on selected townships

4. Success story of community caries prevention in country

After pilot project (after 18 months) - 40% less new carious teeth, 60% less caries progression (reduction in pulp involvement)

In 2008, 76% of local brands are effective after advocacy processes (Ko Ko Maw, 2008)

Advocacy process

- Not concern with toothpaste, distribution of fluoride water in some region
- Assessment of free ionizable F in toothpaste in Myanmar market (result- N=21, both import and local, 38% less than 700ppm, 71% less than 700ppm free ionizable F (Ko Ko Maw & Wim van Palenstein Helderman, 2004)
- Fluoride toothpaste used - 26% of local brands showed desirable efficacy (>700ppm free available fluoride) Production and marketing of fluoride toothpaste from the factory of the Ministry of Industry 1 (Myanmar), Pepsodent with fluoride, free ionizable 780ppm (Ko Ko Maw, 2004)
- 2006, Consultative advocacy meeting for development of affordable and effective fluoride toothpaste for Myanmar (local/international, Dental, Medical, Health, MDA, local manufacturers)
- Distribution of user instruction in Myanmar

5. Other activities

- Oral health education pamphlet and oral health education video programs were telecast on the national TV program.
- Oral health messages are included in the school textbooks primary school children.
- Dental public health activities of the dental public health unit (branch of MDA) did oral health survey and oral health education in schools and communities.
- National Oral Health survey in future of the dental public health unit
- Joint dental public health activities in Myanmar with International organizations such as JICA, JAICOH, IADR, APDF, AAPD, AOHPF
- Signal and FDI programs in school children to promote health education such as live, learn and laugh program, day and night tooth brushing program

HOME CARE FOR DENTAL CARIES CONTROL

1. Instruction of fluoride toothpaste used in schools and community

- Fluoride tooth paste- locally available
 - Colgate- Active ingredient
 - Sodium Fluoride 0.24% (0.14% W/V), Triclosum 0.30%
 - Fresh up- SMFP 0.76%, Potassium Nitrate- 5%
 - Signal- SMFP 1450 ppm
 - Pepsodent- free ionisable fluoride-780 ppm (Ko Ko Maw, 2004)
- How to use effectively
 - A. Health Education
 - teach tooth brushing technique in simple way, use fluoride toothpaste twice a day, before immediately bed time and after meal at morning,
 - Amount of F toothpaste: 6 mo – 2 yr: half pea size, 2 – 6 yr: pea size or width of toothbrush, 6 and older: full length of toothbrush.
 - Brushing Time – Minimum of two minutes

- Post brushing behaviors – Spit out the toothpaste and minimize rinsing behaviors with water.
 - B. Community service
 - school oral health care service should be done frequently and at least three times a year
 - corporation of parents in oral health care and should participate in taking record of good oral health behavior
 - motivation of good oral habit in children by corporation of teachers and parents
2. Fluoride mouth rinse used- No history and no relevant data
- Children or school
 - Adult or elderly
 - How to use
3. Any other home care caries control in children, adult and elderly
- No specific home care

CARIOLOGY EDUCATION IN DENTAL SCHOOL

Dental schools- Two Universities, one in Yangon, one in Mandalay

Cariology Department- No separate department

Cariology teaching and learning under –

Department of Conservative Dentistry

Content- Definition of dental caries, Etiology, Classification, Diagnosis of dental caries, Treatment

Department of Preventive and Community Dentistry

Content- Epidemiology and prevention of dental caries

Department of Paedodontics

Content- Microbiological aspect, caries activity tests, Caries risk assessment, saliva and dental caries and Management of dental caries in children

Department of Oral Medicine

Content- Histo-pathology and sequelae of dental caries

Cardiology in clinical practice

Department of Conservative Dentistry- Caries management- Curative and ART, and prevention- fissure sealant

Department of Paedodontic Dentistry- Curative and prevention- Fluoride modalities, Fissure sealant

Specialty or specialist in Cariology

none

REFERENCES

Department of Preventive and Community Dentistry, Data collection in PCD trip yearly.

Ko Ko Maw & Wim van Palenstein Helderma,(2004), Assessment of free ionized/ionisable F in toothpaste from Myanmar market, 2001-2002.

Ko Ko Maw (2004) Invitational meeting on Fluoride exposure and Oral Health Care for Myanmar, July -2002.

Pathfinder oral health survey (2006–2007), Myanmar, Caries free rate (%), Prevalence of Dental Caries and Mean DMFT, and Periodontal disease.

Population Department, Ministry of Immigration and Population (2013), Estimate population and its structure.

Prathip Phantumvanit (2013) SEARO oral Health Indicators, Myanmar 2013- Myanmar Dental Conference, 2012.

Thein Tun Oo (2010) Epidemiological characteristics of Dental Caries and Treatment Need among 14 year-old school children using DMFT and DMFS indices, Dissertation.

Tin Wai (2013) Quality care of Myanmar, Presentation, 27th August 2013.

"Caries Control throughout Life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions (3)

Fluoride and current caries situation in some portions of Myanmar

SAW TUN AUNG³¹

INTRODUCTION

Myanmar, located in South East Asia, is developing country. According to the current socio-economical situation, 12 year old DMFT, an indicator not only for dentition status, but also for the over all oral health status in Myanmar varies in the regions of the country. Such variables, mainly depends upon changing lifestyle. However, another factor like fluoride should also be studied, for the influential role in the caries prevalence.

Caries are common in the developed countries, where high sugar content westernized foodstuffs are available. Instead of being that purpose, the caries rate drastically declines in those countries, within several late decades of the previous century. Experts highlighted, after doing some reviews, the widely utilization of fluoridated toothpaste in those countries, is the main reason.

Among the various fluoride usages of caries prevention, water fluoridation, professional application methods, fluoride supplements are still not available in Myanmar. The most common sources of fluoride in Myanmar are mainly based upon the drinking water. Generally, there are 3 categories of fluoride levels (0, 0.1-1.5 and above 1.5 mg/L) in Myanmar drinking water. Apart from the drinking water, some fluoridated toothpaste distributed in Myanmar market is another source. In some mountainous region, the tradition of drinking plain tea, in which optimal level of fluoride is contained, can also give the effectiveness of fluoride, in caries prevention.

In this paper, the role of fluoride on caries, in some portions of Myanmar, i.e. two from upper part of the country, where fluoride level is more than 1.5 mg/L and another one from lower portion, where

³¹ Professor/Head, Department of Preventive & Community Dentistry, University of Dental Medicine, Yangon, Myanmar Email: Saw Tun Aung <dr.sawhtunaung@gmail.com>

fluoride level is less than 1.5 mg/L is studied. At the same time, the effect of fluoridated toothpaste is also study, for the purpose of dental caries prevention.

MATERIALS AND METHOD

The study areas of this paper are based upon Myingyan, Shwebo and Nyaungdon. First two townships are situated in the Mandalay and Sagaing division and the last one is the township of Ayeyarwady division. Mandalay and Sagaing are the divisions of Upper Myanmar and Ayeyarwady is located in the Lower Myanmar. According to the previous research, the fluoride content of drinking well water of Mandalay and Shwebo divisions is more than 1.5 mg/L and the drinking water of Ayeyarwady division is less than 1.5 mg/L.

The sample size of the study is 352. Sample size was determined by using the formula of Swanga and Lemeshow, WHO, Geneva, 1991. The type of study is descriptive, cross sectional and non-intervention in design. In this study, the fluoride content of the toothpastes, occupied the majority share of market, were collected to confirm the real component. At the same time, the frequency of tooth brushing, caries prevalence and mean DMFT of 12 year old school children were also collected. The DMFT of 12 year old school children were selected to know not only the dentition status, but also the global oral health situation, in this study.

Simultaneously, the relationship between drinking water fluoride component and dentition status of the study areas, and fluorosis situation were also examined. Study period is one year (from August 2011 to August 2012)

RESULTS

The table shows that all toothpastes from Myanmar market have below 1000 ppm of fluoride.

Table 1: Fluoride content in the common toothpaste

No.	Code no.	Fluoride component <i>ppm</i>
1	TP1	968.00
2	TP2	968.00
3	TP3	968.00
4	TP4	934.00
5	TP5	634.0833
6	TP6	634.0833
7	TP7	634.0833
8	TP8	827.500
9	TP9	699.200
10	TP10	760.000

Table 2: Previous 12 year old DMFT among Myanmar people

Age group	Author	Year	DMFT
10-12	Menezes et.al	1972	2.38 (Low)
12	WHO(4)	1977	0.80 (Very low)
12	Valentine et.al	1982	1.30 (Low)
12	WHO (6)	1993	1.10 (Very low)
12	Oral Health Unit (7)	1996	0.83 (Low)

Above table shows DMFT of 12 year old in some portion of Myanmar is just between very low and low.

Table 3: Mean 12 year old DMFT of study area

Location	Mean DMFT	Standard Deviation
Shwebo	0.39 (Very low)	0.95
Myingyan	0.2 (Very low)	0.58
Nyaungdon	2.18 (Low)	0.75

ANOVA $p < 0.01$; (Highly significant)

According to the table, 12 year old DMFT for those areas of fluoride level of drinking water (>1.5 mg/L) are very low.

Table 4: Number of children aged 12 year olds with their toothbrushing practice by the study locations.

Location	No. of children		Total
	Tooth brushing <2 times	Tooth brushing ≥ 2 times	
Shwebo	81	45	126
Myingyan	51	49	100
Nyaungdon	68	58	126
Total	200	152	352

$X^2 = 4.76$; $p > 0.05$ Non Significant

Tooth brushing frequencies between three townships show non significant.

Table 5: Effect of frequency of tooth brushing (12 year)

Frequency	Mean DMFT	Standard Deviation
<2 times	0.98	2
≥ 2 times	0.97	1.5

Unpaired t test: $t = 0.165$, $p > 0.05$

Table 6: Population affected by fluoride in drinking water (>1.5 mg/L)

City	Source of water	Population
Sagaing	Dug well	149,000/5,500,000
	Tube well	55,000/5,500,000
	Other	0/5,00,000
Mandalay	Dug well	148,000/7,058,00
	Tube well	185,000/7,058,000
	Other	0/7,058,000
Ayeyarwady	Dug well	0/7,065,000
	Tube well	0/7,065,000
	Other	0/7,065,000

DISCUSSION

According to Table 1, fluoride content in the top 10 toothpastes in Myanmar market, is no more than 1000 *ppm*. In Table 2, 12 year old mean DMFT, collected from 1972, 1977, 1983, 1993, 1996, have shown that it varies between very low and low. However, since these were the data collected randomly in the convenient areas, it does not represent the national level. At the same time, the data collected in 2012, presented in table (3), shows the various 12 year old DMFT in the study area, it can be noticed the varieties of results. Among the first 12 year old two townships, resided in the high fluoride level (>1.5mg/L) in drinking water, have a very low 12 year old DMFT. In the same table, it can be seen, low 12 year old DMFT, in Nyaungdon Township, located in Ayeyarwady division, where fluoride level is less than 1.5 mg/L in drinking water (See Table 6).

Table 4 and 5 indicated that the dentition status is not affected by fluoridated toothpastes. Community's oral hygiene care should be promoted by using strategies of oral health promotion. The behavior and awareness of positive oral hygiene care should be changed to promote the dentition status, whether they use fluoridated toothpastes or not.

In this study, it can be concluded that only fluoride from drinking water effect positively on dentition status. However, the problem, i.e. fluorosis should be taken care, in the other hand.

REFERENCES

Bratthall D et.al. Reasons for the caries decline: what do the experts believe? Eur J Oral Sci 1996; P 416-422.

Gunshima Y et.al The Effects of Fluorides in the Prevention of Caries in Adults: Dentistry in Japan, Volume 34, 1998, p 84-6.

Peterson PE. The Effective Use of Fluorides in Public Health, The Workshop on "Effective Use of Fluoride in Asia" Phang-Nga, Thailand, March 22-24, 2011, p 22-30.

World Health Organization. Inadequate or Excess Fluoride: A Major Public Health Concern, The Workshop on "Effective Use of Fluoride in Asia". Phang-Nga, Thailand, March 22-24, 2011. p 13-17.

World Health Organization Expert Committee on Oral Health Status and Fluoride Use, Fluorides and Oral Health; WHO Technical Report Series, 846, 1994.

NEPAL

Shaili PRADHA

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

NEPAL

*Shaili PRADHA*³²

DENTAL CARIES EPIDEMIOLOGY

Dental caries is considered a major public health problem globally due to its high prevalence and significant social impact. It is one of the commonest oral problems affecting children and elderly globally involving the people of all regions and society. It can be seen in all age groups involving both deciduous and permanent teeth. Treatment of dental caries involves restorative or pulp therapy which is not only expensive but also painful.

The 2004 National Pathfinder Survey shows that 58% of 5-6 year old school children suffer from dental caries (Yee and Mishra 2006). With this high prevalence, dental caries is more prevalent than malnutrition that affects 49% of the child population (Ministry of Health annual report 2009/10). The Survey reported pain and discomfort due to untreated dental caries in 18% of 5-6 year olds and 64% in older adults. Adolescent school children reported inability to eat followed by inability to speak properly. The survey reported that in 5-6 years old, dental caries prevalence was 57.5%, mean dmfs was 5.47 and the mean dmft was 2.70. 5-6 year old school children from urban schools had significantly higher mean dmfs and dmft than their counterparts attending rural schools. Total no of sample size was 1027, 5.27 had ds, 0.19 had ms and 0.03 had fs component in 5-6 yr old.

In total of 1047, 12-13 year old age group, the dental caries prevalence was 25.6%, mean DMFS was 0.74 and the mean DMFT was 0.50. DT was 0.45, MT was 0.01 and FT was 0.03. In total of 1074 15-16 year old children, dental caries prevalence was 25.6%, mean DMFS was 0.74 and DMFT was 0.50. DT was 0.52, MT was

³² Professor, Coordinator, MDS Periodontology and Oral Implantology, National Academy of Medical Sciences and Chief, Oral Health Focal Point, Department of Health Services, Ministry of Health and Population. Email: Shaili Pradhan <shaili_p@yahoo.com>

0.04 and FT was 0.07. In the age group 34-49, with sample size 603, prevalence of dental caries was 57.5% and mean DMFT of this study group was 2.71. D component was 66.4%, M was 28.4% and F was 5.2%. DT was 1.80, MT was 0.77 and FT was 0.16.

In a total of 616 for older adults aged 50-99 yrs, prevalence of dental caries and mean DMFT was 69.6% and 6.40, while DT was 3.65, MT was 2.69 and FT was 0.06. After 2004 there is no national survey or data on oral conditions, however, there are some published reports of academic institutions which adopt certain districts for teaching learning purposes.

In a total of 2,177 of 5-6 year old and 3,323 of 12-13 year old school children from urban and rural areas, the caries prevalence and mean dmft score of 5-6 year olds was 67% and 3.3. Similarly the caries prevalence and mean DMFT score of 12-13 year olds was 41% and 1.1 (Yee and McDonald 2002).

In a study of 638 school children, 325 of age 12-13 years and 313 of age group 5-6 years, conducted in Kathmandu valley, dmfs and caries prevalence was 3.79 and 69%, similarly in 12-13 year age group, DMFS and caries percentage was found to be 1.6 and 53.23% (Subedi B et al 2011).

In a study conducted in a study population of 3174 school going children of 5-14 years old, the prevalence of dental caries was found to be 47.1%, mean DMFT in 5-7 year old was 1.96 and 11-14 years was 1.84 (Adhikari, Malla and Bhandari 2012).

In another study conducted on 361 school age children by age group from 5-16 years, caries prevalence and mean dmft/DMFT score of 5-6 years old and 12-13 years old was 52%, 1.59 and 41%, 0.84 respectively (Dixit et al 2013).

COMMUNITY DENTAL CARIES PREVENTION PROGRAMME

Nepal does not have any community fluoride administration in the country, as there is no sufficient regular water supply to every household from the Government. People depend on boring water supply and well water for daily household work. In 1995, an attempt was made to lobby for salt fluoridation as there is one door system for salt in the whole country through a salt trading corporation which supplies salt to almost 90% of the houses in the country. However, it could not materialize because of some unavoidable circumstances.

Government through Oral health focal point does have regular community oral health program for caries prevention in children and in elderly. This is conducted every year as per the budget allocated. Though few in numbers, community oral health program for caries prevention in children is carried out every year in the form of orientation on oral health to school children and teachers and Atraumatic Restorative Treatment by Government. Such programs are also conducted by academic institutions and NGOs regularly as part of their curriculum. As for elderly, there is no separate program for caries prevention. However, a few messages are aired regularly through the radio on oral health. Some NGOs do fluoride varnish application on school children.

There is no official document exactly whether caries prevalence, dmft has reduced or not after 2004, no national survey has been conducted in the country,. However, there is a published report on gains in oral health and improved quality of life of 12-13 year old Nepali school children five and six years after the introduction of fluoride toothpaste in 1991 (Yee, McDonald and Helderma 2006). There was a 26.6% decline in caries prevalence and 38.0% decrease in 12-13 year old DMFT. There is also increasing in tendency to have dental checkup, which may be attributed to the dental camps organized by Government and private sector, oral health education, orientation and awareness programs in schools, radio and TV both by the Government as well as private sector.

HOME CARE FOR DENTAL CARIES CONTROL

Nepalese population totally rely on fluoridated tooth paste for dental caries control. Ninety five % of the toothpastes available in the market are fluoridated and is easily available to all the population, as it is manufactured in Nepal. Most of the Nepalese people brush immediately after waking up, before breakfast and we need to bring change in this behaviour and they are not aware about not to rinse thoroughly after brushing and most people brush once a day only.

Purely fluoride mouth rinse is not available in the country; however anti plaque mouth washes mixed with fluoride are available. Fluoride is available in the form of sodium fluoride, sodium monofluorophosphate in the tooth paste in 1000 ppm. Some private clinics do offer fluoride varnish and gel applications, however it is quite expensive.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

History of dental education in the country is very recent. The first dental college was started in Nepal by the private sector in 1999. At present there are 12 dental schools with five dental colleges having both undergraduate and postgraduate courses and 2 institutes having only postgraduate courses, rests have only undergraduate courses.

In Nepal Cariology is not a separate department; it is incorporated in Conservative and Endodontics department. However, Cariology subject is introduced to undergraduates from 1st year as introductory classes, it is also covered in 2nd and 3rd year and in the final year, it deals in detail. Cariology covers all the aspects of dental caries including etiology, classification, prevention, treatment and maintenance.

In clinical practice, Cariology is taught by Conservative and Endodontics department and contents are theory as well as practical. In practical classes students learn to detect caries as well as management of dental caries. In preclinical classes which are incorporated in 1st and 2nd year classes, students initially learn about caries and cavity preparation in cast and phantom head in laboratory till 2nd year and from 3rd year onwards they learn in human subjects regarding diagnosis of dental caries and preparation of different cavities for the management of dental caries.

There are very few specialized dental surgeons in all aspects of dentistry. Thus our country lacks specialist in Cariology till date.

REFERENCES

Adhikari RB, Malla N and Bhandari PS (2012). Prevalence and treatment needs of dental caries in school going children attending dental outpatient department of a tertiary care centre in western region of Nepal, National journal of medical sciences 2012;1(2):115-8

Dixit LP et al (2013). Dental Caries prevalence, oral health knowledge and practice among indigenous Chepang school children of Nepal, BMC Oral Health 2013,13:20

Ministry of Health and Population (2011): Department of Health Services Annual Report 2066/2067 (2009/2010)

Subedi B et al (2011). Prevalence of Dental Caries in 5-6 years and 12-13 years age group of school children of Kathmandu valley, J Nepal Med Assoc 2011;51(184):176-81

Yee R and McDonald N (2002). Caries experience of 5-6 year old and 12-13 year old school children in central and western Nepal. Int Dent J 2002;52:7-10

Yee R, Mishra P (2006). Nepal Oral National Pathfinder Survey 2004

Yee R, McDonald N and Helderma VP (2006). Gains in oral health and improved quality of life of 12-13 year old Nepali school children: outcomes of an advocacy project to fluoridate toothpaste. Int Dent J 2006;56:196-202.

PHILIPPINES

Maria Liza C CENTENO

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

PHILIPPINES

Maria Liza C CENTENO³³

DENTAL CARIES EPIDEMIOLOGY

The prevalence of dental caries in the Philippines has remained high for several decades now. There are several efforts to address this problem. The programs are offered on a national scale by several agencies both by the government and private sectors, however, these programs have remained fragmented across the nation, which has made the impact less significant.

The following data were gathered from the latest report released August 2013 by the Department of Health-National Center for Disease Prevention and Control, this concluded the nationwide dental survey conducted in 2011 by the National Monitoring and Evaluation Dental Survey (NMEDS), in collaboration with the University of the Philippines, National Institutes of Health.

**Table 43: Average Decayed, Missing, Filled Teeth (XDMFT) in the Philippines by Age Group
1977 – 2011**

Age Group	1977	1982	1987	1992	1998	2011
5-6 Years	3	1.4	0.79	1.3	0.4	0.08
12 Years	2.96	6.39	5.52	6.1	4.57	3.25
15 -19 Years			8.51	8.25	6.29	5.29
35 - 44 Years	10.41	14.18	14.82	14.42	15.04	12.93
All Ages	5.71	8.7	9.41	9.41	8.62	8.86

Source: NMEDS, 2011

³³ *Philippine Pediatric Dental Society, Inc., Pediatric Dentistry Center.
Email: Maria Liza Centeno <lizacenteno@yahoo.com>*

1. Caries free at 3, 6 and 12 years old children

The NMEDS 2011 report gathered the dmft and DMFT in its sample population and the data showed that dental caries in children has lowered but is still by far high in comparison to that of the region. While there is no data specific for 3 years old, the survey included children aged 5 and 12 years old. Average decayed and filled temporary teeth were 5.6, which were mostly decayed. Only 6 of the 586 subjects had filled teeth. Missing teeth are not included since these could either be unerupted or extracted early due to caries (NMEDS, 2011).

Table 21: Average Decayed and Filled Temporary Teeth (dft), Philippines 2011

	Number	Average
Total Examined	673*	
Sound	7110	10.6
Decayed	3774	5.6
Filled	6	0.009
Dft	3780	5.6

*Includes 87 subjects aged 12 years old

Source: NMEDS, 2011

2. dmft at 3, 6(5) years old children, with d,m,f component breakdown

Overall, prevalence of dental caries in temporary teeth was 87.7% from among five hundred eighty six (586) 5-year old children, which is HIGH according to the severity classification of diseases. Males have higher prevalence at 88.9% compared to the females at 86.4%. The urban children obtained a very high prevalence at 90.8% while the rural children was at a high 84.1%.

3. DMFT at 12, 15, 35-44, >60 years population, with D, M, F component breakdown

Table 14: Average Number of Decayed, Missing and Filled(DMFT) Teeth by Age, Philippines 2011

Age	Average Number of Teeth			
	Decayed	Filled	Missing	DMFT
5	0.06	0.00	0.02	0.08
12	2.58	0.01	0.66	3.25
15-19	3.51	0.09	1.69	5.29
35-44	3.14	0.22	9.57	12.93
65-74	1.78	0.06	21.03	22.87
Total	2.22	0.08	6.56	8.86

Source: NMEDS, 2011

4. Prevalence in Permanent Teeth

By age, the prevalence of dental caries is HIGH for the 12, 15-19 and 35-44 year age groups and Very High for the 65-74 years age group.

By gender and residence, the prevalence of dental caries is HIGH for both female and male. It is also MEDIUM for both urban and rural areas.

5. Average Decayed Missing Filled Teeth (XDMFT)

The average decayed, missing, filled teeth were highest since 65-74 years age group at an average of 22.87 and 3.25 for 12 years age group. The occurrence of XDMFT was also higher in urban areas when compared with rural areas.

6. Prevalence of Missing Teeth

Females (70.9%) have a higher prevalence of missing teeth compared to males (53.9%). The prevalence of missing teeth is VERY HIGH for 65-74 years and 35-44 year age groups at 98.8% and 94.9%, respectively.

7. Average Missing Teeth

The average number of missing teeth was higher in females at 8.39 compared to males at 4.44. By age, 12 years age group received the lowest number of missing teeth at an average of 0.69, while the 65-74 years age group showed a high 21.03 missing teeth.

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

The Dental Services of the Department of Health (DOH) was reorganized in the early nineties and simultaneously the devolution of the local government was implemented. This political reorganization created a significant impact on the oral health programs in the country and for a time, the regions, provinces and municipalities provided mostly curative services until the DOH came up with its Oral Health Policies, Guidelines and Programs in 2005. The "Orally Fit Child Program" for under 6-year old children of the DOH and the Oral Health Program 'Fit for School Program' of the Department of Education (DEPED) contributed greatly to the improvement of the oral

health status of children specifically for oral hygiene as evidenced by the majority (93.3%) of the study population brushing their teeth. This may be the reason for the high decrease in periodontal disease. However, the same cannot be said for dental caries status. To meet the WHO Goals, both government agencies still have to do more. (NMEDS, 2011)

1. Community fluoride administration in the country

At present, water fluoridation or any means of public health fluoride administration in the country has not been restored. Water Fluoridation in Metro Manila lasted for 3 years, from 1983-1986, however, the program did not continue after the supply was consumed. There are no immediate plans for the implementation of any form of public health fluoridation program in the country.

2. Success story of the community caries prevention in the country

There are isolated programs in several regions where oral health awareness is being advocated. Most of it are being successfully implemented but since there is no centralized agency monitoring the programs, there are no data to statistically prove its significant impact to the community.

HOME CARE FOR DENTAL CARIES CONTROL

Toothbrushing remains to be the main means of controlling dental caries in the Philippines. A great majority of the subjects (93.3%) cleaned their teeth with toothbrush in all regions examined and only 2.4% used other methods while 3.2% didn't clean their teeth at all. (NMEDS, 2011) However, the survey did not ask if the respondents used toothpaste for brushing nor were their brushing habits asked. It also did not inquire frequency and time of toothbrushing. While it is customary for Filipinos to use toothpaste for tooth brushing, there remains insufficient proof of the use of Fluoridated toothpaste. Interestingly, the survey also revealed that almost half (48.4%) of the respondents went to a dentist to get a free toothpaste (NMEDS, 2011). Whether there is actual toothbrushing or use of Fluoridated toothpaste, it is worthy to note that most of the respondents know that toothbrushing is an essential part of hygiene.

In 2011, the Philippine Pediatric Dental Society, Inc. released the Fluoride Guidelines on the use of toothpaste, mouthwashes and fluoride supplements. Below is the summary tabulating the recommendations.

Philippine Pediatric Dental Society, inc. Fluoride guidelines 2011

Fluoride Vehicle	6 months to 2 years	2 to 6 years	6 years and above
Water fluoridation	0.5–1 ppm	0.5–1 ppm	0.5–1 ppm
Fluoride toothpaste	Twice a day	Twice a day	Twice a day
- frequency	1000 ppm smear	1000 ppm pea size	1500 ppm 10 mm and above
- concentration	-	-	-
- amount	none	When able to spit	Daily
Fluoride mouthrinse	-	Daily	For 30 seconds
- frequency	-	for 30 seconds	10 ml
- time	-	10 ml	-
- amount	Caries risk assessment	Caries risk assessment	1 mg
Fluoride Supplements	-	-	2-4x a year
Fluoride Gel	2-4x a year	2-4x a year	2-4x a year
Fluoride Varnish	-	-	-

While dental caries remains to be high, there are concerted efforts in the private sector to curb its prevalence. Several non-government organizations have coalesced to create a unified advocacy and programs for the benefit of the oral health of the entire Philippines. The absence of measures emanating from the Department of Health has prompted several non-government organizations, such as the Philippine Dental Association, the Philippine Pediatric Dental Society, the University of the Philippines Alumni Association and the University of the Philippines College of Dentistry to coalesce and have a unified advocacy and programs for the benefit of the oral health of the entire Philippines.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

There are 27 dental schools all over the Philippines, the subject on Cariology is included in Restorative Dentistry subjects. There is no separate department dedicated to Cariology alone. At present, there is no specialty group or research department intended for Cariology.

REFERENCES

National Monitoring and Evaluation Survey 2011 Final Report. Department of Health-National Center for Disease Prevention and Control. Released August 2013.

4th National Monitoring and Evaluation Dental Survey 1998. Dental Health Service Department of Health.

National Monitoring Evaluation Dental Survey Dental Health Service Implementation Support Division, Dental Research Publication Department of Health 1992.

RA9484 "The Philippine Dental Act of 2007".

Philippine Pediatric Dental Society, Incorporated. Guidelines on the Use of Fluoride 2011.

SINGAPORE

Eu Oy CHU

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

SINGAPORE

Eu Oy CHU³⁴

DENTAL CARIES EPIDEMIOLOGY

The School Dental Service (SDS) provides comprehensive oral health care to primary and secondary school children. In June 2006, it rolled out a fully integrated computer system, Integrated Dental Electronic Assessment for Students (IDEAS), which performs roles ranging from front desk patient management to management of clinical records. IDEAS allows more than 200 clinicians who are situated at the School Dental Centre (SDC) in Health Promotion Board (HPB) and 230 dental clinics island-wide in real-time accessing and capturing of student records. Access to the system is done either through school and government networks or 3.5G wireless network. The use of odontogram charting, treatment planning and treatment execution facilitate data capture and provides a useful guided clinical approach to the management of the patients. The design of the odontograms also facilitates the capture of structured data for analysis and research.

The data in this report pertain to 7, 12 and 15 year olds in the year 2011 and was generated from the IDEAS system. Table 2 shows the demographic profile of pupils examined for the period from January 2011 to December 2011. Table 1 shows that the majority of the children stayed in 4-5 room flats.

Table 1: Percentage of children stayed in different room size.

Year	Percentage of children per room size				
	1-3 Room	4-5 Room	Executive	Private	Others
2011	15	60	9	17	3

³⁴ Senior Deputy Director, School Dental Service, Health Promotion Board, Singapore Email: Oy Chu EU (HPB) <EU_Oy_Chu@hpb.gov.sg>

Table 2: Demographic profile of pupils examined for the period from January 2011 to December 2011.

	Age (yrs old)		
	7	12	15
Total no of local children examined	31,746	38,628	33,093
<i>Ethnic Groups (%)</i>			
Chinese	69.5	70.0	73.0
Malay	13.8	14.0	12.6
Indonesian	6.0	6.0	5.3
Eurasian	0.4	0.5	0.4
Indian	8.7	8.3	7.8
Others	1.6	1.2	0.9
<i>Gender (%)</i>			
Male	51.3	52.0	51.0
Female	48.7	48.0	49.0

1. Primary Dentition: Oral health status of 3 year olds

The results of the latest study of pre-schoolers were published in 2009. 1,782 children aged 3-6 years were examined. The caries status was evaluated using WHO examination procedures and diagnostic criteria. It was found that about 40% of the children (26%, 37%, and 49% in 3-4, 4-5, and 5-6 year-olds, respectively) were affected by caries. The mean (sd) dmft and dmfs were 1.54 (2.75) and 3.30 (7.49), respectively. About 90% of the affected teeth were decayed teeth. The study revealed a significantly skewed distribution of caries lesions, indicating that 16% children with high caries activity (dmft \geq 4) were carrying 78% lesions. Rampant caries, defined as caries affecting the smooth surfaces of two or more maxillary incisors, were found in 16.5% of children. About 61% of affected surfaces were smooth surfaces. Demographically, Malay children and boys tended to have more rampant caries. Higher caries severity and treatment needs were found among Malays and children in the low socio-economic group (Gao et al., 2009).

2. Oral health status of 7 year olds (Charts 1-4)

Of the 31,746 pupils aged 7 examined in the year 2011, 49.5% of the children were affected by dental caries. The mean dmft of the primary teeth was 2.09. The main contributory factor to the dmft index was the filled (f) component (mean=1.58) (Figure 1). In terms of severity of caries experienced, about one-fifth of the children (20.1%) had dmft \geq 4.

Malay children had a higher deciduous dmft (2.47) as compared to Chinese (2.06) and Indians (1.60) (Figure 2). Like the 3 year olds, the Malays and the boys tended to have higher caries experience (Figure 3).

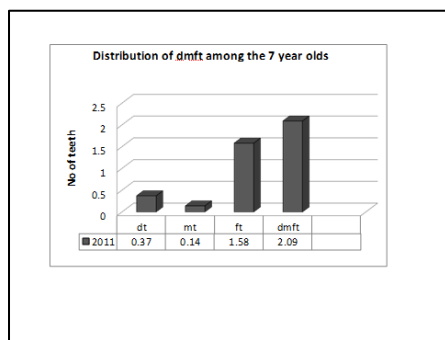


Figure 1

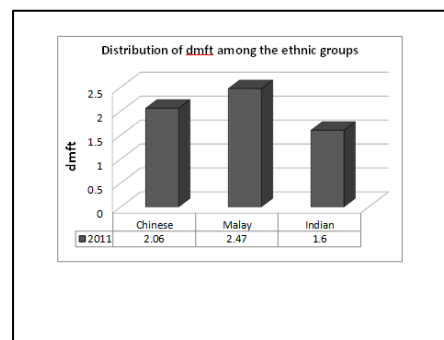


Figure 2

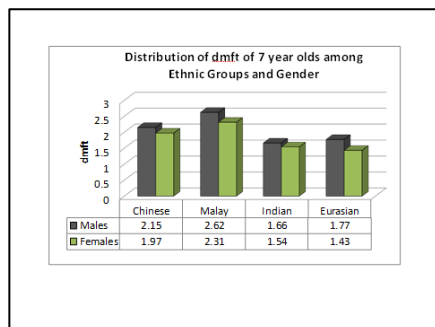


Figure 3

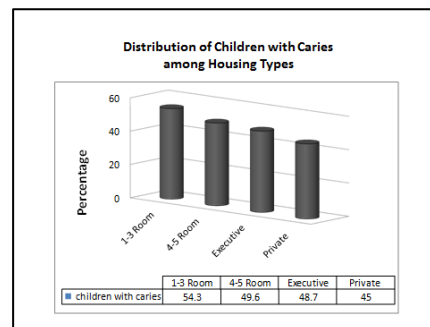


Figure 4

Housing types of the children were recorded and used as a gauge of the socioeconomic status of the children. A higher percentage of children who stayed in 1-3 room flats had caries compared to children who stayed in private apartments or properties (Figure 4).

Amalgam was once the main material for use in filling, its utilization rate has dropped from 60% of restorations in 2007 to 33% of restorations in 2011.

3. Permanent Dentition: Oral health status for 12 and 15 year olds

In the year 2011, a total of 38,628 12 year olds and 33,093 15 year olds were examined respectively. About 29.4% of the 12 year olds and 40.0% of the 15 year olds had dental caries. The mean DMF teeth for these age groups were 0.56 and 1.04 with the filled (F) component being the major contributory factor to the indices (Charts 5, 6).

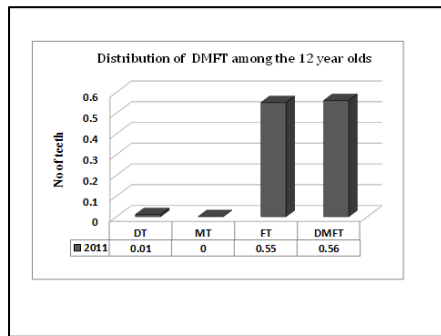


Figure 5

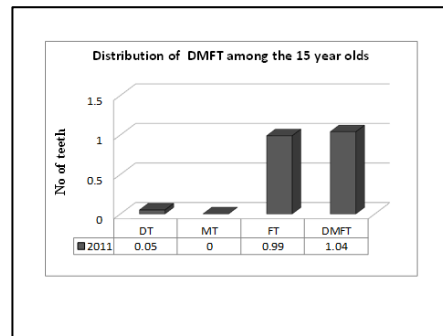


Figure 6

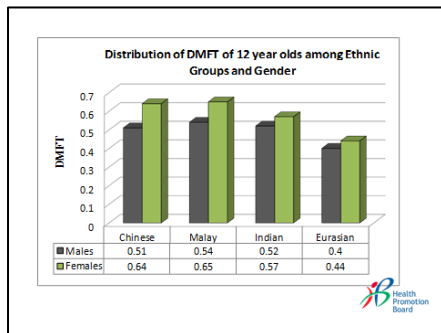


Figure 7

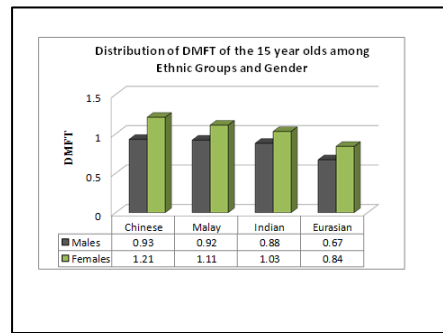


Figure 8

In both age groups, the girls had a higher mean DMFT compared to the boys across all ethnic groups. At age 12, the Malay children had a higher mean DMFT as compared to Chinese and Indian children. But by age 15, the Chinese children had the highest DMFT compared to the other ethnic groups (Charts 7, 8).

In summary, the prevalence of dental caries in children has been shown to be influenced by ethnicity, educational level and socioeconomic standards. There is a disparity in the burden of disease within the community.

4. Adult population

Table 3: The distribution of caries free and DMFT according to gender, age group, ethnicity and education is shown in the table below.

	Caries Free (%)	Mean no. of Teeth			
		DT	MT	FT	DMFT
<i>Overall</i>	9.9	0.9	3.1	4.1	8.1
s.d.	—	1.5	6.4	4.2	7.1
<i>Gender</i>					
Female	58.6	0.9	2.9	4.5	8.3
Male	41.5	1.0	3.4	3.3	7.7
<i>Age Group</i>					
20–24	30.3	0.5	0.1	1.8	2.4
25–34	29.0	0.9	0.3	3.2	4.3
35–44	17.8	1.0	1.1	5.3	7.4
45–54	11.8	1.1	3.6	4.4	9.1
≥55	11.2	0.9	8.8	3.7	13.4
<i>Ethnicity</i>					
Chinese	56.6	0.8	3.6	4.6	9.0
Malay	13.8	1.4	2.1	2.6	6.1
Indian	26.3	1.0	1.3	2.5	4.8
Others	3.3	1.1	0.9	3.7	5.7
<i>Education</i>					
Primary & Below	13.8	1.1	7.1	3.2	11.4
Secondary	44.1	1.0	2.1	4.5	7.6
Tertiary	42.1	0.6	0.7	4.1	5.4

The last adult survey was conducted in 2003. It found that 9.9% of the adult population was caries free. The mean DMFT among the population surveyed was 8.1

The distribution of caries free and DMFT according to gender, age group, ethnicity and education is shown in the Table 3.

COMMUNITY DENTAL CARIES PREVENTION PROGRAMME

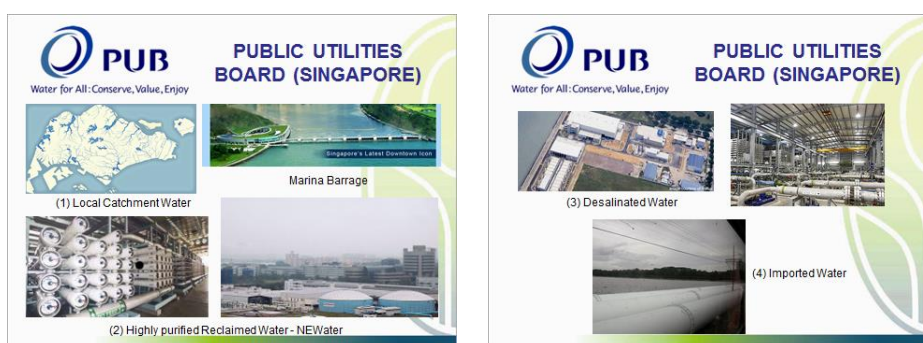
1. Water Fluoridation

Singapore adopted water fluoridation in 1954 after a careful review of the benefits of fluoridation, its effectiveness in reducing dental caries and that the fluoride level in the tap water was safe when consumed.

Since 1957, the entire water supply of Singapore was fluoridated at 0.7 mg/l. In the same year, a ten-year study was conducted to compare the prevalence rate of dental caries among children in Singapore against that of Malacca in Malaysia, where the water was not fluoridated. The study showed that fluoridation of drinking water in Singapore had lowered the prevalent rate of dental caries by 30% among our children. There was no corresponding fall in the prevalence rate of dental caries among children of Malacca.

In the light of an increase availability of multiple forms of fluoride, the "optimal" fluoride concentration of drinking water was reduced to 0.6 mg/l in January 1992. The current fluoridation level of 0.4 to 0.6 mg/l in our tap water is well within the latest (2004) World Health Organization (WHO) guidelines of 1.5 mg/l and is not expected to have any adverse health concerns.

Today, fluoride in drinking water has contributed to Singapore having one of the lowest DMFT index for 12 year olds.



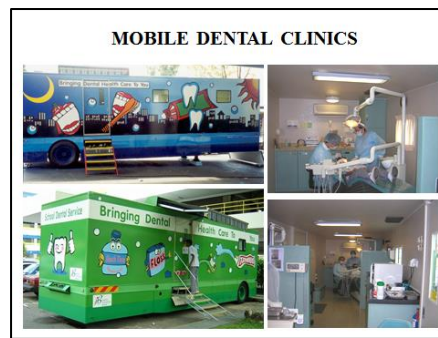
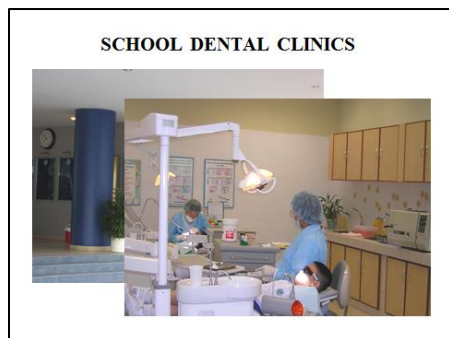
2. School Dental Service: Dental Services to Primary Schools

The School Dental Service (SDS) was introduced in 1948. The first school dental clinic was set up in an operating theatre at

the Tan Tock Seng Hospital with just 1 school dental officer. Over the years, dental clinics were built in primary schools in tandem with the Ministry of Education's school development plan. The mission was to provide on-site, free basic oral health care services, health promotion and education to the children. Dental Nurses (now known as Dental Therapists) were deployed to provide the services.

Today, the services are provided to all primary school children (including children with special needs) via 185 school dental clinics. The services can be broadly divided into curative, preventive care and oral health promotion. Curative services include fillings, pulpal therapy, and extractions. Scaling, polishing, application of fluoride therapy and fissure sealants on permanent teeth as well as interceptive orthodontic therapy constitute the main preventive services. Annually, staff is audited on caries management to ensure that the services, especially the preventive services, are properly and timely executed. In addition, tooth brushing is taught and reinforced throughout the primary school years and dental health talks are conducted to empower the children with the skills and knowledge to take care of their own teeth.

3. Extension of dental services to all secondary schools



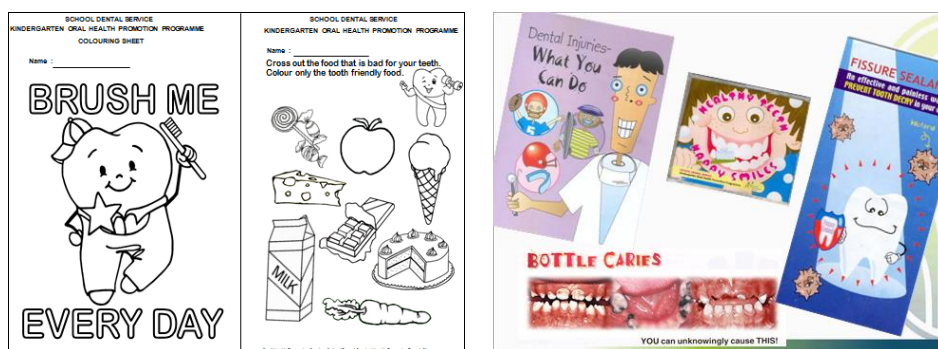
To build on the good results of the dental programme for primary school children, the Government extended the free on-site dental services to all secondary school children in 2002. Unlike the delivery of services to the primary school children, the secondary school children are provided with readily available, accessible and comprehensive basic oral health care services via 20 school dental clinics and 27 mobile dental clinics.

Each mobile dental clinic visits 4-5 secondary schools in a year and spends 2-3 months in each school to render the secondary school children dentally fit for the year before moving off to the next school.

4. Services to Preschoolers

Every year, the dental therapists will visit kindergartens and deliver an oral health promotion programme to the pre-schoolers. Through interactive activities and presentations, the pre-schoolers are taught the importance of oral health and how to prevent dental caries. Parents are also provided with dental health education resource materials – My Toothbrushing Diary and stickers are distributed to complement what the pre-school children have learnt in schools.

Pre-school children who require dental care could seek dental treatment at School Dental Centre. They charge a concessionary rate that takes into account a 75% subsidy from the Government. Permanent residents get 25% subsidy.



5. Programme for Low Social Economic Status (SES) preschool children

In 2012, SDS and a Family Service Centre (FSC) initiated a programme for the low SES pre-schoolers. The children were referred from the FSC to School Dental Centre and to 3 of the field dental clinics for dental screening and treatment during the school holidays. It was found that about 30 per cent of the children had rampant caries and they required several visits to complete treatment. Fees were waived for these children.

The children were accompanied by their parents who were taught how to take on an active role at home for their child/children's oral health.

6. Caries Risk Assessment

In Jan 2005, Caries Risk Assessment (CRA) was introduced in SDS. Colour-coded stickers were first used on treatment charts to identify the caries risk status of all the primary school pupils enrolled in SDS programme.

With the introduction of IDEAS, factors like past caries experience, number of white spot lesions and oral hygiene status were input into the system to identify and track the patients' caries risk, electronically. Originally, only pupils in Primary 5 identified as low caries risk were exempted from screening. It was later extended to 2 levels of pupils: pupils in Primary 3 identified as low caries risk were also exempted from screening.

The application of the CRA has reduced the number of dental therapists required to manage the Primary School Oral Health Programme.

7. Community Service for the needy, elderly

Adult dental services are rendered at Government polyclinics and mainly at private dental clinics.

Since 2004, during the school holidays in June and December, MDCs manned by dental officers and oral health therapists have been deployed to community centres and nursing homes. There, they attended to the elderly needy in the community and to the residents of the nursing homes at subsidized rates. Most of the treatment provided was scaling, fillings and extractions.

For patients who required follow up treatment, they were provided with a list of private dental clinics under the Community Health Assist Scheme (CHAS) where they could attend and continue to enjoy government subsidies for basic dental care.



HOME CARE FOR DENTAL CARIES CONTROL

Plaque Disclosing Programme

SDS collaborated with Oral Kare in the development of a plaque disclosing toothpaste to help children develop proper brushing habits and to help them improve their oral hygiene. The toothpaste was introduced into the Primary 3 oral health promotion programme. Pamphlets were distributed for the children to bring home to their parents for the continuation of the programme at home.


A survey was conducted to evaluate the impact of the plaque disclosing programme among the Primary 4 pupils who had participated in the programme the previous year when they were in Primary 3.

30% of the pupils showed improvement in their oral health status as compared to the previous year and 53% increased knowledge on the causes and effects of dental diseases and the reasons for brushing their teeth. Hands-on teaching on the use of disclosing toothpaste created a "seeing is believing"

**Plaque Disclosing Programme
(4 Main Activities)**


(I) Pupils Education

Slide presentation on PowerPoint to educate the pupils
What is dental plaque?
How to see dental plaque?
What are the effects of dental plaque on teeth and gums?
How to remove dental plaque?



Plaque Disclosing Programme

(II) Dental Plaque Identification



- Staff apply plaque disclosing toothpaste onto the toothbrush
- Pupils look into the mirror and staff teach pupils to identify dental plaque through the stained areas (pink)



CARIOLOGY EDUCATION IN DENTAL SCHOOL

The Faculty of Dentistry (FOD), National University of Singapore (NUS) is currently the only dental school in Singapore.

Cariology education is taught throughout the four years of the dental undergraduate curriculum. The academic aspects of cariology (i.e. aetiology, pathogenesis, fluorides, and caries preventive programmes) are covered in the first year. This is taught by staff from the Discipline of Oral Sciences (Dental Public Health) and Paediatric Dentistry. To complement this, staff from the Discipline of Restorative Dentistry teach the undergraduates about the management of dental caries in the pre-clinical Operative Technique curriculum.

The students will then apply the knowledge and skills acquired in the pre-clinical years when they enter clinics in their third and final years as part of the Operative/Restorative Dentistry, Paediatric Dentistry, and Special Needs Dentistry clinics. Apart from providing curative treatment for the management of caries, the students are also taught to perform Caries Risk Assessments for their patients where they assess dietary intake, use of fluoride, bacteria count (Strep Mutans, Lactobacillus), saliva pH/buffering capacity and flow rates etc.

REFERENCES

Gao XL, Hsu CYS, Loh T, Koh D, Hwang H.B, Xu Y. Dental caries prevalence and distribution among pre-schoolers in Singapore. Community Dental Health (2009) 26, 12–17.

School Dental Service, IDEAS System.

Adult Oral Health Survey 2003.

TAIWAN, REPUBLIC OF CHINA

*Lin-Yang CHI
Lih-Jyh FUH*

"Caries control throughout life in Asia"

Country Report on Dental Caries Epidemiology and Relevant Interventions

TAIWAN, REPUBLIC OF CHINA

Lin-Yang CHI³⁵

Lih-Jyh FUH³⁶

DENTAL CARIES EPIDEMIOLOGY

According to the national survey results, dental caries prevalence for 5-6 year-old children decreased from 89.38% (1997) to 79.32% (2011) (Figure 1). In the meantime, deft index decreased from 7.31 to 5.44 (Figure 2). It is clear that much more efforts are indicated to meet the target for the year 2000 set by WHO for the 5-year-old that caries prevalence should be less than 50%.

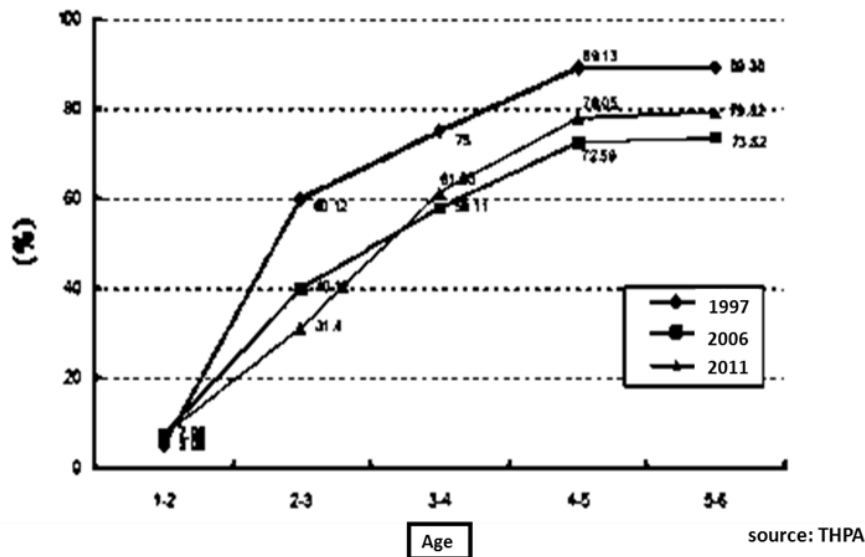


Figure 1: Secular trend of prevalence of dental caries among preschool children in Taiwan, 1997-2011.

³⁵ Associate Professor, Department of Dentistry, National Yang-Ming University, Taipei, Taiwan.
Email: Lin-Yang CHI <chily@ms.ym.edu.tw>

³⁶ President, Association for Dental Sciences, R.O.C., Professor & Director, Department of Prosthodontics, School of Dentistry, China Medical University Taichung, Taiwan.
Email: ljfuh <ljfuh@mail.cmu.edu.tw>

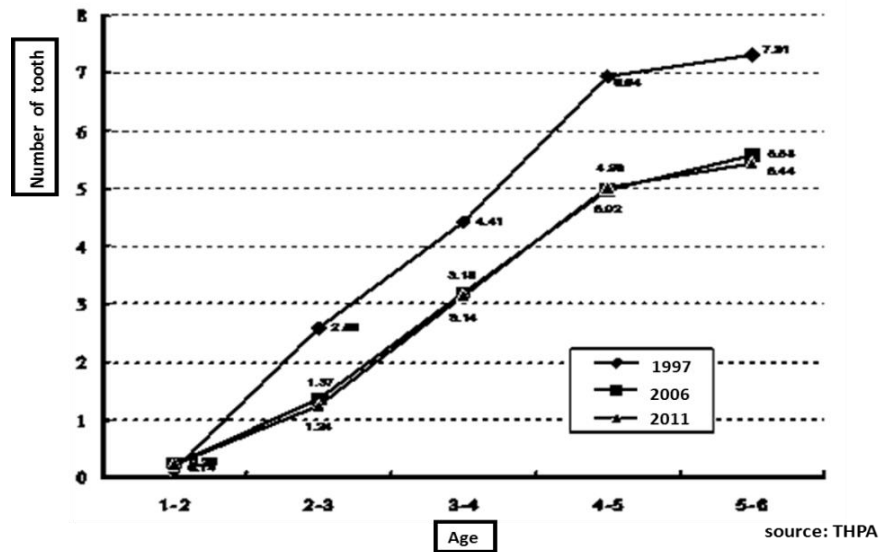


Figure 2: Secular trend of deft among preschool children in Taiwan, 1997-2011.

Table 1: DMFT and DMFS of schoolchildren in Taiwan, 2006

Age (year)	DMFT index	DMFS index
6	0.25	0.33
7	0.48	0.60
8	0.94	1.18
9	1.07	1.50
10	1.33	1.88
11	2.00	2.79
12	2.58	3.91

While the WHO goal for 12-year-old in 2000 was DMFT less than 2.0, schoolchildren in Taiwan did not meet that goal in 2006. The DMFT of 12-year-old in Taiwan was 2.58 and DMFS 3.91 in 2006 (Table 1). It should be noted that DMFT is a composite index and changes in its value need to be interpreted cautiously. For example, Taiwan had its National Health Insurance launched in 1995, which provided most dental services, including operative dental services, to more than 98%

of its 23 million population. While the decrease in total DMFT was not satisfactory, the significant increase in F (Filling) component needs to be taken into consideration (Table 2).

Table 2: DMFT and its components of 12-year-old in Taiwan, 2000-2012

Year	DMFT	DT	MT	FT
2000	3.31	1.35 (41%)	0.03 (1.0%)	1.93 (58%)
2006	2.58	1.15 (45%)	0.12 (5.0%)	1.31 (51%)
2013*	2.50	0.82(33%)	0.01 (0.4%)	1.67(67%)

* preliminary results

Source: YH Huang (2013)

Table 3: Prevalence of dental caries and DMFT among people aged 18+ in Taiwan, 2004 (N=2660)

	Prevalence			DMFT		
	n	%	p-value	mean	SD	p-value
Gender						
Male	1145	84.64	<0.0001	7.1	6.94	<0.0001
Female	1196	91.46		9.73	6.84	
Age group						
18-34	842	83.63	<0.0001	6.59	7.93	<0.0001
35-44	397	90.91		7.27	6.01	
45-49	405	88.94		7.85	7.14	
50-64	488	92.48		9.99	6.49	
65-74	150	92.41		15.81	5.3	
75+	59	82.47		15.45	5.68	
Area						
Metropolitan	184	94.24	<0.0001	9.20	5.19	0.0312
City	393	95.55		8.90	7.18	
County	1724	85.79		8.25	7.96	
Mountainous village	40	90.1		6.49	2.08	
Total	2341	87.99		8.39	7.01	

Source: YH Yang (2006)

Prevalence of dental caries among elderly people (65 years old and over) in Taiwan was 89.36% in 2004, with mean±SD of DMFT index as 15.71±5.43. There was significant urban-rural difference as 9.20±5.19 and 6.49±2.08, respectively (P<0.0001) (Table 3).

While women had a higher prevalence (61.24%) of filling for dental caries than men (47.87%), men had in average more remaining teeth (24.03±6.41 teeth) than women (22.41±6.70 teeth) (p<0.0001). Those aged 65+ had a lowest filling rate (43.55%) and least remaining teeth (14.35±5.65 teeth) among all age groups (both p<0.0001).

Table 4: Prevalence of filling for dental caries and the number of remaining teeth among people aged 18+ in Taiwan, 2004 (N=2660)

	Prevalence of Filling			No. of remaining teeth		
	mean	SD	p-value	mean	SD	p-value
Gender						
Male	47.87	40.16	<0.0001	24.03	6.41	<0.0001
Female	61.24	35.91		22.41	6.70	
Age group						
18-34	56.28	58.56	<0.0001	25.70	6.06	<0.0001
35-44	57.01	38.75		24.58	4.73	
45-49	58.08	43.66		23.65	6.05	
50-64	52.09	31.65		21.00	6.09	
65-74	46.33	21.40		14.31	5.69	
75+	36.50	18.01		14.43	5.60	
Area						
Metropolitan	39.64	26.68	<0.0001	24.77	4.26	0.004
City	58.85	43.81		22.75	7.34	
County	56.09	42.48		23.17	7.51	
Mountainous village	23.54	13.73		23.86	1.67	
Total						
Total	54.70	38.46		23.23	6.62	

Source: YH Yang (2006)

As far as living area was concerned, people living in the mountainous areas had a lowest filling rate (23.54%), while people living in cities had least remaining teeth (22.75±7.34 teeth) (p<0.0001 and p=0.004, respectively) (Table 4). Women had a higher prevalence of edentulism (2.2%) than men (1.2%) (p=0.067). As would be expected, those aged 65+ had the highest prevalence of edentulism (13.6%) among all age groups (p<0.0001). Adult inhabitants living in metropolitans had a

higher prevalence of edentulism (2.6%) than those living in mountainous villages, but the difference was not statistically significant ($P=0.67$) (Table 5).

Table 5: Prevalence of edentulism among people aged 18+ in Taiwan, 2004 (N=2660).

		Edentulism			
		n	case	%	p-value
Gender	Male	1353	17	1.2	0.067
	Female	1307	28	2.2	
Age group	18-34	1007	0	0	<.0001
	35-44	437	1	0.2	
	45-49	455	5	1.1	
	50-64	527	8	1.5	
	65-74	163	19	11.7	
	75+	72	13	18.1	
Area	Metropolitan	195	5	2.6	0.67
	City	411	8	2.0	
	County	2009	32	1.6	
	Mountainous village	45	0	0.0	
Total		2660	45	1.69	

Source: YH Yang (2006)

Table 6: Oral health status of disabled people in Taiwan, 2005

Age	DMFT	DT	MT	FT	% Caries	% Filling
12	3.14	1.95	0.39	0.80	69.43	35.93
13-18	6.60	3.98	0.58	2.04	87.89	36.06
19-44	10.31	4.67	3.29	2.35	93.27	32.86
>44	17.68	4.68	11.50	1.50	98.73	20.70

Source: National oral health survey of disabled people in Taiwan (2005)

There were 953,214 registered disabled people in 2006, which accounted for 4.2% of the total population. The DMFT of the 12-year-old disabled people were 3.14, in which DT was 1.95 (62.1%) – both were significantly higher than their counterparts in the non-disabled population. However, the FT component was 0.80 (25.5%) and significantly lower than the nondisabled population (1.17 and 45.3%), indicating that there was a disparity in oral health services provided

to and/or used by the disabled population (Table 2, 6 and 7).

Table 7: Oral health status between disabled and non-disabled people aged 6-18 in Taiwan, 2005.

Age	DMFT		DT		MT		FT	
	ND	D	ND	D	ND	D	ND	D
6	0.20	0.21	0.12	0.18	0.00	0.01	0.09	0.02
9	1.36	1.64	0.52	1.11	0.06	0.17	0.78	0.37
12	2.58	3.14	1.20	1.95	0.13	0.39	1.17	0.80
15	4.67	6.22	2.39	3.79	0.19	0.58	2.09	1.84
18	4.92	7.44	1.87	4.19	0.30	0.69	2.75	2.57

Source: National oral health survey of disabled people in Taiwan (2005)

COMMUNITY DENTAL CARIES PREVENTION PROGRAM

Topical fluoride application has been one of the most effective measures to prevent dental caries. Fluoride varnish, used by dentists to prevent caries for more than three decades, has been shown to reduce caries in the permanent dentition by 46% and primary dentition 33%. Taiwan Health Promotion Administration (THPA), Ministry of Health and Welfare, has provided topical fluoride application service to all children aged 5 years or less twice a year since 2004, extended to those aged 6 years or less in 2013.

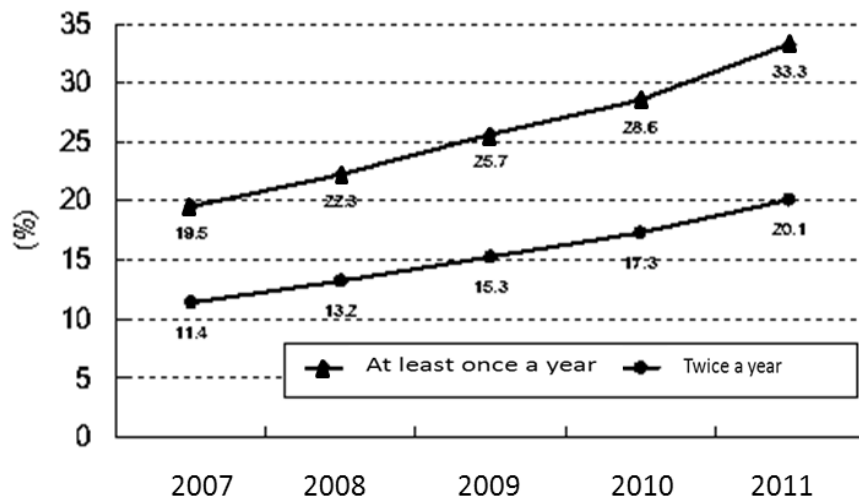


Figure 3: Utilization rate of topical fluoride application service among preschool children in Taiwan, 2007-2011

For children of special need, including those of low-income families, indigenous areas, remote areas, and those disabled, the service has extended to 12-year-old and four times a year. The utilization rate increased from 11.4% in 2007 to 20.1% in 2011 (figure 3), and THPA expected to significantly improve the utilization rate by sending dentists into the kindergartens/nurseries since 2013.

Studies have shown that more caries happened in occlusal surface of posterior teeth than on smooth surfaces. Pit & fissure sealant (PFS) has been regarded as a more effective measure to prevent occlusal caries than fluoride-containing materials. Traditionally public PFS programs have been offered to targeted groups of high risk in developing dental caries, partly due to its relatively high cost. THPA launched a free PFS service to the underprivileged schoolchildren since 2010, and is preparing to extend the service to all first-grade schoolchildren (around 195,000 children) in Taiwan starting from 2014.

Being unable to fluoridate drinking water, Taiwan Dental Association (TDA) has chosen to promote fluoridated mouthwash in primary schools as an alternative strategy to prevent dental caries since 1997 with sponsorship from the government. An earlier pilot study carried out by Taiwan Academy of Pediatric Dentistry showed that daily use of 0.05% NaF mouthwash had a better effect of caries reduction (44%) than weekly use of 0.2% NaF mouthwash (36%). However, the later scheme was chosen due to administrative considerations. For the past 16 years more than 98% of Taiwan's 1.9 million schoolchildren used 10c.c. mouthwash containing 0.2% NaF after lunch weekly during school days (Table 8).

In fact, TDA has done a lot in oral health education. National oral hygiene skill competition of schoolchildren had been one of the major yearly events to promote schoolchildren's motivation of oral hygiene from 1993 to 2004. The competition grinded to a halt due to shortage of government budget and changes in health promotion strategy.

Table 8: Coverage rate of NaF mouthwash program of schoolchildren, 1997-2004.

Year	No. of Counties & Cities	No. of Schools	No. of Students	Coverage rate (%)
1997	10	34	40,640	2.1
1998	13	48	52,281	2.7
1999	16	368	457,773	23.8
2000	21	1,959	1,414,000	73.4
2001	25	2,429	1,819,495	94.5
2002	25	2,632	1,903,357	98.0
2003	25	2,627	1,883,509	98.2
2004	25	2,638	1,882,186	98.4

The Ministry of Education (MoE) launched Health Promoting School (HPS) program in 2005, and 'oral health' has been listed as one of nine optional themes. More than one third of the HPSs chose oral health as their focus in 2006. MoE tried to establish a network of school dentists in 2009, which ended up with less than 20% of the 2500 primary schools did find a school dentist, and the program is practically suspended now.

HOME CARE FOR DENTAL CARIES CONTROL

A national campaign 'National Oral Health Week' will take place during the last week of October since 2010. The national associations of dentists join forces with TPHA to provide the latest information of the epidemiology of oral diseases and methods of prevention. In addition to brushing teeth regularly with fluoridated toothpaste, people are also advised to use dental floss to promote periodontal health. Bass method has been chosen as the 'standard method' of brushing teeth. However, people are also encouraged to visit dentists every 6 months to discuss the best way to keep their oral hygiene in a high standard. It should be noted that Taiwan's national health insurance provide most of dental services free of charge to about 98% of the national population except the prosthetic and orthodontic treatment.

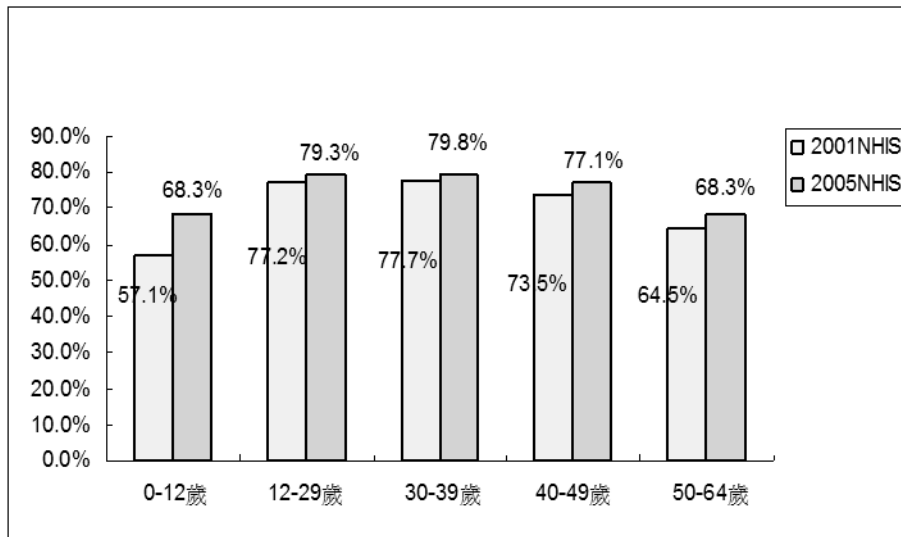


Figure 4: Percentage of people brushing their teeth before sleep by age group in Taiwan, 2001 and 2005 (source: TPHA)

According to a national survey carried out by TPHA in 2005, about one quarter of the population went to bed in the night without brushing their teeth. Compared to the survey results in 2001, there was a significant improvement in the percentage of people brushing their teeth every day (98.2% in 2005), mean number of toothbrushing per day (1.87 times in 2005), and the percentage of people using dental floss regularly (17.8% in 2005). The improvement was most obviously among those aged 12 and less. Females performed better than males and the better the education the better the oral hygiene practice.

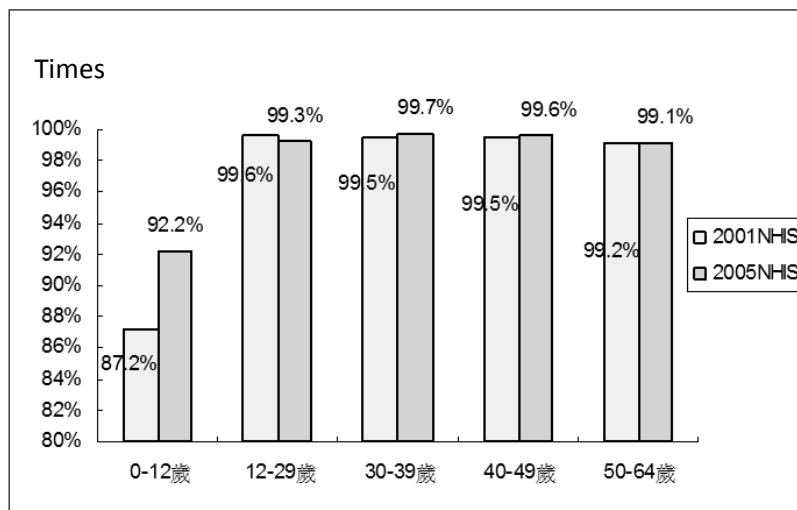


Figure 5: Percentage of people brushing their teeth everyday by age group in Taiwan, 2001 and 2005. (source: TPHA)

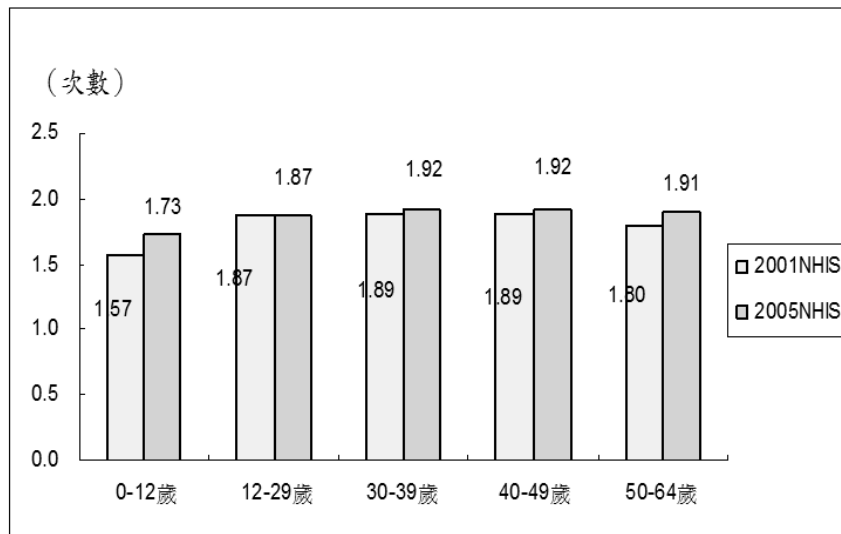


Figure 6: Mean number of toothbrushing per day by age group in Taiwan, 2001 and 2005 (source: TPHA)

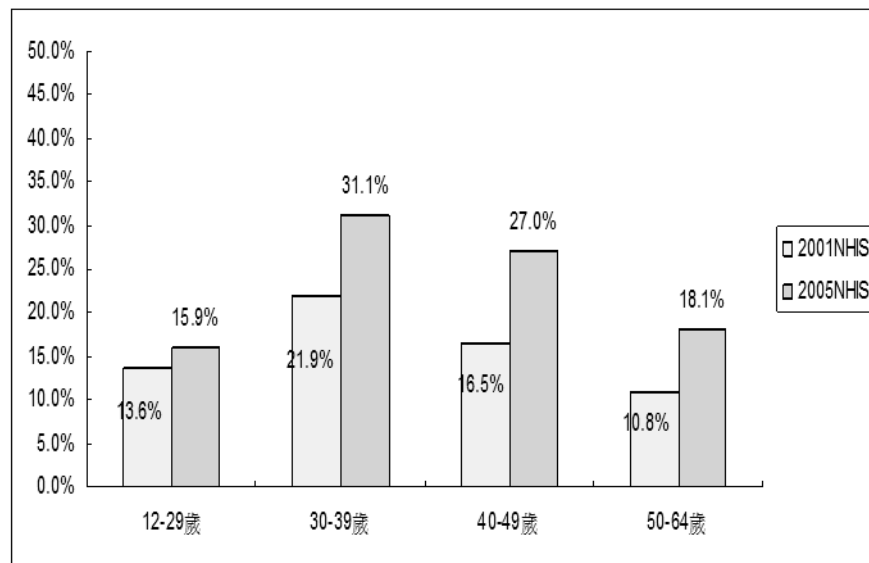


Figure 7: Percentage of people flossing their teeth every day by age group in Taiwan, 2001 and 2005 (source: TPHA)

DENTAL EDUCATION IN CARIOLOGY IN DENTAL SCHOOL

There are 7 universities in Taiwan boast a department of dentistry – 5 of them have a school of dentistry/Stomatology. Most of the undergraduate students came from local high schools, and studied for 6 years (including 1-year internship) before graduation. Cariology is not offered as an independent course but instead the relevant

knowledge and discussion are disseminated into many required courses such as: oral histology, oral pathology, oral radiation, operative dentistry, endodontics, and dental public health. Almost every dental department in Taiwan offers postgraduate course – most of them focus on specialties of clinical dentistry, and some of them have an independent institute of oral medicine/biology for studying basic dental sciences.

REFERENCES

- Chen HS et al. National oral health survey for the disabled people in Taiwan, 2005.*
- Yang YH et al. National oral health survey for adults and elderly people, 2006.*
- Huang ST et al. National oral health survey for children and adolescents in Taiwan, 2006.*
- Huang ST et al. National oral health survey for preschool children aged less than 6 years old, 2012.*
- Chiou YC et al. Report on the National Fluoridated Mouthwash Anti-caries program for schoolchildren, 2012.*
- Huang YH et al. National oral health survey for children and adolescents in Taiwan, 2013 (preliminary report).*
- Administration of Health Promotion, Ministry of Health and Welfare, <http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicArticle.aspx?No=200811210013&parentid=200811100003>, visited on 2013.10.25*
- Administration of Health Promotion, Ministry of Health and Welfare, <http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicArticle.aspx?No=200811210014&parentid=200811100003>, visited on 2013.10.25*
- Administration of Health Promotion, Ministry of Health and Welfare, <http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicArticle.aspx?No=201212170001&parentid=201003040001>, visited on 2013.10.25*
- Administration of Health Promotion, Ministry of Health and Welfare, <http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicArticle.aspx?No=200811210016&parentid=200811100003>, visited on 2013.10.25*
- Administration of Health Promotion, Ministry of Health and Welfare, <http://www.bhp.doh.gov.tw/BHPNet/Web/HealthTopic/TopicBulletin.aspx?id=201305210001&parentid=200712250070>, visited on 2013.10.25*
- Administration of Health Promotion, Ministry of Health and Welfare, <http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicBulletin.aspx?No=201203140001&parentid=201003040001>, visited on 2013.10.25*

*Administration of Health Promotion, Ministry of Health and Welfare,
<http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicBulletin.aspx?No=201203140002&parentid=201003040001>, visited on
2013.10.25*

*Administration of Health Promotion, Ministry of Health and Welfare,
<http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicArticle.aspx?No=201011180001&parentid=200811100002>, visited on
2013.10.25*

*Administration of Health Promotion, Ministry of Health and Welfare,
<http://www.hpa.gov.tw/BHPNet/Web/HealthTopic/TopicArticle.aspx?No=201011180001&parentid=200811100002>, visited on
2013.10.25*

THAILAND

*Sutha JIENMANEECHOTECHAI
Chantana UNGCHUSAK
Supranee DALODOM
Piyada PRASERTSOM
Oranart MATANGKASOMBUT*

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

THAILAND

Sutha JIENMANEECHOTECHAI³⁷

Chantana UNGCHUSAK³⁷

Supraanee DALODOM³⁷

Piyada PRASERTSOM³⁷

Oranart MATANGKASOMBUT³⁸

ORAL HEALTH STATUS

For over 20 years since 1977, the Bureau of Dental Health has been responsible for the national oral health survey in every 5 years to acquire important dental health status of Thai people. The survey data have been used for planning, evaluation, service provision, and adjusted operational strategies. In addition to the national survey, the Department of Health support for provincial-based oral health survey as a baseline for setting priorities and adjusted operational plan in the areas.

The results of the suggested that dental caries status of Thai people tends to improve slightly over the past decade, i.e. reduced tooth decay in children, increased functional teeth in adults and elderly, and reduced tooth loss.(Table 1, 2, Figure 1-3) Regarding the prevalence of dental fluorosis, data revealed 5.8 % in 12 years old. The level of severity was very mild and mild level according to Dean’s index (Table 2). The major sources of over fluoride consumption is underground water. There was 0.9 % of drinking water sources containing fluoride more than 4 milligrams per liter.

³⁷ Bureau of Dental Health, Department of Health, Ministry of Public Health, Nontaburi.
Email: Sutha Jienmaneechotechai <suthajien@gmail.com>,
Chantana Ungchusak <uchantana@gmail.com>,
Supraanee Dalodom <supraanee.d@anamai.mail.go.th>,
Piyada Prasertsom <pprasertsom@gmail.com>

³⁸ Faculty of Dentistry, Chulalongkorn University,
Email <Oranart Matangkasombut@ <noon.oranart@gmail.com>

Table 1a: Oral health status of Thai population by prevalence of dental caries (%), National oral health survey 1984-2012.

Age (yrs)	% Prevalence of dental caries					
	1984	1989	1994	2001	2007	2012
<i>Primary teeth</i>						
3	-	66.5	61.7	65.7	61.3	51.7
5	-	-	-	-	80.6	-
5-6	71.6	-	-	87.4	-	78.5
6	-	83.1	85.1	-	-	-
<i>Permanent teeth</i>						
12	45.8	49.2	53.9	57.3	56.9	52.3
15	-	-	-	62.1	66.3	62.3
18	63.1	63.3	-	-	-	-
17-19	-	-	63.7	-	-	-
35-44	80.2	76.8	85.7	85.6	89.6	86.7
≥60	95.2	93.9	-	-	-	-
60-74	--	-	95.0	95.6	96.1	97.1

Table 1b: Oral health status of Thai population by mean no. of decay, missing and filled teeth, National oral health survey 1984-2012.

Age (yrs)	Mean no. of decay, missing and filled teeth					
	1984	1989	1994	2001	2007	2012
<i>Primary teeth</i>						
3	-	4	3.4	3.6	3.2	2.7
5	-	-	-	-	5.4	-
5-6	4.9	-	-	6	-	4.4
6	-	5.6	5.7	-	-	-
<i>Permanent teeth</i>						
12	1.5	1.5	1.6	1.6	1.6	1.3
15	-	-	-	2.1	2.2	1.9
18	3.0	2.7	-	-	-	-
17-19	-	-	2.4	-	-	-
35-44	5.4	5.4	6.5	6.1	6.7	6.0
≥60	16.3	16.2	-	-	-	-
60-74	-	-	15.8	14.4	15.8	14.9

Table 2: Mean decayed (dt, DT) missing (mt, MT) and filled (ft, FT) teeth by indexed age group, 2012.

Age (yrs)	No. of teeth present	Decayed dt, DT	Missing mt, MT	Filled ft, FT	DMFT, dmft
3	19.93	2.57	0.05	0.06	2.68
5	20.04	3.98	0.13	0.26	4.37
12	26.16	0.55	0.04	0.72	1.34
15	27.70	0.89	0.09	0.97	1.95
35-44	28.27	0.77	3.69	1.57	6.04
60-74	18.81	1.41	13.19	0.44	15.03
80-89	8.92	1.24	23.08	0.09	24.41

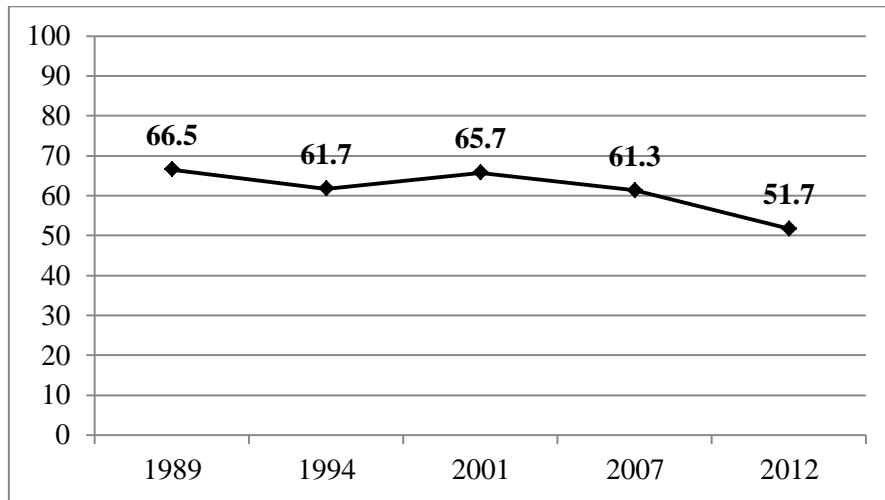


Figure 1: Trend of dental caries in 3 years old children, National oral health survey 1994-2012

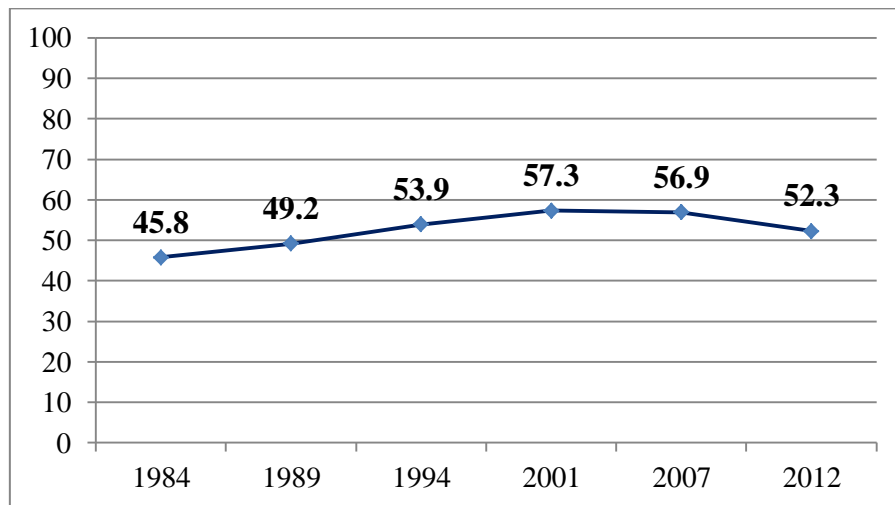


Figure 2: Trend of dental caries in 12 years old children, National oral health survey 1994-2012

Table 4: Prevalence of dental fluorosis in 12 years old children
1984-2012

Region	Year					
	1984	1989	1994	2001	2007	2012
Urban	8.8	4.7	13.7	11.2	6.1	12.4
Rural	18.7	9.4	18.6	10.4	5.6	7.2
Country	16.8	8.2	17.0	11.6	5.8	9.2

Tooth loss is the main problem in adult and elderly. WHO has set “20 functional teeth” as the key indicator of oral health in these groups. National data revealed that more than 90% of Thai adults had at least 20 teeth in their mouth but half of the teeth were rapidly lost in elderly. However, the situation became better in each survey (Figure 4). Although, tooth loss situation was gradually declined, there was still a group of edentulous mouth in elderly requiring rehabilitation for their quality of life improvement (Figure 5).

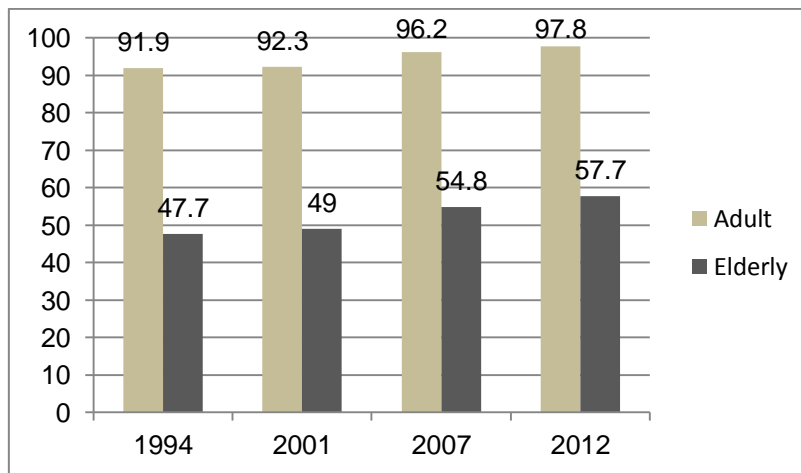


Figure 4: Percentage of adult and elderly with 20 functional teeth,
1994-2012.

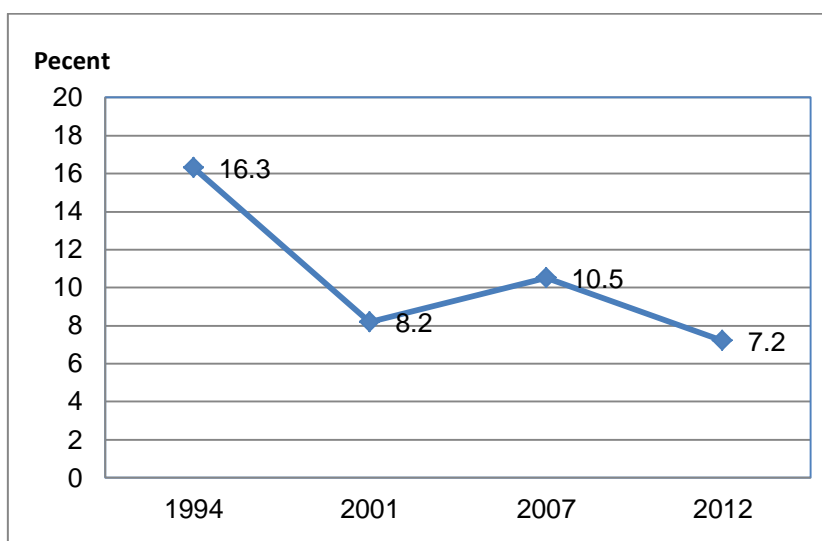


Figure 5: Percentage of Thai Elderly with edentulous mouth

MAJOR ORAL HEALTH PROMOTION AND PROVENTION PROGRAMS

1) Promotion and prevention programs for pregnant women and children 0-5 years

The Thai government has major concerned with addressing the tooth decay problem among children as it may pose adverse effect on children's oral health, general health and development. The intervention to control dental caries in primary teeth was initiated as a part of the Dental Health program in the 1992-1996 National Health Development Plan with subsequent intervention programs/projects every 3 - 5 years. In 2013, the Ministry of Public Health announced a policy to prevent and control tooth decay among the childhood. The national indicator was set and targeted to reduce prevalence of dental caries in primary teeth. The indicator is "By 2014, no more than 57% of early childhood (3 years old) having tooth decay". In line with this, dental care services were identified which include oral cavity check-up; skill trainings on tooth brushing for caregivers; children with high risk of tooth decay receiving fluoride varnish application or other suitable forms.

Major activities for this target group include:

1) *Promotion and prevention service for pregnant women.*

Pregnant women are entitled to receive a periodontal examination and oral hygiene instruction, as well as an essential treatment according to the benefit package of the Universal Health Care Coverage. These services are integrated into ANC clinic.

2) *Promotion and prevention service for children 0-2 years.*

The service is integrated into the well-child clinic. Children receiving immunization program are transferred for further oral health check-up for hygiene and early stage tooth decay, with a plan for continuous service and care. Parents will be advised and trained how to brush the child's teeth. Children with any tooth decalcification (white spot) found will receive locally application of fluoride such as fluoride varnish or other suitable forms, with follow-up appointments up until 3 years old.

3) *Promotion and prevention service for children 3-5 years.*

Dental health promotion service is incorporated into other health care in the day care center for early childhood or pre-school children. The service activities include daily tooth brushing after lunch, control of sugary diets, and oral health checkup by dental personnel for 2 times a year.

4) *Set up a community-based surveillance for primary tooth decay*

In addition to institutionalized services, Thailand makes use of village health volunteers (VHVs) to help monitor tooth decay among children at family and community levels. The VHVs serve to locate potential children at high risk of tooth decay, and inform parents for early prevention by brushing teeth with fluoridated toothpaste. Oral health check up is combined with other health care activities such as weigh measuring to monitor nutritional status. (For details, see section 4.5 on *Village Health Volunteers*).

5) *Communication campaigns on "Good teeth begins at first tooth"*

Due to the high rate of primary tooth decay and parents' lack of understanding and concern of primary teeth care, educational campaigns are conducted to create social trends through various forms of media so as to raise awareness on dental care by starting from the first erupted tooth. The campaigns are undertaken in collaboration of the Department of Health, the National Health Security Office, and the Thai Health Promotion Foundation.

2) School oral health promotion and preventive dentistry.

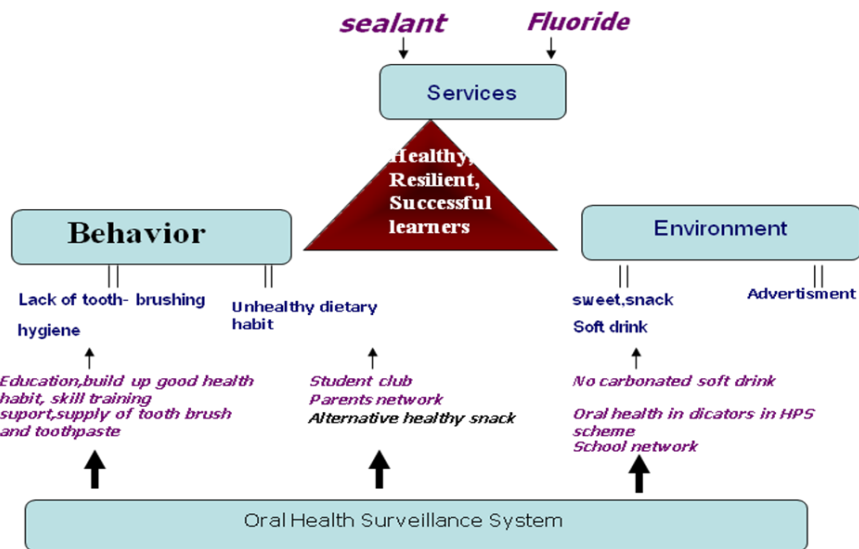


Figure 6: Thailand School Oral Health Program Strategies

Oral health prevention and promotion in school-age children has long been implemented continuously for more than three decades. During the first decade (1977-1987), the focus was on the incremental dental care by school dental nurse. However, because of less coverage of care, the second decade (1988-1998) had introduced the school-based dental health surveillance by utilizing available data to solve dental health problem on school own effort, along with improving skills in oral health care. During the third decade up until the present, under the framework of "health promoting school to promote healthy behaviors among Thai children", the programs on tooth

brushing, proper diets (reduced flour and sugar) and enhanced health literacy for children have been undertaken using 3 key strategies. They are after lunch tooth brushing with fluoridated toothpaste in school; food environmental management in school' and organizing curriculum-based learner development activities (Figure 6).

1) *Development of school network of Thai healthy teeth student.*

It aims to establish a school network to carry out dental health promotion in school. The high potential school serves as a host school and advocates surrounding schools to work together to promote school dental health by involving teachers, parents, students, and the communities. In each year, there are learning and sharing activities in the school- network with successful experience, as the learning source for other schools.

2) *Campaigns and policy recommendations for "No-Soda School"*

In order to reduce risks of obesity and oral health problem, campaigns have been conducted to encourage schools to stop selling carbonated drinks, sugared drinks, and crunchy snacks in school by urging through the education area offices to take action so that all schools in their respective areas become 'No-Soda Schools' (More details in section 5.4 on *Sweet Enough*).

3) *Collaborative work with the private sector (Public-private mix)*

The school dental health promotion program is operated with the cooperation from the Colgate-Palmolive, Thailand to initiate the "Bright Smile Bright Future" project, for which materials/media, toothbrushes and toothpastes are supported by the private sector.

4) *Fluoridated milk for preventing dental caries*

It was started in the year 2000 as a collaborative project between the Department of Health, the Royal Chitralada Projects, the World Health Organization, and the Borrow Foundation. Fluoride is added to milk provided under

the school supplementary food (milk) project in order to prevent tooth decay in children 4-12 years. Evaluation of early phase in Bangkok reported that among children who drink fluoridated milk for 5 consecutive years, the effect on reducing permanent tooth decay is 34.4% higher than among children who did not drink fluoridated milk. Based on this, the project has then been expanded to the provincial level in Chumphon, Khon Kaen, Surat Thani, Sa Kaeo, Chonburi, Krabi and Phatthalung, covering approximately 954,901 children within 13 years. Moreover, this project also serves to help develop the fluoridated milk project in foreign countries such as Korea, Malaysia, Brunei and Mongolia.

3) Oral health promotion program in elderly

Thailand is moving toward an aging society and expected to be aged society in 2025. Nowadays, the number of older people 60 years and more is 9.5 million persons or 14.7 percent which increase about 200,000 persons every year. A higher proportion of elders cause higher prevalence of Chronic Diseases, such as diabetes, hypertension and oral diseases with common risk factors and need more complexity care than the younger.

Tooth loss is the main oral health problem in aging population especially complete tooth loss that related to eating, chewing and swallowing abilities, affected to poor nutrition, unhealthy and low quality of life. The 7th National oral health survey in 2012 reported that the elders who have at least 20 functional teeth is increased from 49% in 2001 to 58% in 2012 but there were still 8.2% who lost all of their teeth and 2.5% or 250,000 older people needed Complete dentures. Moreover, oral hygiene behavior is less effective to prevent tooth loss. Bureau of Dental Health has launched Oral Health Programs since 2005 to improve their oral health by increasing proper functional teeth (at least 20 permanent teeth or 4 posterior occlusal pairs). Networking co-operation, oral health services system towards Comprehensive care, Building the capacity of health personnel and key persons in the community, National policy and Campaign to advocate social response, Model development and knowledge management, were used as Basic strategy. Oral Health Programs related to the Quality of Life for Aging Population are as follows.

1) *The Royal denture project.*

To celebrate on the auspicious occasion of His Majesty the King, oral health promotion and rehabilitation service for Thai elderly was initiated. This program correspond to the King's speech that concerning on oral health issue of Thai people "Persons who lose their teeth, it's difficult to enjoy food, which make them feel unhappy, mental health is ill and becomes weakened". The objectives of the program are to provide more coverage in the complete denture service and to develop proper promotion & prevention model for Thai elders. Since 2005, complete denture service covers more than 300,000 elders all over the country or 35,000 persons each year.

2) *Elderly club for oral health promotion.*

In 2006, the Bureau of Dental Health offered a development program for elderly club to arrange the activities for oral health promotion of members. Initially, 32 model clubs were developed and have been progressively expanded up until today with 2,620 clubs nationwide, covering more than 500,000 older people.

3) *Promotion and prevention services by District health promoting hospital.*

In 2008, the Bureau of Dental Health mobilized the district-based services of oral health promotion and prevention among the elderly group. The activities included oral health examination and risk group screening, oral hygiene instruction, plaque control, fluoride application to prevent root caries, cleaning and polishing to prevent acute periodontal disease. In 2012, the project covered 970 District health promoting hospital.

4) *Integration with health promotion for the elders.*

The Department of Health, Bureau of Health promotion, has set 5 standards of healthy elder which include *a)* physical, mental, and social well-being; *b)* 20 functional teeth or 4 posterior occlusal pairs; *c)* BMI in the normal range; *d)* regular physical activities and *e)* Activities of

daily living indicated that they can live by themselves. In 2010, oral health prevention and promotion had been expanded to the subdistrict level as an activity integrated with health promotion for the elders such as long-term care activities, health promoting temple aiming at achieving healthy elder.

5) *National Geriatric dentistry plan 2014-2021.*

In 2012-2013, the National Geriatric dentistry plan had been formulated as a collaborative plan between the Ministry of Public Health, the King's Dental Innovation foundation, and the Ministry of Education. The plan consists of:

Strategy 1: development of model, system and quality of comprehensive oral health care;

Strategy 2: research and development of innovations for geriatric oral health care;

Strategy 3: geriatric dentistry courses or special training for health personnel and

Strategy 4: management, including monitoring and evaluation system.

The National Geriatric Dentistry Plan will improve the following status: tooth loss, untreated dental caries including coronal and root caries, periodontal disease and poor oral hygiene, oral cancer and mucosal lesions, attrition, xerostomia and other condition related to non chronic disease.

4) Campaigns for policy movement to reduce consumption of sweet diet (Sweet Enough)

The database suggested that in 2002, Thai people consumed sugar 3 times higher than that of WHO's recommendation. Based on this situation, a number of dentists, pediatricians and academicians of various disciplines who are concerned with the adverse health effect on Thai children due to excessive consumption of sugar, had joined together and run the campaign for policy movement to reduce consumption of sweet diets. The campaign took various forms to raise Thai social awareness and to invoke policy and legal movement to reduce over sugar consumption habits among Thai children. The

operation received support from the Department of Health and the Thai Health Promotion Foundation (ThaiHealth).

Operation strategies: Based on the mountain-moving-triangle concept initiated by Prof. Emeritus Dr. Prawet Wasi, relevant knowledge and information are utilized for this movement.

1) *Creating and management of knowledge.*

The operations of networks was focused on the search of knowledge and to propose policy issues that would affect reduced sugar consumption in children; survey of main food sources of sugar and amount received by children; opinion survey among dentists and pediatricians toward the campaign to reduce sweet consumption in children; review of knowledge on measures to reduce sugar consumption in oversea countries; and research & development of implementation model to reduce sugar consumption in different settings (e.g. schools, child development centers, hospitals, local administrative organization, etc.)

2) *Campaign among children using the alternative procedures (Wisdomization with imagination)*

This includes the trial of campaign model focussing on the participation of target groups, along with the social marketing process; attending lectures offered by various organizations; campaigns at both the national and local levels. The modes of the campaign include displays, public information programs through local media (cable TV, newspapers, radio)

3) *Policy Pressure*

This is to explore relevant proclamations/laws/ ministerial regulations that should be revised to facilitate reduced sugar consumption, for example:

- a) *The Ministry of Public Health's Notification No. 286, 287:* In 2004, it was proposed that the MOPH's regulations be revised to prohibit sugar adding in the follow-up formula milk, which was resulted in the change in 2006 approving the revision of ministerial's regulations as stated in its

notifications No.156 and 157 to No.286 and 287 that prohibit sugar adding in the follow-up formula milk.

- b) No-Soda School: It was proposed that the Ministry of Education announces the No-Soda School policy, and as a result, the education area offices throughout the country were informed to implement No-Doda School by discontinuing the sale of soda drinks, chunky snacks and high-sugared drinks.
- c) Healthy meetings: The MOPH and WHO Thailand collaborated in the research study and recommended that proper food for meeting's breaks should be provided together with the body stretching during the meetings. Accordingly, there were organizations and hotels that made an agreement as a model to adopt the healthy meeting approach and serve fruits/low calorie food.
- 4) *Ministry of Public Health's Notification No. 305*: On the suggestion that the Food and Drug Administration defines a simple food label spelling out the content of sugar, fat, energy, and sodium, the Ministry of Public Health's Notification No. 305, B.E. 2550 (2007) provided that 5 categories of snacks, i.e. fried or baked potato, popcorn, crisp rice or crunchy/extruded snacks, crackers or biscuits and assorted wafer require a nutrition label with warning "Consume less and exercise for health"
- 5) *Building an area-based campaign network*: It was aimed to develop campaigns that suit the economic and social context in a particular area and to bring about movement of on-going implementation. It encourages area-based model development. For example *No Sugar Day*: Snacks, drinks or sugar condiment is not allowed to be sold in schools for one campaign day in a week. *Reducing sugar supply in the school's kitchen*: Schools have a policy to reduce the purchase of sugar for school's cooking and in turn reduced consumption of sugar and expenses. *Changing the expenses into savings*: Schools encourage students to save their money for

snacks and eat less snacks while practicing money saving, and coordinate with the local banks to support student activities.

The campaign network for less sugar consumption in Thai children employed the key strategy of policy process developed from major problem issues as the causes of excessive sugar consumption among children; developed the models, innovations and media promote health literacy and change the mindset of Thai people to practice proper consumption behavior; and conduct research & development to offer snacks/drinks alternatives to the society.

5) Village health volunteers (VHVs) and dental health work.

The VHVs are those with voluntary spirits to assist in community health care. They are selected by the villagers and attended basic training program arranged by the Ministry of Public Health. At present, there are totally 980,000 VHVs all over the country of which 10–20 VHVs are located in each village. The VHVs play vital roles as change agents of health behavior, convey health information, give advice and disseminate knowledge, plan and coordinate public health development activities. They also provide health services such as health promotion, disease surveillance and prevention, first aid and primary care, provide drugs and supplies as defined by the Ministry of Public Health, refer cases for services and rehabilitation, and organize public sector's health activities in the village/community.

The scope of work engaged by VHVs covers 14 elements including:

- 1) Nutrition,
- 2) Health education,
- 3) Treatment and care,
- 4) Provision of essential drugs,
- 5) Sanitation and clean water supply,
- 6) Maternal and child health and family planning,
- 7) Local communicable disease control and prevention,
- 8) Immunization promotion,
- 9) Dental health promotion,
- 10) Mental health promotion,
- 11) Environmental health promotion,
- 12) Consumer protection,

- 13) Prevention and control of accidents, disasters, and non-communicable diseases, and
- 14) AIDS

In 2012, VHVs' capacity building was implemented by offering VHVs specialized training programs. These programs were intended to be conducted by the provincial health offices to correspond their local problem situation. In 2013, the dental health specialized program was added and the training has been extended to improve VHVs' knowledge, skills, and expertise in dental health promotion. This is a part of the movement to promote people's good oral health and their capability to take care of themselves and family members especially children and the elderly to change health behavior. Finally, social measures were collectively established and management mechanism was in place to facilitate better community health care system.

HOME CARE FOR DENTAL CARIES CONTROL

Fluoride tooth paste is common among Thai. Most of toothpastes in the market are fluoridated. The fluoride content in tooth paste normally sale in Thailand is 1000 *ppm* according to FDA regulation. Data from the recent survey reported that most of Thais used fluoride toothpaste in their daily life. There were 91.4% of school children used fluoride toothpaste. The figure decreased with age. There were 89.5% in adolescent (15 yrs), 81.0% and 80.7% in adult and elderly respectively. Mouth-rinsed was not common among Thai people, especially commercial mouth-rinse. There was 27.2% and 14.6% of adult and elderly in the recent survey reported to use mouth-rinse in their daily self-cleansing.

The major problem of home care is the effectiveness of tooth brushing. Although toothbrushing twice daily is common knowledge among people but there were approximately 5% of people who didn't brush their teeth daily. Moreover the quality of tooth brushing is not clean enough for disease prevention. The Bureau of Dental Health has established self-care empowerment program in community level. There are manuals and leaflets distributed in villages. Mass media i.e; newspaper, radio, and television are also more frequent used to raise perception and concern in the oral health of Thai people.

CARIOLOGY EDUCATION IN DENTAL SCHOOL

Table 5: Cariology in dental curricula in Thailand

University	Dedicated Cariology courses	No. or credits	Year offered	Responsible departments
Chulalongkorn	Yes (I, II, III)	3	2 nd , 3 rd	Multiple departments a) Microbiology & Biochemistry b) Operative c) Pediatric
Mahidol	Yes (I and II)	3	2 nd and 3 rd	Multiple departments (Coordinator: Oral Biology)
Chiangmai	Yes (I and II)	2	2 nd and 3 rd	Multiple departments I. Oral diagnostics II. Orthodontics & Pedodontics
Prince of Songkhla	Integrated in "Dental and periodontal health and diseases"	2	2 nd	Oral Biology and Conservative Dentistry (with lecturers from multiple departments)
Khon Kaen	No (part of 2 courses: I. Oral biology II. Preventive Dentistry)	~1	3 rd	Oral biology and Pediatric (with lecturers from Diagnostic, Restorative, and Community Dentistry)
Srinakarinwirote	Integrated in "Caries and periodontal diseases" course	3 (1 on caries)	3 rd	Operative, Endodontics, Pathology, and Microbiology
Thammasat	Yes	3	3 rd	Oral Biology
Naresuan	No	~2	2 nd and 3 rd	Operative, Oral Biology, Community Dentistry
Rangsit	Yes	2	3 rd	Operative Dentistry
Western	Yes	3	2 nd (summer)	Multiple departments (Currently by external lecturers)

There are 10 dental schools in Thailand; 7 are public and 2 private. Although none has a dedicated Cariology department, most schools offer Cariology as integrated multidisciplinary courses with lecturers from several departments (see Table 5).

The majority offers 2-3 credits of Cariology courses in the 2nd and 3rd years of the 6-year curricula. These courses cover both basic and clinical sciences related to Cariology including Biochemistry, Microbiology, Immunology, Operative, Endodontics, Pedodontics, and Community Dentistry. In all schools, Cariology-related clinical practices are supervised by the departments of Operative, Pedodontics, and Community Dentistry.

REFERENCES

Bureau of Dental Health, Department of health, Ministry of Public Health. National Oral Health Survey, Thailand 2012. 1st ed., Office of The War Veterans Organization of Thailand Printing. Bangkok. 2013.

Dental Health Division, Department of health, Ministry of Public Health. Thailand Oral Health Goal 2020. Office of The War Veterans Organization of Thailand Printing. Bangkok. 2007.

Prasertsom P, Jirapongsa W, Changban P, Luengvara P, Rattananungsima K, Rityue A. 37 Years of Experience of Oral Health Promotion in schoolchildren. Thailand Journal of Health Promotion and Environmental Health. 2009; 32: 24-33.

Ungchusak C, Jienmaneechotechai S, Jirapongsa W, Prasertsom P, Visalseth W, Dalodom S, Bangkerdsing W. The 5th Asian Conference of Oral Health Promotion for School Children. Thailand Journal of Health Promotion and Environmental Health. 2009; 32: 34-40.

Dental Health Division, Department of health, Ministry of Public Health. Guideline for oral health promotion program. Fiscal Year 2013. Office of The War Veterans Organization of Thailand Printing. 2013

Bureau of Dental Health, Department of health, Ministry of Public Health. Oral health surveillance in village: Manual for Village Health Volunteer. 2nd, Office of The War Veterans Organization of Thailand Printing. Bangkok. 2013.

Bureau of Dental Health, Department of health, Ministry of Public Health. Training Curriculum of Village Health Volunteer for Oral Health Promotion 2013. 1st ed, Office of The War Veterans Organization of Thailand Printing. Bangkok.

VIETNAM

*Trinh Dinh HAI
Ngo Dong KHANH*

“Caries control throughout life in Asia”

Country Report on Dental Caries Epidemiology and Relevant Interventions

VIETNAM

*Trinh Dinh HAI³⁹
Ngo Dong KHANH⁴⁰*

INTRODUCTION OF VIETNAM

Vietnam, officially the Socialist Republic of Viet Nam, is the easternmost country on the Indochina Peninsula in Southeast Asia. With a population of over 90 million, Vietnam is the 13th most populous country in the world. The population density is 260 people per square kilometer, with most (69.6%) of the population living in rural areas. Over the past few years, Vietnam has witnessed a gradual change in its population structure. In 2008, the percentage of the population aged 0 -14 was 25.1%, a decrease of 5.9% compared with 2000. However, the percentage aged over 64 years increased rapidly (by 0.6 %) over the same seven-year period. This shows that fertility has continued to decline in recent years, while the number of elderly people has been increasing gradually.

Vietnam has 54 different ethnic groups, with the Kinh representing 87% of the total population. The rest are ethnic minorities scattered all over the country, mostly in mountainous and remote areas.

Vietnam is divided into 58 provinces and 5 centrally-governed cities, which exist at the same level as the provinces. Hanoi is the capital city. The government often groups the various provinces into eight regions: Northwest, Northeast, Red River Delta, North Central Coast, South Central Coast, Central Highlands, Southeast, and Mekong River Delta.

³⁹ Assoc Prof, Director of the National Hospital of Odonto Stomatology in Hanoi; President, Vietnam Odonto Stomatology Association (VOSA).
Email: Trinh Dinh HAI <haitdnhos@yahoo.com>.

⁴⁰ President, HoChiMinh city Odonto Stomatological Association (HOSA), Vice Dean, Faculty of Odonto Stomatology in HoChiMinh City. Email: Ngo Dong KHANH <ngodongkhanh@ymail.com>.

HEALTH SERVICE SYSTEM IN VIETNAM

The Ministry of Health is the government agency that exercises state management in the field of people's health care, including preventive medicine; consultation and treatment; rehabilitation; traditional medicine; pharmaceuticals, including vaccine production; hazardous effects of cosmetics on human health; food hygiene and safety; medical equipment; health facilities; population and family planning; and health system development and management.

The health system is a mixed public-private provider system, in which the public system plays a key role in health care, especially in terms of policy, prevention, research and training. The private sector has grown steadily since the 'reform' of the health sector in 1989, but it is mainly active in outpatient care. Inpatient care is provided entirely through the public sector.

The health care network is organized under state administrative units at the central, provincial, district, commune and village levels, with the Ministry of Health at the central level. In the public sector, there are 774 general hospitals, 136 specialized hospitals and 11,576 primary health care centers. The establishment of the grassroots health care network (including the commune and district levels) as the foundation for health care has yielded many achievements, especially that of contributing toward the attainment of national health care goals for the entire population.

The health stations in communes provide primary health care services, including consultation, outbreak prevention and surveillance, treatment of common diseases, maternal and child health care, family planning, hygiene and health promotion. Health care is further strengthened by the implementation of national health care programs to deal with diseases and health issues that are of important public health concern. For example, the tuberculosis control program has made every effort to maintain- over many years-a high implementation rate, with DOTS (Directly Observed Treatment Short course) now covering 100% of the affected population. The WHO has highly commended the program and has ranked it as being on par with those countries that have achieved the highest standards in the world.

DENTAL CARIES IN VIETNAMESE POPULATION

1. The situation and developing tendency of dental caries in school children.

In 1991, Vo The Quang reported the situation of dental caries by the First National Oral Health Survey. The results showed that from 1983 to 1991, the dental caries had an increasing tendency in caries rate as well as the average DMFT. The results of the First Oral Health Survey were presented in Table 3.1.

Table 3.1: Dental caries experience in Vietnamese children (1983–1991)

Age	Dental caries experience in Vietnamese children							
	Vietnam		North of VN		South of VN		HoChiMinh City	
	% caries	DMFT	% caries	DMFT	% caries	DMFT	% caries	DMFT
<i>1983</i>								
12	-	-	19.30	0.40	76.29	2.51	-	-
<i>1984</i>								
12	-	-	-	-	-	-	77.90	3.27
15	-	-	-	-	-	-	83.95	3.40
<i>1991</i>								
12	57.33	1.82	43.33	1.15	76.33	2.93	-	-
15	60.00	2.16	47.33	1.38	82.99	3.59	-	-

In 2002, The Second Oral Health Survey was conducted by the National Institute of Odonto-Stomatology Hanoi and HoChiMinh City (National Hospital of Odonto-Stomatology Hanoi and HoChiMinh City presently). The results of the Second Oral Health Survey showed that the caries experience of children had increased compared to the results of the First Survey and were presented from Table 3.2 to Table 3.4.

Table 3.2: Caries experience in deciduous dentition in Vietnam (2002)

Age	% caries	dmft				dmfs			
		dt	mt	ft	dmft	ds	ms	fs	dmfs
6-8	84,9	5.07	0.31	0.02	5.40	11.5	1.37	0.02	12.98
9-11	56.3	1.85	0.10	0.01	1.96	4.12	0.47	0.01	4.60

The result from table 3.2 showed that the prevalence of dental caries in deciduous dentition in school children at age 6-8 was 84.9% with the average dmft of 5.1. Especially, each school child in this age group had average nearly 13 surfaces destroyed by caries. Deciduous caries in school children had reflected the potential of risk factors of dental caries. The fish portion of dmfs index was only 0.02. This situation suggested that the majority of caries in surfaces did not treat.

Table 3.3: Caries experience in permanent dentition (2002)

Age	% caries	DMFT				DMFS			
		DT	MT	FT	DMFT	DS	MS	FS	DMFS
6-8	25.4	0.47	0.00	0.01	0.48	0.59	0.00	0.01	0.60
9-11	54.6	1.15	0.02	0.02	1.19	1.60	0.08	0.03	1.71
12-14	64.1	1.96	0.05	0.04	2.05	3.10	0.24	0.05	3.39
15-17	68.6	2.12	0.15	0.13	2.40	3.26	0.73	0.17	4.16

Prevalence of caries in permanent dentition as well as DMFT index was increased 25.4% of school children in the age group 6-8 had experienced dental caries with the average DMFT of 0.48 when at age group 15-17, the prevalence of dental caries was 68.6% with the average DMFT of 2.40. The increasing in dental caries rate in school children had reflected the potential of risk factors of dental caries as well.

Table 3.4: Dental caries experience in key age group in Vietnam (2002)

Age (yrs)	% caries	dmft				dmfs			
		dt	mt	ft	dmft	ds	ms	fs	dmfs
6	83.7	5.88	0.24	0.03	6.15	12.99	1.13	0.03	14.15
		DMFT				DMFS			
		DT	MT	FT	DMFT	DS	MS	FS	DMFS
12	56.6	1.83	0.01	0.03	1.87	2.93	0.05	0.04	3.02
15	67.6	2.03	0.12	0.01	2.16	3.10	0.59	0.02	3.71

The result from Table 3.4 showed that the prevalence of deciduous caries was very high in school children at age 6 with average dmfs of 14.15. The caries rate in permanent dentition was increasing with age, that was 56.6% and 67.6% at age 12 and 15, respectively.

Deciduous caries experience by age group and area is shown in table 3.7. Most areas had mean scores of near six for younger children except the Red River Delta and Central Highland which had mean scores between 3.0 and 3.5.

Table 3.5: Deciduous caries experience by age and urban/rural locality (2002)

Age (yrs)	Area	n	% caries	dmft			
				dt	mt	ft	dmft
6-8	Urban	403	84.4	4.98	0.31	0.08	5.37
	Rural	303	85.1	5.10	0.31	0.00	5.41
9-11	Urban	408	51.	1.60	0.18	0.02	1.80
	Rural	283	57.6	1.93	0.08	0.00	2.01

Table 3.6: Permanent caries experience by age and urban/rural locality (2002)

Age (yrs)	Area	n	% caries	DMFT			
				DT	MT	FT	DMFT
6-8	Urban	403	24.6	0.40	0.00	0.03	0.43
	Rural	303	25.6	0.49	0.00	0.00	0.49
9-11	Urban	408	50.8	1.15	0.00	0.06	1.12
	Rural	283	55.8	1.15	0.02	0.01	1.18
12-14	Urban	392	68.4	1.70	0.05	0.14	1.89
	Rural	303	63.0	2.03	0.05	0.01	2.09
15-17	Urban	385	78.3	2.56	0.26	0.33	3.15
	Rural	285	65.8	1.43	0.05	0.02	1.50

Table 3.5 and 3.6 showed that deciduous caries experience varied little by urban/rural location and age group.

Table 3.7: Primary caries by geographic area (2002)

Area	Age	n	% caries	dmft			
				dt	mt	ft	dmft
Northern Highland	6-8	98	80.7	6.43	0.06	0.00	6.49
	9-11	99	74.5	2.44	0.02	0.00	2.46
Red River Delta	6-8	97	72.3	3.41	0.01	0.03	3.45
	9-11	104	53.2	1.68	0.00	0.01	1.69
North Central Coast	6-8	99	83.7	5.61	0.34	0.00	5.95
	9-11	93	50.9	2.32	0.03	0.00	2.35
South Central Coast	6-8	10	91.6	4.82	0.31	0.00	5.13
	9-11	96	53.3	1.73	0.09	0.00	1.82
Central Highland	6-8	96	71.1	3.04	0.18	0.00	3.22
	9-11	106	38.3	1.25	0.10	0.00	1.35
North East South	6-8	96	88.2	5.12	0.56	0.03	5.71
	9-11	90	54.0	1.52	0.33	0.02	1.87
Mekong River Delta	6-8	96	93.7	5.71	0.59	0.04	6.34
	9-11	90	51.1	1.65	0.18	0.02	1.85

Table 3.8: Permanent caries by geographic area (2002)

Area	Age	n	% caries	dmft			
				dt	mt	ft	dmft
Northern Highland	6-8	98	19.3	0.43	0.00	0.00	0.43
	9-11	99	43.5	0.78	0.00	0.02	0.80
	12-14	108	77.2	2.17	0.03	0.00	2.21
	15-17	101	65.7	1.88	0.11	0.02	2.01
Red River Delta	6-8	97	10.3	0.15	0.00	0.00	0.15
	9-11	104	50.7	0.81	0.00	0.00	0.81
	12-14	104	43.9	0.92	0.03	0.02	0.97
	15-17	101	32.3	0.89	0.02	0.02	0.93
North Central Coast	6-8	99	31.6	0.70	0.00	0.00	0.70
	9-11	93	61.8	1.54	0.02	0.00	1.56
	12-14	100	65.2	2.33	0.05	0.05	2.43
	15-17	106	67.2	1.96	0.15	0.15	2.26
South Central Coast	6-8	110	43.5	0.96	0.00	0.02	0.98
	9-11	96	68.0	1.90	0.01	0.03	1.94
	12-14	99	81.9	2.73	0.07	0.03	2.83
	15-17	87	92.0	4.02	0.18	0.16	4.36

Table 3.9: Permanent caries by geographic area (2002) (cont.)

Area	Age	n	% caries	dmft			
				dt	mt	ft	dmft
Central Highland	6-8	96	18.2	0.25	0.00	0.00	0.25
	9-11	106	32.4	0.58	0.00	0.01	0.59
	12-14	83	48.2	1.03	0.03	0.00	1.06
	15-17	90	68.1	2.08	0.17	0.06	2.31
North East South	6-8	110	27.3	0.44	0.00	0.04	0.48
	9-11	103	56.4	0.12	0.03	0.09	1.24
	12-14	91	64.5	1.57	0.08	0.17	1.82
	15-17	88	88.2	2.31	0.34	0.45	3.10
Mekong River Delta	6-8	96	29.3	0.44	0.00	0.00	0.44
	9-11	90	61.7	1.38	0.04	0.00	1.42
	12-14	110	70.9	2.36	0.06	0.03	2.45
	15-17	97	86.3	2.71	0.18	0.13	3.02

Permanent caries experience by age and geographic area is shown in table 3.8 and 3.9. Highest mean DMFT scores in the oldest age group were found in South Central Coast with lowest scores in the Red River Delta.

In 2007, in order to get data base for the Salt Fluoridation project to prevent caries for community, National Hospital of Odonto-Stomatology in Hanoi conducted the Survey on dental caries, dental fluorosis of children in Hanoi and LaoCai province. The results of this survey were presented from table 3.10 to Table 3.14.

Table 3.10: Caries experience in deciduous dentition in Hanoi and Laocai province (2007)

Age	n	% caries	dmft				dmfs			
			dt	mt	ft	dmft	ds	ms	fs	dmfs
<i>Hanoi</i>										
6-8	116	92.2	5.4	0.15	0.11	5.7	12.25	0.04	0.16	12.05
9-11	123	67.5	2.9	0.1	0.06	3.0	5.8	0	0.07	5.72
<i>Lao cai</i>										
6-8	110	90.9	6.05	0.03	0.03	6.07	12.44	0.06	0.00	12.49
9-11	146	61.0	2.36	0.01	0.01	2.38	4.75	0.07	0.03	4.86

Over 90% of school children in the age group 6-8 in Hanoi and Lao CAI province had experienced deciduous caries and each child had approximately six teeth affected by caries and more than 12 surfaces destroyed by caries by mean.

Table 3.11: Caries experience in permanent dentition in Hanoi and LaoCai Province (2007).

Age	% caries	DMFT				DMFS			
		DT	MT	FT	DMFT	DS	MS	FS	DMFS
<i>Hanoi</i>									
6-8	18.2	0.30	0.00	0.00	0.30	0.39	0.00	0.00	0.39
9-11	39.0	0.79	0.00	0.01	0.80	1.01	0.00	0.01	1.02
12-14	43.1	1.08	0.02	0.02	1.12	1.56	0.00	0.02	1.58
15-17	47.1	1.24	0.01	0.04	1.29	1.64	0.01	0.04	1.68
<i>Lao cai</i>									
6-8	18.2	0.30	0.00	0.00	0.30	0.39	0.00	0.00	0.39
9-11	39.0	0.79	0.00	0.01	0.80	1.01	0.00	0.01	1.02
12-14	39.0	0.79	0.00	0.01	0.80	1.01	0.00	0.01	1.02
15-17	47.1	1.24	0.01	0.04	1.29	1.64	0.01	0.04	1.68

Permanent caries status in school children in Hanoi and LaoCai province was increasing in caries rate and in mean DMFT/DMFS as well. One important problem was the low rate of filling teeth (ft component) compared with high rate of decay teeth (dt component).

Table 3.12: Caries experience in permanent dentition in Hanoi and LaoCai Province (2007).

Age	% caries	DMFT				DMFS			
		DT	MT	FT	DMFT	DS	MS	FS	DMFS
<i>Hanoi</i>									
6-8	18.2	0.30	0	0	0.30	0.39	0	0	0.39
9-11	39.0	0.79	0	0.01	0.80	1.01	0	0.01	1.02
12-14	43.1	1.08	0.02	0.02	1.12	1.56	0	0.02	1.58
15-17	47.1	1.24	0.01	0.04	1.29	1.64	0.01	0.04	1.68
<i>Lao Cai</i>									
6-8	18.2	0.30	0	0	0.30	0.39	0	0	0.39
9-11	39.0	0.79	0	0.01	0.80	1.01	0	0.01	1.02
12-14	39.0	0.79	0	0.01	0.80	1.01	0	0.01	1.02
15-17	47.1	1.24	0.01	0.04	1.29	1.64	0.01	0.04	1.68

The permanent caries rate in school children in Hanoi and LaoCai Province was slightly increasing by age. This situation is shown in table 3.12.

Table 3.13: Dental caries in key age groups in LaoCai province (2007)

Age	n	% caries	dmft				dmfs			
			dt	mt	ft	dmft	ds	ms	fs	dmfs
6	37	91.9	6.27	0.00	0.00	6.27	11.89	0.00	0.00	11.89
			DT	MT	FT	DMFT	DS	MS	FS	DMFS
12	48	39.6	0.88	0.02	0.00	0.90	1.23	0.00	0.00	1.23
15	63	60.3	1.35	0.00	0.00	1.35	1.79	0.00	0.00	1.79

Table 3.13 and 3.14 showed that over 90% of 6 years old children in Hanoi and LaoCai had experienced deciduous caries. The prevalence of permanent caries at age 12 and 15 was high too.

Table 3.14: Dental caries in key age groups in Hanoi (2007)

Age	n	% caries	dmft				Dmfs			
			dt	mt	ft	dmft	ds	ms	Fs	dmfs
6	38	97.4	6.05	0.11	0.11	6.27	13.4	0.1	0.1	13.1
			DT	MT	FT	DMFT	DS	MS	FS	DMFS
12	36	52.8	1.4	0.0	0.2	1.6	1.9	0.0	0.3	2.1
15	55	63.6	2.4	0.02	0.07	2.5	3.1	0.0	0.07	3.2

2. Dental caries change in Vietnamese children from 1999 to 2007

Between 1999 and 2007 the deciduous caries experience in 6-8 year olds increased significantly in Hanoi (23% increase in caries prevalence and 50% increase in dmfs) and slightly in LaoCai (11% increase in caries prevalence and 9% increase in dmfs). There were similar to the 1999 survey national average levels (national 1999 – 12.98 dmfs, Hanoi 2007 – 12.25 dmfs, LaoCai 2007 – 12.49 dmfs). This situation is presented in Figure 3.1.

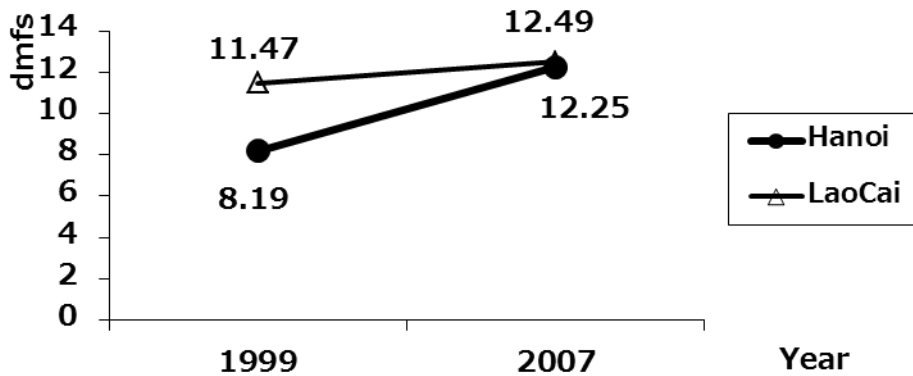


Figure 3.1: Deciduous caries experience (dmft) and caries prevalence (%) in Hanoi and Lao Cai 6-8 year olds in 1999 and 2007

Over the same period, permanent caries experience in 12-14 year olds remained at similar levels in Hanoi (3% decrease in caries prevalence and 9% increase in DMFS), and decreased markedly in LaoCai (41% decrease in caries prevalence and 13.4% in DMFS). Both Hanoi and LaoCai caries experience for this age group were below the 1999 national survey average (national 1999 – 3.39 DMFS, Hanoi 2007 – 2.60 DMFS, LaoCai 2007 – 1.58 DMFS). This situation is shown in Figure 3.2.

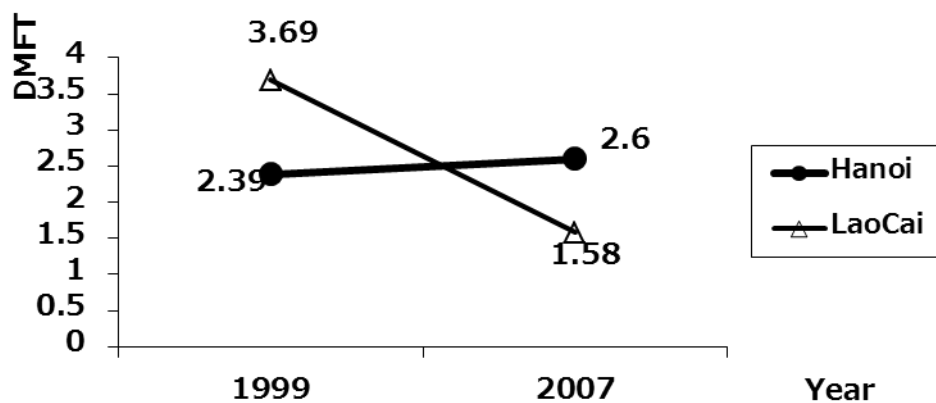


Figure 3.2: Permanent caries experience (DMFT) and prevalence (%) in Hanoi and Lao Cai 12-14 year olds in 1999 and 2007.

3. Dental caries experience in Vietnamese adults

Table 3.15: Dental caries experience by age group

Age	n	% caries	DMFT			
			DT	MT	FT	DMFT
18	63	87.5	2.28	0.52	0.04	2.84
18-34	1013	75.2	2.31	0.77	0.21	3.29
35-44	1160	83.2	2.35	2.10	0.25	4.70
45+	999	89.7	2.14	6.64	0.15	8.93

Dental caries experience increased with age from a mean of 2.84 teeth in 18 year olds to 8.93 in those 45 years and older (Table 3.15). Over 75% of adults in each age group had caries experience. Untreated decay accounted for 80% of the caries experience in 18 year olds and declined to 24% in those 45 years and older. The mean number of missing teeth increased across age groups from 0.52 in 18 year olds to 6.64 in those 45 years and older. There were very few filled teeth in all age groups.

Table 3.16 shows the caries experience by sex for each age group. In each age group males had less disease than females. This was apparent for all components of the DMFT score as well as for the total score.

Table 3.16: Dental caries experience by age and sex

Age	Gender	n	% caries	DMFT			
				DT	MT	FT	DMFT
18-34	Male	374	74.8	2.30	0.53	0.11	2.94
	Female	639	74.7	2.33	1.00	0.30	3.63
35-44	Male	442	89.7	1.82	1.87	0.14	3.83
	Female	718	88.5	2.83	2.31	0.36	5.50
45+	Male	436	88.0	1.63	6.10	0.12	7.84
	Female	563	84.3	2.54	7.06	0.17	9.77

Table 3.17 shows caries experience by urban or rural locality for each age group. Generally, in each age group urban persons had more caries experience than rural persons. This is particularly evident in the percentage of a percentage of persons with caries experience.

Table 3.17: Dental caries experience by age and urban/rural

Age	Location	n	% caries	DMFT			
				DT	MT	FT	DMFT
18-34	Urban	643	88.1	2.49	1.02	0.43	3.94
	Rural	370	61.4	2.26	0.69	0.14	3.09
35-44	Urban	753	95.3	2.20	2.78	0.59	5.57
	Rural	407	82.9	2.39	1.92	0.16	4.47
45+	Urban	625	93.7	2.23	8.07	0.40	10.70
	Rural	374	78.6	2.12	6.22	0.07	8.41

DENTAL NETWORK IN VIETNAM

The dental health care network in Vietnam is still too small. Currently, two thirds of the districts in the country do not have dental physicians, those being mainly in mountainous areas. Departments of Odonto-Stomatology in many province hospitals are still limited and are unable to meet the needs of people.

One dentist in Vietnam serves 20,000 people on average, while in developed countries, the rate is one dentist per 1.000 to 2.000 people. On the other hand, although the Ministry of Health has focused on the oral health promotion program for school children, until now, the program has only been adopted in eight provinces (Ninh Binh, Nam Dinh, Hai Duong, Thai Nguyen, Thua Thien Hue, Da Nang, Lang Son and Tuyen Quang). The number of provinces that take part in the oral health promotion program is 58 (92.1%). There are 5 provinces that still do not offer the oral health promotion program (Ha Giang, Vinh Phuc, Thanh Hoa, Lai Chau and Hoa Binh). Although most provinces offer the oral health promotion program, only about 6 out of 12 million school children are receiving regular dental care at school.

At the national level: There are two National Hospitals of Odonto-Stomatology, one hospital is in Hanoi and the other is in HoChiMinh City. Of these two hospitals, the hospital in Hanoi is the leading hospital, and it offers the following services: Supplying dental services for the community, Training in dentistry and maxillofacial surgery, Managing the dental network at the national level, Conducting research in dentistry and related issues, Conducting the prevention of oral diseases for children and communities throughout the country.

At the provincial level: There are five Dental Hospitals and three Dental Centers in big cities (Hanoi, Ho Chi Minh City, Hue, Da Nang and Can Tho). Additionally, in all of the other provinces, there is a dental department that belongs to the provincial general hospital.

At the district level: About 30% of the districts in the country have a small dental department that belongs to the district medical center, with dentists and/or dental nurses and simple dental equipment.

At the commune/ward level: There is no dental clinic in most communes or wards.

Private dental system: Developed in a short amount of time, this system considerably contributes to dental service for people, especially in big cities and towns.

The School based Dental Program (SDP) is significant in creating opportunities for school children to access dental care services and to learn about preventative dental care measures.

The dental care network at the ward and the district levels is still insufficient and weak. School children in most rural and mountainous areas have difficulty accessing dental care and dental advice services.

ORAL HEALTH PROMOTION IN VIETNAM

1. Vietnamese Governmental Policies

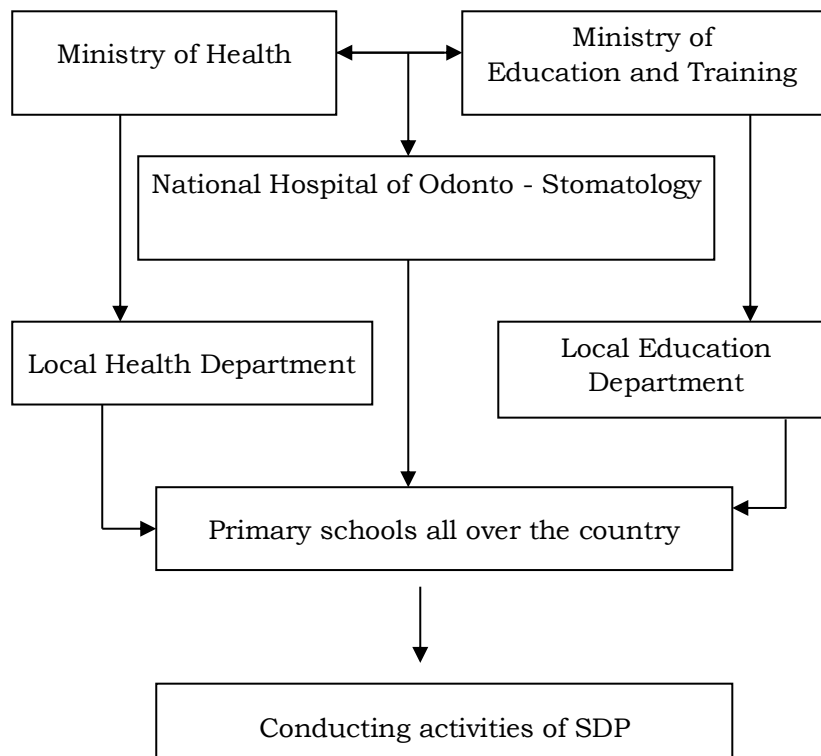
In 1987, Viet Nam's Prime Minister requested the Ministry of Health and the Ministry of Education to issue policies on the development and implementation of the School based Dental Program (SDP) with the aim of promoting dental health care for school children. Under the supervision of the Prime Minister, on 21st October 1987, the two ministries issued an inter-ministerial circular No. 23 on the missions and implementation of the SDP. Then on 19th September 1994, the two ministries issued an inter-ministerial circular No. 14, which provides guidance on the implementation of voluntary health care insurance for school children. Accordingly, part of the funding was allocated for the SDP.

On 1st March 2000, the two ministries issued Circular No.3 (2000), which provides guidance on the implementation of school based health care and supplements the ongoing regulations for school-based health care, including the School based Oral Health Care Program.

2. Oral Health promotion for school children

2.1 Implementing and managing School based Dental Program (SDP)

Management System of the SDP



2.2 The component of SDP:

The SDP consist of four components: Oral Health education, fluoride mouth rinsing and tooth brushing, clinical prevention and fissure sealants.

The 1st component: Oral Health Education

Oral health education is an important component of the SDP. Teachers and school dental workers (dental therapists) are trained in oral health education and received the training materials for giving dental education to primary school children.

The most important skill that these teachers and therapists teach school children is how to brush their teeth properly. Additionally, the teachers highlight the importance of oral health for students and give them basic knowledge about how to protect themselves against dental diseases by practicing oral healthcare activities, such as having a healthy diet, getting periodic oral examinations, etc.

The 2nd component: Mouth rinsing with a 0.2% sodium fluoride weekly at school and tooth brushing with fluoride toothpaste

The primary school managing board organizes mouth rinsing with a 0.2% sodium fluoride for school children weekly at schools, under the supervision of teachers and dental therapists. Tooth brushing with fluoride toothpaste after lunch carried out at kindergartens and primary schools.

The 3rd component: Clinical prevention

Clinical preventive activities consist of periodic examinations and early treatment for common oral diseases. In order to implement clinical preventive dentistry, the dental clinics at schools require dental equipment for operated by dental therapist. Dental clinical preventive activities include: Periodic oral examinations to find early signs of common oral diseases, such as dental caries, gingivitis, etc., and to evaluate oral hygienic status individually. Providing early treatments, such as deciduous teeth extraction, atraumatic filling, scaling calculus, gingivitis treatment and introduction for school children to control dental plaque, in the dental clinics at schools.

The 4th component: Pit and fissure sealants

Filling pits and fissures on tooth surfaces with resins or Glass ionomer Cement (GIC) to prevent dental caries in the occlusal surface of permanent molars.

2.3 The public use of fluoride to prevent dental caries for school children in Vietnam

Using fluoride to prevent dental caries has been implemented in Vietnam for several decades, and it has brought a considerable benefit to reducing the prevalence of caries and the average DMFT. Fluoride regimens used in Vietnam focus on target groups, including

- The community: water fluoridation, salt fluoridation.
- Individual consumers: tooth brushing with fluoride toothpaste and fluoride mouth rinsing.

2.3.1 Water fluoridation

Water fluoridation is the systemic fluoride method that has been applied in Viet Nam until present. Water fluoridation has been implemented in Ho Chi Minh City since 1989 with the original concentration of 0.70 ppm in the first stage; it is now at 0.50 ppm. Currently, the water fluoridation network covers 20/24 districts in Ho Chi Minh City and one city in Dong Nai province, with a total of about 10 million citizens.

After 10 years of fluoride supplementation in tap water, caries prevalence of 12-year-old children decreased from 87% to 45%, and the DMFT is <2 for this age group.

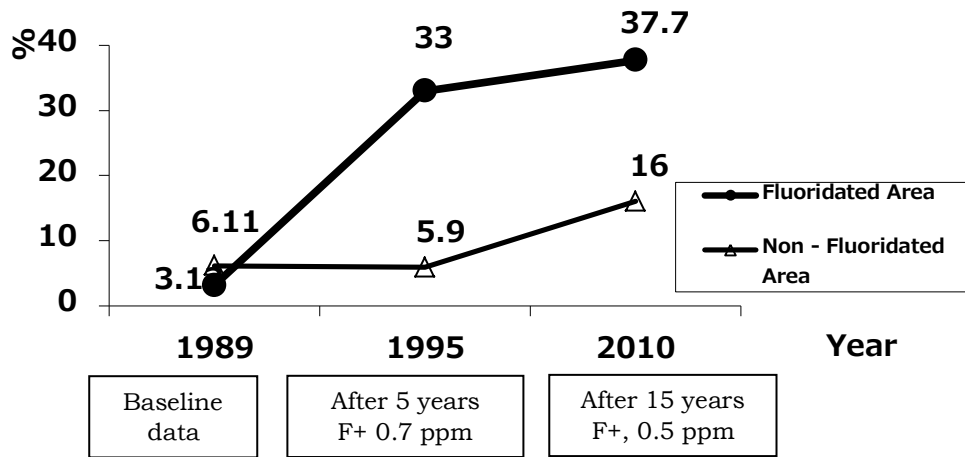


Figure 6.1: Proportion of caries free in 5 year old children between Fluoridated and Non-Fluoridated area in HoChiMinh City

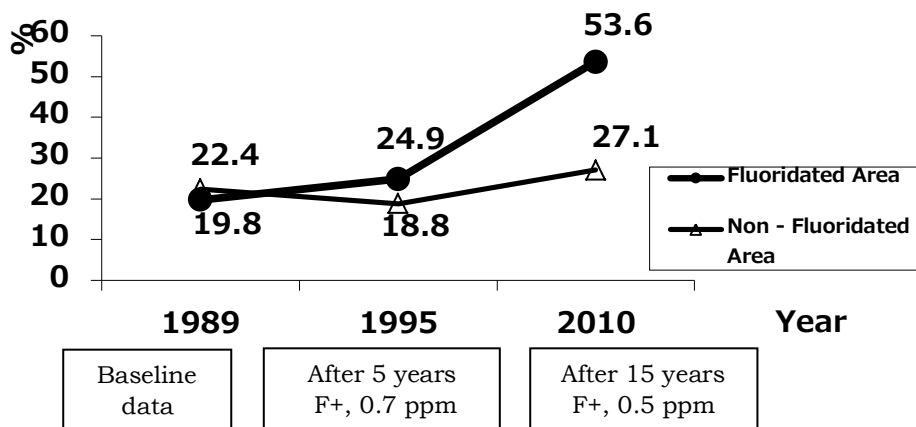


Figure 6.2: Proportion of caries free in 12 year old children between Fluoridated area and Non - Fluoridated area in HoChiMinh City

In Ho Chi Minh City, after 20 years of conducting water fluoridation, the percentage of caries-free in 5-year-old, as well as 12-year-old, children clearly increased. This means that the dental caries experience in deciduous dentition as well as in permanent dentition was remarkably reduced.

The implementation of water fluoridation in Ho Chi Minh City has obviously been very effective in preventing dental caries, even with the

fluoride concentration in the water level at 0.5 ppm. There was a similar result in the mean DMFT for 5-year-old and 12-year-old children. These results are presented in Figure 6.3 and 6.4.

Water fluoridation is the most effective method for caries prevention, but it covers only a small area where people have a tap water network. More than 70% of Vietnamese people, especially in rural areas, who do not have tap water will not be able to benefit from this program.

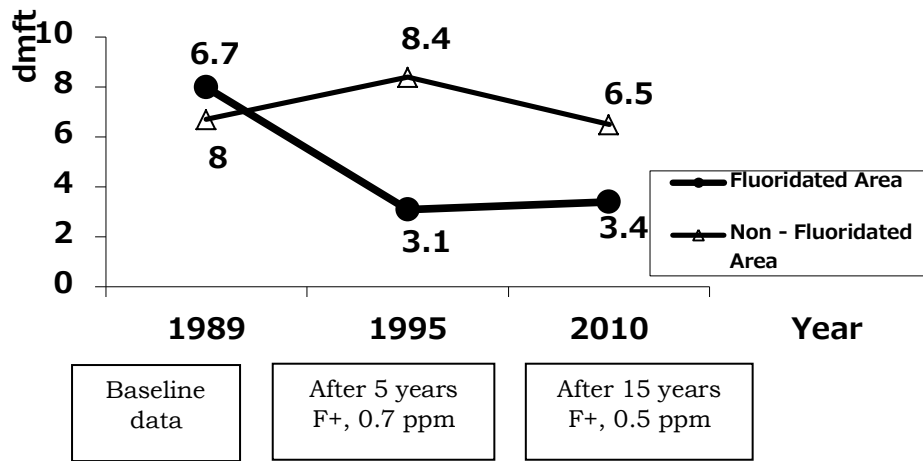


Figure 6.3: dmft in 5 year old children between Fluoridated area and Non – Fluoridated area in HoChiMinh City

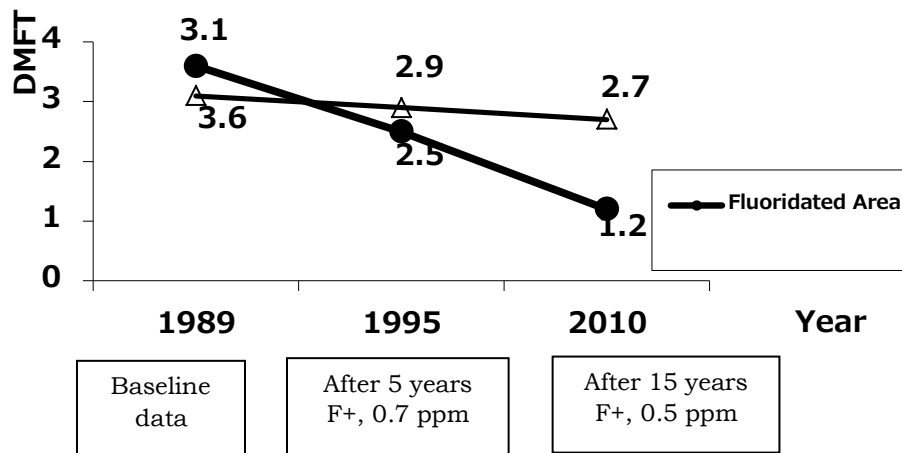


Figure 6.4: DMFT in 12 year old children between Fluoridated area and Non-Fluoridated area in HoChiMinh City

2.3.2 Mouth rinsing with Sodium Fluoride

Mouth rinsing with a 0.2% sodium fluoride weekly for children in primary schools was implemented in HoChiMinh City in 1980, and it expanded to many provinces in Vietnam quickly. Mouth rinsing with a 0.2% sodium fluoride weekly has been one important part of the school based oral health promotion program, and more than five million school children have benefited from this program since 2004. Today, mouth rinsing with a 0.2% sodium fluoride weekly has been implemented widely throughout Vietnam and has proven to reduce dental caries in children effectively.

2.3.4 Tooth brushing with fluoride toothpaste

According to the results of the National Oral Health Survey in 2002, more than 90% of children and adults brush their teeth and use toothpaste when brushing in Vietnam. Since that time, the awareness of the community about tooth brushing to prevent caries increased considerably, and most Vietnamese people now brush their teeth every day. Most toothpaste available on the Vietnamese market is fluoridated toothpaste now.

2.3.5 Fluoridated salt

According to the Second National Oral Health Survey (2002), 84.9% of children in Vietnam are affected by dental caries in the primary dentition. The lack of fluoride in most drinking water sources leads to the low concentration of fluoride in people's oral cavities, which has been shown to prevent caries. The risk of dental caries is growing in the country, due to the growing consumption of sugars, though many prevention programs have been carried out.

In 2006, the World Health Organization (WHO) recommended that salt fluoridation should be implemented urgently to prevent caries for

communities in Vietnam. The recommended dosage now is at the level of 250 ppm fluoride.

With technical and financial support from the World Health Organization in Vietnam, the pilot phase of salt fluoridation program has been implemented, with the following activities:

- Epidemiology surveillance on caries prevalence, DMFT, fluorosis in the region where fluoridated salt is being distributed. Salt consumption and dietary habits also are being investigated.
- A map of fluoride concentration in natural drinking water in this area was developed.
- Set up procedure of fluoridated salt production and control the quality of salt under supervision of WHO's experts
- Produce 20 tons of fluoridated salt and transport to Lao Cai province
- Make plans for the communication campaign to raise social acceptance
- Make plans for delivery of fluoridated salt to Lao CAI province, which serves over 20 million people
- Make plans to monitor the program
- Fluoridated salt will be delivered at Bat Xat district, Lao CAI province by the end of 2011 to prevent dental caries for communities and especially for children under the supervision of the National Hospital of Odonto-Stomatology in Hanoi and the World Health Organization in Vietnam.

DENTAL EDUCATION IN VIETNAM

Education is provided through kindergartens, primary schools, secondary schools, high schools and various tertiary institutions. All citizens attending government schools have free education. The non-government schools charge a fee to their students irrespective of whether they are citizens or not.

Currently, there are 7 public dental schools, 5 public and private dental nurse schools. The number of dentists who graduated from dental school increased from 2,345 in 2000 to 4,650 in 2012.

The core curriculum for the training of doctoral degree in Odonto-Stomatology was approved by the Ministry of Health in 2009 and its implementation will provide a common platform for each dental school to be evaluated.

A recent revision of the curriculum structure in faculty, to suit the core curriculum, has led to a better integration and harmonization of the teaching of undergraduate and graduate students.

The undergraduate curriculum for doctor degree in Odonto-Stomatology was first revised as mentioned in the last reports, the former one covered up to 6 years, with the first 2 years majoring in general knowledge, fundamental sciences and part of health sciences, and the last four years focusing in knowledge and skills in dental disciplines. The new curriculum has been modified since the last academic year, the new one has maintained the 6-year program, with 3 first years majoring in basic health sciences as well as general medicine and the last three years of knowledge and skills in dental disciplines. It is known as the "3 plus 3 curriculum for doctoral degree in Odonto-Stomatology".

The reasons why the Faculty increased the number of credits in basic health sciences are to promote a closer integration between dentistry and medicine and provide dental students with a better knowledge of the health care system.

The Faculty has also reformed the graduate curriculum since the end of the last academic year. The graduate division of the Faculty is dedicated to training competent specialists in various fields of dentistry. All applicants are recruited upon entrance examination, they can choose one of 2 following programs: (1) one for dental practitioners leading to the 1st and 2nd degree of specialty (under the Ministry of Health); or (2) the other leading to the Master and the Ph.D degree (under the Ministry of Education).

In the former program, whatever the graduate course, the learners will be provided with foundation core courses, basic dental sciences, and advanced technical competencies in a group of dental clinical disciplines depending on the field of practice they selected such as: (1) Exodontics, Minor oral surgery, Oral pathology; (2) Conservative dentistry, Periodontology, Prosthodontics; (3) Or Orthodontics, Pediatric dentistry, Dental Public Health.

In the new one, the learners will be provided with foundation core courses which are common to all groups, they will follow the modules

of theory and clinical practice according to the competencies they have selected at the entrance. The new curriculum has been established in 3 specialties oriented groups which are related to the surgical and pathological Dentistry including Exodontics, Minor oral surgery, Oral pathology; and Restorative Dentistry including Conservative dentistry, Periodontology, Prosthodontics; and Preventive and Developmental Dentistry comprise meaning Orthodontics, Pediatric dentistry and Dental Public Health. The new program has been applied since the beginning of this academic year.

CONCLUSION

The prevalence of dental caries is very high in Vietnamese school children. Dental Caries' status in permanent dentition is increasing with age. Nearly 85% of school children from ages 6-8 have caries in deciduous dentition, and each student has more than 6 teeth and 12 surfaces affected by caries per person. In the past ten years, there has been a tendency to increase in dental caries in this age group, which demonstrates that there is a potential for the risk factor of dental caries in Vietnam to increase further. The analysis of thousands of drinking water samples collected from many provinces across the country over a long period of time shows that the majority of Vietnamese school children has used drinking water sources that are decreased or totally lacking in fluoride. This is one of the potential risk factors of dental caries; therefore, conducting preventive strategies is urgent.

Apart from the deficiency of fluoride in natural drinking water sources for communities, the increase in sugar consumption is a severe risk factor that requires more interest from the community than in the past two decades. There are a considerable percentage of schoolchildren who have never made a dental visit and do not brush their teeth every day, which shows the lack of interest of some parents and schools in oral health care for children. The oral hygiene status of many students is at an unacceptable level.

The leaders of the Government, the Ministry of Health, the Ministry of Education and the Vietnamese Dental Profession have paid more attention to oral health promotion for school children (OHPSC). Oral health promotion is presented through instructive policies for the implementation of OHPSC in Vietnam, which has been enforced since 1987. OHPSC in Vietnam has been greatly effective in dental caries prevention, while risk factors are increasing. Especially in areas where OHPSC has been strictly implemented over the past five years, an

ideal oral health status of school children reaches the World Health Organization's targets. In Vietnam, as well as for many other countries in the world, there has to be an interest taken in OHPSC before it can promote oral health for the community. It is necessary to extend, sustain and develop the OHPSC program to offer oral health care coverage for all Vietnamese schoolchildren frequently and stably. The OHPSC program in Vietnam has been financially effective for the community as well.

It is necessary for the dental profession of Vietnam to stimulate collaboration and sharing of information with other countries in the region and the entire world for the purpose of school-based oral health promotion. This will be helpful in enhancing oral health for general health and well-being, and it will have a significant impact on the quality of people's lives.

REFERENCES

Robert-Thomson KF, Spencer AJ, Hai TD et al. "The second National Oral Health Survey of Vietnam, 1999: Background and methodology.

Loc G.D, Spencer AJ, Hai TD, et al. "Oral Health status of Vietnamese children: Findings from the National Oral Health Survey of Vietnam 1999", Asia Pacific Journal of Public Health, Vol 23, Number 2, March 2011.

Truong TV, Hai TD et al. National Oral Health Survey of Vietnam 2001. Medical Publishing House. Hanoi, Vietnam 2002.
Hai TD (2005). "Dental caries prevention", Medical Publishing House, 2004.

Hai TD, Minh NTH et al. Survey on Fluoride concentration in drinking water sources and dental caries, dental fluorosis situation in children in Hanoi and LaoCai province. Report of Ministry of Health's study. 2010.

Khanh ND. The School Oral Health Promotion Program; Success - Challenges and Solution. The Scientific Proceeding of the 6th ACOHPSC, Hanoi, 2011.

Khanh ND, Hai HD, Hung HT et al. "Effect of water fluoridation of HoChiMinh city after 20 years". The National Scientific Proceeding, 2010.

Quang VT. "Fluoride in caries prevention", Medical Publish House, 1985.

Quang VT. "Dental caries status in Vietnam and the Oral Health approach to the year. 2000", *Hospdent (Tokyo)*. 1992, 4(1), 20-21.
World Health Organization. *Oral Health Surveys (Basic methods) 4th Ed.* Geneva, WHO, 1977.

World Health Organization, "WHO information series on School Health Oral Health Promotion: An essential elements of a Health Promoting School", Document eleven, WHO, Geneva, 2003.

World Health Organization, "The World Oral Health Report 2003: Continuous improvement of Oral Health in the 21st century - The approach of the WHO Global Oral Health Programme, 2003.

ORGANIZING COMMITTEE

LOCAL ORGANISING COMMITTEE

- | | | |
|-----|---|----------|
| 1. | Assoc/Prof Khun Mettachit NAWACHINDA
Vice President
Dental Innovation Foundation under Royal Patronage | Chair |
| 2. | Assoc/Prof Prathip PHANTUMVANIT
Director, National Dental License Examination Board
Thailand Dental Council | Co-chair |
| 3. | Dr Sutha JIENMANEECHOTCHAI
Director
Bureau of Dental Health, Ministry of Public Health | Member |
| 4. | Dr Chantana UNGCHUSAK
Bureau of Dental Health, Ministry of Public Health | Member |
| 5. | Dr Supranee DALODOM
Bureau of Dental Health, Ministry of Public Health | Member |
| 6. | Assoc/Prof Araya PHONGHANYUDH
Faculty of Dentistry, Mahidol University | Member |
| 7. | Dr Piyada PRASERTSOM
Bureau of Dental Health, Ministry of Public Health | Member |
| 8. | Assoc/Prof Oranart MATANGKASOMBUT
Faculty of Dentistry, Chulalongkorn University | Member |
| 9. | Assoc/Prof Waranuch PITIPHAT
Faculty of Dentistry, Khon Kaen University | Member |
| 10. | Assoc/Prof Siriruk NAKORNCHAI
Faculty of Dentistry, Mahidol University
Dental Association of Thailand | Member |
| 11. | Dr Thanya SITTHISETTPHONG
Faculty of Dentistry, Thammasat University | Member |
| 12. | Dr Kornkamol NIYOMSILP
Bureau of Dental Health, Ministry of Public Health | Member |
| 13. | Mr Worawut KULKAEW
Dental Innovation Foundation under Royal Patronage | Member |
| 14. | Dr Woranuch CHETPAKDEECHIT
Faculty of Dentistry, Thammasat University | Member |
| 15. | Mr Pongthon HAEMAOUPATHOM
Dental Innovation Foundation under Royal Patronage | Member |
| 16. | Miss Winapha CHANSUD
Dental Innovation Foundation under Royal Patronage | Member |
| 17. | Mr Khachen KHEOBAINGAM
Dental Innovation Foundation under Royal Patronage | Member |

EDITORS

Dr Yupin SONGPAISAN
Dr Khun Mettachit NAWACHINDA
Dr Chantana UNGCHUSAK

Map of the workshop venue

Map

