

**ORAL HEALTH IN AGEING SOCIETIES:  
INTEGRATION OF ORAL HEALTH AND GENERAL HEALTH**

Respiratory diseases: ■ chronic obstructive pulmonary disease ■ aspiration pneumonia	■ Poor oral hygiene ■ Periodontal disease ■ Difficulty swallowing
Cardiovascular disease: ■ coronary heart disease ■ stroke	■ Tooth loss ■ Severe periodontal disease (bone loss, deep pockets)
Diabetes mellitus (type 1, type 2)	■ Severe periodontal disease

Over the past decade, epidemiological and clinical studies have been undertaken to improve understanding of the associations between oral and systemic diseases (see Annex 3). Various biological mechanisms have been suggested, including the entry of mediators or oral inflammatory conditions, such as gingivitis and periodontitis, into the circulatory system, contributing to systemic inflammation, which has in turn been associated with systemic disease. Causal inference is a major concern to current research as there are still significant gaps in knowledge about the associations between oral and general health.

The criteria to be applied for evaluating the strength of evidence supporting a causal relationship comprise the following (Rothman & Greenland, 2004):

- **Specificity.** A specific agent is found to produce a specific effect.
- **Strength of the association.** Refers to the magnitude of the ratio of incidence (“relative risk”) or some analogous measure. The association may be weak or strong. A strong association serves to rule out hypotheses that the association is due to some weak unmeasured confounder or some modest source of bias.
- **Dose-response relationship.** As the degree of exposure increases, so does the gradient of associated risk.
- **Time sequence.** The exposure of interest precedes the occurrence of systemic disease by a period of time consistent with the proposed biological mechanism.
- **Biological plausibility.** A known biological mechanism may explain the pathophysiological link between a risk factor and the disease in question.
- **Consistency.** Similarity of results obtained in a number of studies conducted in different populations by different investigators, preferably using different methods.
- **Independence from confounding.** The degree to which the association is judged to be independent of potential confounders or known risk factors for the disease.

In recent years, much research has focused on the common risk factors approach to the understanding of associations between oral disease and chronic disease. Several chronic diseases and oral diseases or conditions share risk factors such as the use of tobacco, excessive consumption of alcohol, poor diet and nutritional status, all of which are significantly

affected by socioenvironmental factors.

Findings from current research and use of the strength-of-evidence criteria for causal links between oral health and general health indicators led the meeting to the following conclusions:

- The available scientific evidence is particularly strong for a direct relationship between diabetes and periodontal disease and also suggestive of a relation between periodontal disease and diabetes control.
- The evidence of a direct relationship between periodontal disease and cardiovascular diseases and between periodontal disease and respiratory diseases is less convincing. Evidence is limited by the lack of consistency and by the fact that most studies have used a cross-sectional rather than a longitudinal design or have inadequate control for confounding factors. Appropriate analysis with adequate adjustment for age, tobacco use, and other factors suggests that observed associations between periodontitis and cardiovascular disease could be coincidental rather than causal.
- The impact of xerostomia - dry mouth - on health of the oral cavity has significant biological plausibility. One problem lies in distinguishing the effects of medications on dry mouth from those of the underlying health condition. There is sound evidence that dry mouth negatively affects oral function and quality of life.
- Biological and behavioural factors are implicated in the complex two-way relationships between inadequate nutrition and weight loss on the one hand and poor oral health status on the other. Diet and nutrition in old age are affected by changes in the immune system, by tooth loss and the status of the oral cavity, and by environmental factors. The evidence is strong that medications can provoke malabsorption of vitamins and minerals essential for health.
- Psychosocial factors and common risk factors may be involved in the association between poor mental health and visual impairment and poor oral health.
- Men and women may need to be examined separately since biophysiological change and experience may be sex-specific.

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## Improvement of oral health and general health in older people

Poor oral health among older people is compounded by poor general health, and the growing disease burden is an important public health issue for countries worldwide. The epidemiological literature shows that, while certain industrialized countries may have some information available about oral health and general health, such data are rare for developing countries – particularly the predominantly rural nations of Africa, the Eastern Mediterranean countries, and the most populous countries of China and India.

The available evidence indicates that there are profound oral health disparities among older people across and within regions and countries, and that such disparities relate primarily to living conditions and to the availability and accessibility of oral health services.

Institutionalized and homebound elderly people have poorer oral health than the active elderly. Some positive trends in dentate status are seen in many industrialized countries where the adults who will become the next cohort of elderly people preserve more natural teeth and functional dentition. Remarkably, however, even in countries with advanced public health services and overall improvements in health in general, social inequality appears to persist in the oral health of older people. Importantly, the association between social position, oral health, and general health varies during the course of life; the global challenges in addressing issues of inequality and inequity in old age are particularly marked in relation to health and health care.

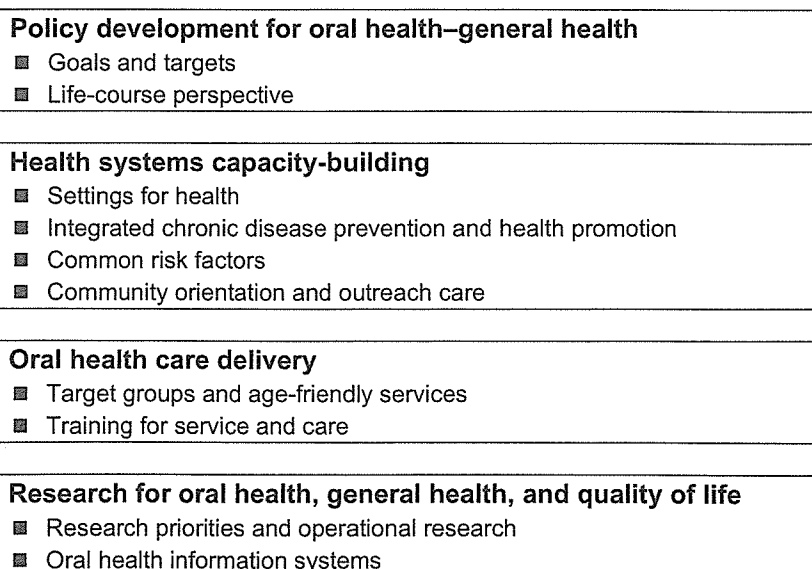
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## **Strategies and areas of action**

Recently, WHO has called for action to promote better health in older people through public health initiatives, age-friendly primary health care, integrated prevention, and multidisciplinary approaches (WHO, 2002e, 2004a). Important mechanisms in oral health promotion and disease prevention relate to the strengthening of health policy development, national capacity-building in health care for the underserved, education and training in service and care for older people, and research for health (Petersen, 2003a; Petersen & Yamamoto, 2005). The challenges vary from country to country and region to region, however, and differences between developed and developing countries are particularly marked.

The meeting participants considered recommendations for action for improved oral health and general health under four principal headings as outlined in **Figure 1**.

**Figure 1. Action for improved oral health and general health in ageing societies**



## Policy development

Oral health problems are often neglected, and in most countries – particularly developing countries – there has been a consequent failure to formulate oral health policies. Only a few countries have clearly stated policies expressed in terms of operational goals and targets specifically for oral health promotion and care in older people. Oral health policies should be an integral part of national and community health policies and should link to policies in such areas as education, nutrition, cancer prevention, tobacco and alcohol control, rehabilitation, and social/health insurance or financing of health care. Policies for oral and general health need to be formulated on the basis of a life-course perspective, with an emphasis that is both temporal and social – looking back at the life experience of the individual or of a cohort or across generations for clues to current patterns of health and disease.

Chronic diseases and related oral health conditions will not only be the leading causes of disability throughout the world by the year 2020 but will also – if not successfully managed – become the most expensive problems faced by health care systems. In this respect, they pose significant threats to all countries. At present, the costs of dental treatment amount to about 0.5–1.0% of gross domestic product in many industrialized countries; by contrast, budgets for oral health care in most developing countries are severely limited.

Significant experiences of policy development in relation to oral health are available from a number of industrialized countries. Oral health policy for the ageing society in Japan has developed as a consequence of Healthy Japan 21 and the 8020 Campaign. Elsewhere, the Council of European Chief Dental Officers has developed policy recommendations for strengthening integrated patient health care, diet and nutrition, and for financing health care for older people, including oral health care.

In some African countries, for example Nigeria, oral health policies are formulated to integrate oral health care with general health care; policy implementation, however, is constrained by a lack of financial and human resources. Similar barriers to the provision of oral health care to older people are encountered in India.

Meeting participants emphasized the importance of strengthening advocacy for action, legislation, and goal-setting and planning of programmes for better oral health – general health in old age. At country level, this process may be prompted by different concerns, such as social justice, welfare, human rights, quality of life, disease burden and cost of treatment, or control of avoidable cancer.

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## Programmes and health systems capacity-building

Public health planners and administrators are encouraged to use the common risk factors approach to integrate interventions for oral health in old age into general health programmes. A benefit of this approach is the focus on improving health conditions for the whole population, as well as for high-risk groups, thereby alleviating inequities. WHO recently launched two global strategies for the prevention of chronic disease, the Global Strategy for Control and Prevention of Noncommunicable Diseases (WHO, 2000) and the Global Strategy on Diet, Physical Activity and Health (WHO, 2004b). Both strategies set guidelines for the implementation of integrated disease prevention, and must incorporate oral health.

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Prevention of tobacco-related diseases has been strengthened significantly since the ratification by countries of the WHO Framework Convention for Tobacco Control (WHO, 2003). In response to this initiative, special activities for prevention of tobacco-induced oral diseases, such as periodontal disease, tooth loss, and oral precancer/cancer, are recommended by the WHO Oral Health Programme (Petersen, 2003b; Petersen, 2003c; Petersen & Ogawa, 2005) and by the World Dental Federation/World Health Organization, based on involvement of oral health professionals in tobacco cessation programmes (FDI/WHO, 2005). In 2005, the World Health Assembly urged countries to develop and reinforce cancer control programmes encompassing prevention, early detection, diagnosis, treatment, rehabilitation, and palliative care (WHO, 2005b). This is particularly relevant to avoidable cancers such as oral cancer, which is relatively common in old age (Petersen, 2005b).

The ageing population may be categorized into three broad functional groups – the functionally independent, the frail, and the functionally dependent. The burdens of oral disease and chronic disease are heaviest among frail and functionally dependent elderly people. Public health programmes should therefore apply appropriate strategies to different groups of older people. Where active, functionally independent older people are concerned, outreach activities may target settings or social environments such as clubs, recreational centres, community centres, or libraries. Older people are less likely than younger people to have received health education early in life, and mass communication and healthy lifestyles programmes must therefore focus on enhancing awareness of the importance of oral and general health and on helping to translate knowledge into practice. For institutionalized and homebound elderly people (i.e. the frail and functionally dependent), the involvement of caregivers may be the key to programme success, as trained nurses and carers play important roles in general and oral hygiene and in diet and nutrition.

Australia's National Oral Health Plan 2004–2013 emphasizes the oral health of older people. Strategies comprise support for at-home oral hygiene, improved affordability of dental care, transport, and assessment on entry to residential care, including question-based oral health assessment in existing community systems. In demonstration projects for community living older people, patients enjoyed a markedly improved quality of life after treatment and intervention.

It is important to ensure the orientation of health care services towards prevention and to deliver care that is appropriate for the diverse needs of the large and growing heterogeneous older population. Oral health systems should overcome any obstacles that prevent or hinder older people's access to and use of health services. For example, the cost – or perceived cost – of treatment may deter socioeconomically disadvantaged older people from visiting a dentist; this problem could be reduced by the creation of age-friendly payment systems.

A growing number of industrialized countries, including Ireland and the Scandinavian countries, are in the process of integrating oral health care for older people with other services accessed by elderly. These programmes focus primarily on frail and functionally dependent elderly people and seek to maximize the potential for multidisciplinary care. Physicians may have a significant role in incorporating oral health concerns in regular routine examinations, for example oral cancer

screening or control of diabetes, referring patients to a dentist when necessary. Equally, dentists may play important roles in the early diagnosis of systemic disease and nutritional deficiencies, referring patients to physicians when necessary for systemic disease management and counselling.

Meeting participants expressed concern about the situation in most developing countries. The barriers to oral health care and primary health care faced by all age groups are particularly high because of the shortage of dental personnel and other health professionals. Community models for outreach services and multidisciplinary provision of essential health care must be implemented urgently to improve health in the low-resources communities of Africa and Asia. Community health care work in the Republic of Korea has provided useful experiences. The community health care concept is based on needs-driven packages of health services in the locality of residence for older people; it incorporates social care, quality of life, and oral health. Similar demonstration programmes established in China link community-oriented oral and general health promotion to control of chronic diseases and integrate oral health services with public health services for the elderly.

Finally, participants discussed the issue of traditional medicine in general and oral health care. Traditional medicine may be an important basis for health care, particularly in communities where the availability or access to formal health services is low.

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#### Training for service and care

The meeting noted that, in several industrialized countries, training in geriatric dentistry has long been included in the curriculum for dental students and practitioners. Such training is oriented largely towards the biomedical and clinical aspects of care rather than the sociological and behavioural factors of ageing, illness, and care. Understanding the economic and psychosocial dimensions of poor oral health and poor general health in terms of functional impairment and the negative impact on quality of life is also fundamental to provision of adequate health care, communication, and health education. By contrast, curricula in most schools of dentistry/stomatology in the African, Asian, and Eastern Mediterranean regions have yet to incorporate geriatric dentistry or medicine.

There was general consensus that systematic education of both oral and medical health professionals on oral health – general health relationships needs to be strengthened, and that both categories of health professionals should be trained in multidisciplinary approaches to holistic, comprehensive health care as well as in prevention and community-oriented health promotion. This enhanced training in social science dimensions of health care is essential if health systems are to meet the needs and expectations of older people in the future. These perspectives were similarly emphasized in a WHO policy document, *Towards age-friendly primary health care* (WHO, 2004a).

The University of Iowa in the USA has gained experience from interdisciplinary geriatric education programmes that include undergraduate and postgraduate training, modelled on the WHO Ottawa Charter for Health Promotion. Theoretical and clinical courses focus on the health of frail, functionally dependent, cognitively impaired, and terminally ill persons and are integrated with geriatric medicine,

psychiatry, and nursing.

Training physicians in oral screening will be instrumental in controlling disease and meeting the health care needs of older people. The shortage of oral and general health professionals in most developing countries makes it vital that training for service and care focus on primary health workers and other health professionals. Primary health workers may have contact at local community or village level with older people suffering from poor oral and general health, and it is critical that they have the necessary background to provide essential health care and to refer patients for specialized care when appropriate.

Globally, caregivers are instrumental in promoting the health of older people. Meeting participants emphasized the role of caregivers in improving self-care capacity in oral and general health and providing for healthy diet and nutrition amongst elderly. Where oral health services and primary health care are available, caregivers may also help disadvantaged older people to overcome the barriers to effective use of these facilities. However, caregivers and other personnel, such as ancillary staff of institutions or nursing homes, often demonstrate an alarming lack of knowledge about the oral health of older persons. Systematic training of these key groups is critical to successful integration of oral health into general health improvement initiatives for older people.

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## **Research for oral health-general health**

Strengthening of research into oral health–general health should focus on biomedical, clinical, and epidemiological aspects. The increasing biomedical research on oral health–general health interrelationships can provide a better understanding of pathophysiological disease mechanisms. Epidemiological research needs to be strengthened considerably to allow assessment of cause-effect relationships, and longitudinal studies on oral health-general health, with appropriate control of potential confounding factors, are badly needed. The Niigata Elderly Study, being carried out between 1998 and 2008 by Niigata University, Japan, promises much: the data from this longitudinal study comprise information about general health, risk factors, and oral health.

The international geriatric research community and the International Association for Dental Research are increasingly interested in research into the oral health of older people. The *Elder's Oral Health Summit*, held in Boston, USA, in September 2004 focused particularly on “What do we need to know?” and stressed the need for research in the following areas:

- overcoming barriers to providing care for underserved people;
- developing an evidence base to identify appropriate dental services for frail and functionally dependent older adults;
- increasing knowledge about disparities in oral health and access to dental care among the poor and racial and ethnic minorities.

Meeting participants emphasized the urgent need for operational research on the health status of older people, particularly in developing countries, in order to inform policy- and decision-makers. Such information should be complemented by data on sociobehavioural risk factors and quality of life.

WHO's Global Oral Health Database includes essential information for surveillance of oral health status; its data are based on standard methodology for oral health surveys (WHO, 1997). Meeting participants recommended that WHO consider the oral health needs of older people and general health aspects when revising the manual *Oral health surveys: basic methods*.

Most recently, WHO has developed the Global InfoBase – an integrated data system for chronic disease surveillance that incorporates common risk factors and oral health status (Petersen et al., 2005). This system allows for analysis of links between chronic disease, oral disease, and common risk factors at aggregate country level. It may be used not only in public health surveillance but also in health systems research. Countries are recommended to adopt similar data information systems at national level, incorporating health information relevant to older people.

The meeting also suggested replication of the International Collaborative Studies of Oral Health Care Systems (ICS Studies) (Arnljot et al., 1985; Chen et al., 1997) to cover developing countries as well. A future global study may assist in oral health systems analysis, including evaluation of oral health intervention programmes for older people.

The need to build and strengthen research capacity as an effective, efficient, and sustainable strategy for enabling countries to benefit from knowledge for better health was stressed recently by WHO (WHO, 2004c). The WHO Oral Health Programme has highlighted the need for more research on oral health-general health relationships, common risk factors, and quality of life in older people (Petersen, 2005c). Translation of available knowledge into clinical and public health practice is particularly encouraged as poor and disadvantaged population groups worldwide have yet to benefit as fully as possible from advances in health sciences.





# 4. CONCLUSIONS AND RECOMMENDATIONS

Research on oral health-general health relationships has grown considerably over the past decade. Background documents and presentations and discussions at the meeting gave rise to the following conclusions:

- The available scientific evidence is particularly strong for a direct relationship between diabetes and periodontal disease and also suggestive of a relation between periodontal disease and diabetes control.
- The evidence of a direct relationship between periodontal disease and cardiovascular diseases and between periodontal disease and respiratory diseases is less convincing. Evidence is limited by the lack of consistency and by the fact that most studies have used a cross-sectional rather than a longitudinal design or have inadequate control for confounding factors. Appropriate analysis with adequate adjustment for age, tobacco use, and other factors suggests that observed associations between periodontitis and cardiovascular disease could be coincidental rather than causal.
- The impact of xerostomia - dry mouth - on health of the oral cavity has significant biological plausibility. One problem lies in distinguishing the effects of medications on dry mouth from those of the underlying health condition. There is sound evidence that dry mouth negatively affects oral function and quality of life.
- Biological and behavioural factors are implicated in the complex two-way relationships between inadequate nutrition and weight loss on the one hand and poor oral health status on the other. Diet and nutrition in old age are affected by changes in the immune system, by tooth loss and the status of the oral cavity, and by environmental factors. The evidence is strong that medications can provoke malabsorption of vitamins and minerals essential for health.
- Psychosocial factors and common risk factors may be involved in the association between poor mental health and visual impairment and poor oral health.
- Men and women may need to be examined separately since biophysiological change and experience may be sex-specific.

Meeting participants considered several recommendations for action towards improved oral health and general health in relation to:

- policy development for oral health and general health;
- health systems capacity-building;
- oral health care delivery;
- research for oral health, general health, and quality of life

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They emphasized the importance of strengthening advocacy for action, legislation, goal setting, and planning of programmes for better oral health–general health in old age. They also expressed concern about the situation in most developing countries where access to oral health services and primary health facilities are limited. For all countries, it was strongly recommended that oral health systems be effectively oriented towards disease prevention and health promotion and that systems better match the needs of older people, including the functionally independent, the frail, and the functionally dependent.

Meeting participants stressed the need for training of health professionals for better service and care, based on multidisciplinary and holistic approaches, and pointed out the instrumental role of caregivers globally in promoting the health of older people.

In the opinion of meeting participants, strengthening of quality research into oral health–general health relationships is needed. Translation of knowledge into clinical and public health practice is particularly important as poor and disadvantaged population groups world-wide have yet to benefit as fully as possible from advances in health sciences. This is especially applicable to the oral health of older people in most countries.

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# ANNEX 1

## Meeting programme

### *Day 1 – Wednesday, 1 June 2005*

09:00 – 09:30	Registration	
09:30 – 09:40	Welcome and opening remarks	Dr Wilfried Kreisel, Director, WKC
09:40 – 10:15	Objectives of the meeting	Dr Poul Erik Petersen, ORH/HQ (Dr Hiroshi Ueda)
	Introduction and election of Chairperson and Rapporteurs	
	Adoption of the agenda	Chairperson
10:15 – 10:20	Photo session	
10:20 – 10:40	<i>Coffee/tea break</i>	
10:40 – 12:00	Session 1 – Profile of global ageing: challenges to health	Dr Gary Andrews
	Session 2 – Introduction to WHO global strategies and approaches for the improved oral health of older people	Dr Poul Erik Petersen (Dr Hiroshi Ueda)
	Discussion	
12:00 – 13:30	<i>Lunch break</i>	
13:30 – 14:40	Session 3 – State-of-the-science on the relationship between oral health and general health status in ageing societies: what is known and not known	Dr Daniel Kandelman
	Discussion	
14:40 – 18:00	Session 4 – Country case reports	
	(1a) Japan	Dr Nobuhiro Hanada
	(1b) Niigata Elderly Study, Japan	Dr Hideo Miyazaki
	(1c) Longitudinal Study among Dentists in Japan	Dr Kenji Wakai
	(2) China	Dr Ling Zhu
	(3) India	Dr Hari Parkash
	(4) Ireland	Dr Helen Whelton
	(5) Jordan	Dr Lamis Rajab
	(6) Nigeria	Dr Enosakhare S. Akpata
	(7) USA	Dr Ronald Ettinger
	Discussion (with coffee/tea break)	

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***Day 2 – Thursday, 2 June 2005***

09:00 – 09:20	Feedback from Day 1	Chairperson/Rapporteurs
09:20 – 12:00	Session 5 – Essential dimensions of oral health in the elderly	
	(1) Medical and nutritional	Dr Cyril Enwonwu
	(2) Quality of life and life-course	Dr Anne Pak-Poy
	(3) Inequity in health	Dr Murray Thomson
	(4) Community health care	Dr Ok-Ryun Moon
	Discussion (with coffee/tea break)	
12:00 – 13:30	<i>Lunch break</i>	
13:30 – 14:20	Session 6 – Global diversity in ageing societies: the feasibility of comprehensive and integrated oral health approaches in different ageing societies and identification of target groups of older people	Dr Jos van den Heuvel
	Discussion	
14:20 – 15:30	Session 7 – Indicators and surveillance of oral health and risk factors in ageing societies	Dr Poul Erik Petersen Dr Hiroshi Ogawa
	Discussion	
15:30 – 15:50	<i>Coffee/tea break</i>	
15:50 – 16:40	Session 8 – Bridging the gaps: research and policy, clinical and public health practices, multidisciplinary approaches	Dr Kaumudi Joshipura
	Discussion	
16:40 – 17:30	Session 9 – 8020 Survey in Hyogo Prefecture, Japan	Dr Mitsugu Kanda

***Day 3 – Friday, 3 June 2005***

09:00 – 10:00	Review of Days 1 and 2	Chairperson/Rapporteurs
10:00 – 11:30	Session 10 – Recommendations	Facilitators: Dr Poul Erik Petersen and Dr Hiroshi Ueda
11:30 – 12:00	Session 11 – Next steps toward oral health in ageing societies	
12:00 – 12:30	Closing session	
	Closing remarks	Dr Wilfried Kreisel
	Close of the meeting	Chairperson

# ANNEX 2

## List of participants

### *Temporary Advisers*

**Dr Enosakhare Samuel Akpata**, Professor, Department of Restorative Sciences, Faculty of Dentistry, Kuwait University, Safat, Kuwait

**Dr Gary Andrews**, Professor and Director, Centre for Ageing Studies, University of South Australia and Flinders, Adelaide, South Australia, Australia

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**Dr Ronald Ettinger**, Professor, Department of Prosthodontics, College of Dentistry, University of Iowa, Iowa City, IA, USA

**Dr Nobuhiro Hanada**, Director, Department of Oral Health, National Institute of Public Health, Tokyo, Japan

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**Professor Daniel Kandelman**, Professor and Director, Department of Oral Health, Faculty of Dental Medicine, University of Montreal, Montreal, Canada

**Dr Hideo Miyazaki**, Professor, Graduate School of Medical and Dental Sciences, Niigata University, Niigata, Japan

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**Professor Lamis Rajab**, Faculty of Dentistry, The University of Jordan, Amman, Jordan

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**Dr Jos van den Heuvel**, Chief Dental Officer, Ministry of Health, Welfare and Sport, The Hague, Netherlands

**Dr Kenji Wakai**, Department of Preventive Medicine, Aichi Cancer Center Research Institute, Nagoya, Japan

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**Dr Masahiko Hori**, Hyogo Dental Association, Hyogo, Japan

**Dr Masayuki Kawamura**, Hyogo Dental Association, Hyogo, Japan



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**Dr Hiroaki Wakabayashi**, Hyogo Dental Association, Hyogo, Japan  
**Dr Takayuki Kuroda**, President, International Association for Dental Research (IADR), Alexandria, VA, USA  
**Dr Mariko Naito**, Graduate School of Medicine, Nagoya University, Nagoya, Japan  
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**Secretariat**

**WHO Centre for Health Development, Kobe, Japan:**

**Dr Wilfried Kreisel**, Director  
**Dr John Cai**, Ageing and Health Programme Coordinator  
**Dr Hiroshi Ueda**, Technical Officer, Ageing and Health Programme  
**Dr Kukan Selvaratnam**, Technical Officer, Informatics, Information Technology  
**Ms Yoko Inoue**, Secretary  
**Ms Merisa Romero**, Secretary  
**Ms Kazumi Ueda**, Secretary

**WHO, Geneva, Switzerland**

**Dr Poul Erik Petersen**, Chief, Oral Health Programme  
**Dr Hiroshi Ogawa**, Oral Health Programme

# ANNEX 3

## Background discussion paper

### Interrelationships between oral health and general health of older people

Professor Daniel Kandelman  
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## 1. The global demographic transition and the elderly population

The global population is increasing at an annual rate of 1.2%, while the population of those 65 years or older is increasing at a rate of 2.3% (UN, 2002). About 600 million people are currently aged 60 years or older and this number is expected to double by 2025 (WHO, 2002). By 2050, there will be two billion elderly people, 80% of them living in developing countries. The United Nations estimates that persons older than 80 years will comprise 20% of the world's elderly population (UN, 2003). In China, more than 1.2 billion people (or approximately 10% of the total population) are 60 years or older; this proportion is expected to increase in the next decades, and a significant proportion of the older population will live in rural areas. In India, the percentage growth of the population aged 60 years or older is much higher than that of other age groups. Life expectancy at birth was only 32 years when the country achieved its independence 50 years ago, whereas the figure has risen to more than 62 years. In the United States, the age group showing the greatest increase in numbers is the centenarians (people aged 100 years and over). In Japan, the ageing population is changing rapidly with the proportion of adults 65 or older at 17.2% in 2000 growing to 28.9% in 2025 (UN, 2002).

The growing proportion of the elderly is attributed mainly to the decrease in mortality rates among older people and to overall declines in birth rates. In addition, progress in health care and the implementation of public health measures have extended life expectancies worldwide.

The demographic transition challenges health authorities, particularly with regard to the burden of disease and its impact on quality of life of the elderly persons. Indeed, the increase in life expectancy does not necessarily progress in parallel with improved quality of life. In Sweden, for instance, the total number of people suffering from physical and mental disorders is increasing and becomes more difficult to control (Heyden, 1998). Poor oral health affects people's quality of life with respect to eating, social appearance and communication. The rise in life expectancy without improvement in quality of life has a direct impact on health expenditures and is becoming a key public health issue in the more developed countries. It may also become a major burden for countries with high population densities and emerging economies, such as China and India.

The WHO Health Report 2002 (WHO, 2002) identifies some major global risks of disease, disability and death in the world today. The impact of different risks of losing healthy life years is aggravated with ageing, because of lower individual resistance, growing burden of chronic diseases, and poor socio-environmental and nutritional conditions. Although most persons can now look forward to living longer, the risk of developing at least one chronic disease (such as hypertension or diabetes) increases with age; this reflects more a cumulative effect of a life-long exposure to risk factors and is not related to chronological age *per se* (WHO, 2002). The trend currently observed in the population at large is more obvious with older persons, whose age-associated physiological changes may deprive them of their mobility and independence (and to a much greater extent if they are also ill with chronic diseases).

The purpose of this report is to review the literature on the inter-relationships between oral health and general health, with special reference to elderly populations. The impact of poor oral health on quality of life is analyzed and the implications for oral health care are discussed.

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## **2. Psychosocial function, general health and oral health**

Many physiological changes take place as part of ageing, such as decreasing vigour and skilfulness, as general metabolism slows down. Hearing and sight, smell and taste can all be impaired to some degree. General body physiology is affected, along with organ functions, including reduction in heart strength, reduction of ventilatory capacity of the lungs, slower nerve transmission in the brain, decreased muscle mass, and increased risk of endocrine problems. Activities involving locomotion can also be impaired due to loss of elasticity in supporting structures (Avlund et al., 2001). Changes in oral function remain minor as long as oral health is preserved. The situation can be quickly compromised, however, if optimal oral health is not maintained.

In an attempt to identify target groups for which oral health services can be rendered, older people have been classified into three categories according to psychosocial function:

1. the functionally independent older adult
2. the frail older adult
3. the functionally dependent older adult

Individuals in the first group can remain largely independent even in the light of greater demands for general health care. Individuals in the next two groups invariably need assistance in maintaining even the most basic levels of personal care. The third group includes those individuals requiring special care at home or in institutions. In most developing countries, family and social support structures are eroding due to a variety of factors, and frail older individuals are consequently at high disease risk (International Conference on Rural Ageing Oral Health, 2001). Finally, in older persons, socio-economic factors such as low income, low education and weak social support have been shown to be closely related to functional impairment in oral health (Kandelman et al., 1986; Petersen & Nörtov, 1989; Shah & Sundaram, 2003). Petersen and Nörtov (1989) found that inactive lifestyle and weak family network are highly associated with poor oral and general health and dental care habits among old age pensioners. Recent studies have indicated a direct relationship between reduction in functional capacities and poorer personal oral hygiene, as well as declining use of dental services (Avlund et al., 2001; Petersen & Nörtov, 1989;

Chalmers, 2003, Österberg et al., 1990; Norlén et al., 1991).

### **2.1 Mental diseases**

The incidence of psychiatric illness is particularly high in the elderly, because of the increased prevalence of dementia with age (Katona & Robertson, 1995). A study assessing the oral health of psychiatric elderly in-patients in South Wales (Lewis et al., 2001) demonstrated a higher prevalence of edentulism than in the general population of the respective age group, as well as relatively poor oral hygiene and a higher DMF score. This confirms previous findings in Denmark (Hede & Petersen, 1992). Depression and periodontitis are both common problems in older adults, and psychosocial stress may induce neglect of oral hygiene (Genco et al., 1999). Furthermore, resistance to periodontal therapies has been reported in people suffering from psycho-social problems (Axteillus et al., 1998). Persson et al. (2003) reported that depression was not associated with a greater risk of periodontitis in older adults, but was associated with tooth loss and chronic disease conditions associated with pain. Poor mental health status was considered as a risk factor in a six-year prospective cohort study of tooth loss and edentulism among institutionalised elderly people (Shimazaki et al., 2003).

Dementia and particularly Alzheimer's disease are frequent among older people, and prevalence rates increase with age (Katona & Robertson, 1995; Henry & Smith, 2005). The progressive loss of intellectual function and memory inevitably leads to deterioration in oral health unless the family or institution are able to assist in oral health care.

A recent study of patients with Parkinson disease (PD) described data on oral health conditions and related factors in people aged 60-69 and 70+ years (Nakayama et al., 2004). It was reported that PD patients often complained of chewing difficulties (taking into account that many of them were edentulous) and swollen gums. Almost half of the patients could not brush their teeth or clean their dentures properly. Complaints about chewing difficulties were most frequent among PD patients with dyskinesia and oral dyskinesia. In addition, problems related to poor function of dentures (i.e. loosening or poor denture retention) were due particularly to lack of muscle coordination and rigid facial muscles. PD patients also appeared to have a high risk of losing their teeth because of the use of anticholinergics or monoamine-oxidase inhibitors, and poor oral health due to xerostomia. Dysphagia is known to be a common symptom in many PD patients (Johnston et al., 1995), and can promote aspiration pneumonia, especially when oral hygiene is neglected. Daily toothbrushing and cleaning of dentures may be impaired due to resting tremors, akinesia and bradykinesia.

### **2.2 Visual impairments**

Visual impairments can be included among chronic disease conditions associated with poor oral health in old age. The main age-related impairments are cataracts, macular degeneration, retinal detachment and glaucoma. Blindness is also linked with diabetes retinopathy, trachoma and leprosy (Schembri & Fiske, 2001). Although the pattern of dental disease in persons with disabilities is shown to be similar to their peers without disabilities (Taylor et al., 1986), visual impairment can affect an elderly person's ability to maintain oral health and to recognize signs of oral