

Review

Strengthening the Prevention of Periodontal Disease: The WHO Approach

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Background: The aim of this paper is to provide an overview of the burden of periodontal disease in adult populations worldwide, to emphasize the essential risk factors common to periodontal disease and chronic diseases, to outline important new strategies for effective prevention of periodontal disease, and to inform about the role of the World Health Organization (WHO) in developing a national capacity for the prevention of disease.

Methods: Information about periodontal health status as measured by the Community Periodontal Index system is stored in the WHO Global Oral Health Data Bank. Updated information concerning WHO standard age groups was used to describe the prevalence rates of signs of periodontal disease, i.e., gingival bleeding, periodontal pocketing, and loss of attachment.

Results: Gingival bleeding is highly prevalent among adult populations in all regions of the world; advanced disease with deep periodontal pockets (≥ 6 mm) affects ~10% to 15% of adults worldwide. The available evidence shows that important risk factors for periodontal disease relate to poor oral hygiene, tobacco use, excessive alcohol consumption, stress, and diabetes mellitus. Integrated preventive strategies based on the common risk factors approach are recommended for public health practice.

Conclusions: The vast majority of countries need to establish a surveillance system for measuring progress in the control of periodontal disease and promotion of oral health. WHO has designed approaches for the integration of oral disease prevention within the prevention of non-communicable chronic diseases, and global strategies are currently being implemented in all regions of the world. *J Periodontol* 2005;76:2187-2193.

KEY WORDS

Chronic disease; general health; periodontal disease; risk factors; surveillance; unhealthy lifestyles.

The World Health Organization (WHO) recently published a global overview of oral health, a statement that described the approaches to oral disease prevention and promotion of oral health during the 21st century.¹ The report emphasized that, despite great improvements in the oral health status of populations across the world, problems still persist. This is particularly so among underprivileged groups in developed and developing countries. In several industrialized Western countries, oral health care is made available to the population, comprising preventive and curative services, and is based on either private or public systems. Meanwhile, people in deprived communities, certain ethnic minorities, home-bound or disabled individuals, and older people are not sufficiently covered by oral health care. Many developing countries have a shortage of oral health personnel, services are mostly offered from regional or central hospitals of urban centers, and little importance is given to preventive or restorative dental care.

Periodontal disease contributes significantly to the global burden of oral disease. Meanwhile, for various reasons, somewhat limited attention has been given to periodontal disease in most countries by the population at large, providers of oral health care, and public health administrators. The objectives of the present report are: 1) to outline the prevalence of periodontal disease in the adult population in a global perspective; 2) to emphasize the importance of risk factors common to periodontal disease and

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several chronic diseases; 3) to discuss essential strategies and approaches in prevention of periodontal disease; and 4) to provide information about the work carried out by WHO for strengthening the control of periodontal disease worldwide.

EPIDEMIOLOGY OF PERIODONTAL DISEASE

Periodontal disease is one of the two major dental diseases that affect human populations worldwide at high prevalence rates.^{1,2} The prevalence and severity of periodontal disease have been measured in population surveys in several developed and developing countries, and these studies were carried out with a wide range of objectives, designs, and measurement criteria.³ The Community Periodontal Index (CPI)^{4,5} was introduced by WHO to provide profiles of periodontal health status in countries and to enable countries to plan intervention programs for effective control of periodontal disease. In addition, the CPI data may be helpful in the surveillance of oral health at country and intercountry levels. Although this index has certain shortcomings when used as a stand-alone means of assessing the extent and severity of periodontal disease,² it has been widely used for descriptive periodontal epidemiologic studies and needs assessment in developed and developing countries.

The major advantages of the CPI are simplicity, speed, reproducibility, and international uniformity. In 1997, WHO suggested including information on loss of periodontal attachment in oral health surveys.⁵ Periodontal disease severity as measured by probing depths and loss of periodontal attachment has been related to age in numerous studies.^{6,7} Epidemiologic data available at WHO confirm studies which show that periodontal disease prevalence and severity tend to be high in older age groups as compared to younger age groups.^{1,8} Therefore, certain indicator age groups are identified by WHO for intercountry comparisons and to assess the impact of oral health systems on periodontal health.⁵ The essential age groups comprise 15 to 19, 35 to 44, and 65 to 74 year olds. Over the last two decades, several countries have provided CPI data to be stored in the WHO Global Oral Health Data Bank,⁸ and they are displayed through a component of the so-called WHO Country/Area Profile Program (CAPP), University of Niigata, Japan. The standard parameters for the presentation of data are percentage of persons by their highest CPI score (prevalence rate) and the mean number of sextants (severity) with certain CPI scores: score 0 = healthy periodontal conditions; score 1 = gingival bleeding; score 2 = gingival bleeding and calculus; score 3 = shallow periodontal pockets (4 to 5 mm); score 4 = deep periodontal pockets (≥ 6 mm); score 9 = excluded; and score X = not recorded or not visible.

The CPI databank was recently updated, and the population data available in the WHO Global Oral

Health Data Bank are summarized for countries in Figures 1 through 8. The CPI data are expressed in mean percentages of persons with certain CPI scores and the mean number of sextants with CPI scores and presented for the three age groups of adults in relation to the WHO region. The most severe score or sign of periodontal disease (CPI score 4) varies worldwide from 10% to 15% in adult populations; however, the most prevalent score in all regions is CPI score 2 (gingival bleeding and calculus), which primarily reflects poor oral hygiene. For some countries, surveillance data are available that may allow the analysis of the impact of oral health programs. Such data are illustrated in Figures 7 through 8.

In most epidemiologic studies carried out globally, significant relationships between socioeconomic

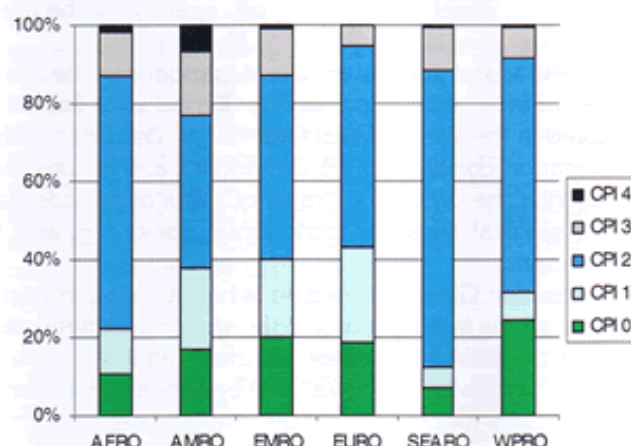


Figure 1.

Mean percentages of maximal CPI scores in 15 to 19 year olds by WHO Regional Offices (RO). AFRO: Africa RO; AMRO: Americas RO; EMRO: Eastern Mediterranean RO; EURO: Europe RO; SEARO: South-East Asia RO; WPRO: Western Pacific RO.⁸

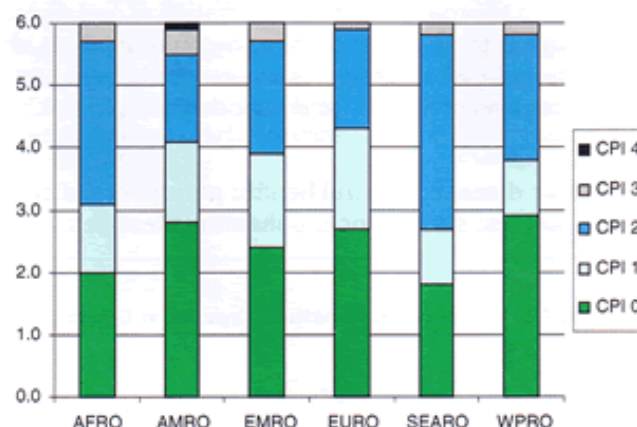


Figure 2.

Mean numbers of sextants with CPI scores in 15 to 19 year olds by WHO Regional Offices.⁸

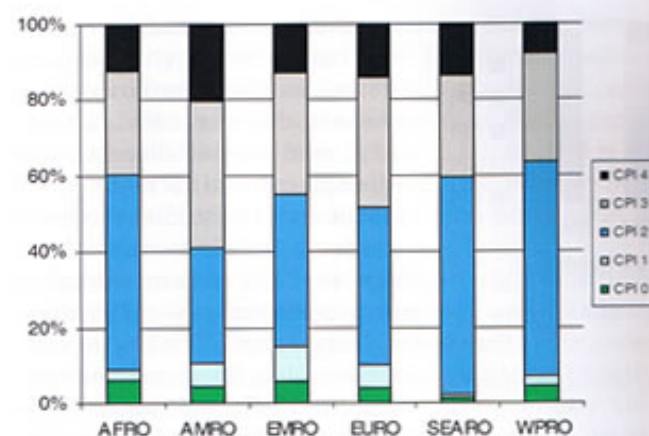


Figure 3.

Mean percentages of maximal CPI scores in 35 to 44 year olds by WHO Regional Offices.⁸

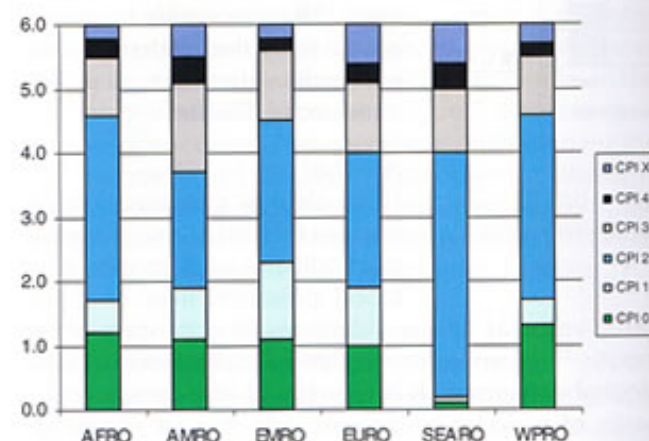


Figure 4.

Mean numbers of sextants with CPI scores in 35 to 44 year olds by WHO Regional Offices.⁸

status and periodontal disease have been observed; i.e., low income or low education contributes to poor periodontal disease status.^{2,7,9-11} According to Drury et al.,⁹ there was a 10% to 20% difference in periodontal disease prevalence and severity between people of higher and lower socioeconomic status in the U.S. population. Considerable differences in the occurrence of periodontal disease are found by urbanization, and the socioenvironmental factors are highly responsible for distinct profiles of periodontal disease observed in populations living in certain geographic regions or locations.¹²

The distribution of periodontal disease within countries also differs according to race or ethnic group regarding prevalence and severity.^{1,10,13} Beck et al.¹⁴ showed that groups of blacks have a risk of periodontal destruction three times higher than that of whites of the same age cohort, and studies by Borrell et al.¹³ found

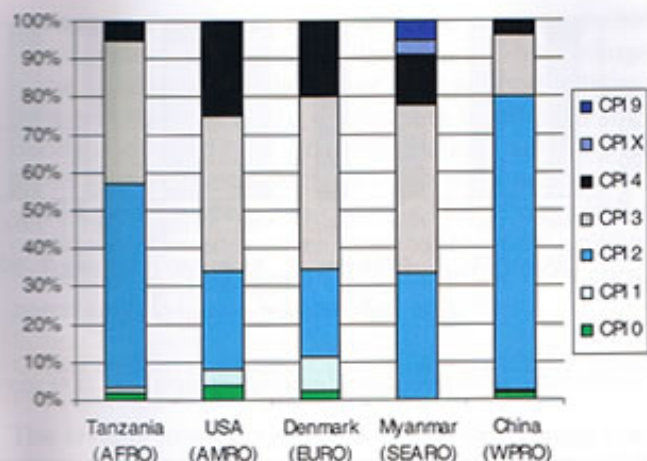


Figure 5.

Mean percentages of maximal CPI scores in 65 to 74 year olds in selected countries.⁸

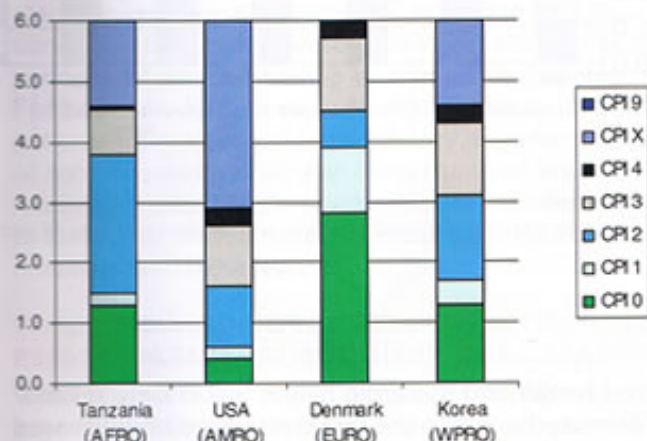


Figure 6.

Mean numbers of sextants with CPI scores in 65 to 74 year olds in selected countries.⁸

that African-Americans were twice as likely to have periodontal disease as were white Americans. The effect of ethnicity on periodontal health status was also documented in adults of developing countries.¹⁵⁻¹⁸

In addition to poor oral hygiene, the important risk factors for severe periodontal diseases relate to tobacco use, malnutrition, excessive alcohol consumption, stress, diabetes mellitus, and certain other systemic disease conditions.¹⁹⁻²³ In several studies applying multifactor analytical models, unhealthy lifestyles have significant effects on risks of several chronic diseases.²⁴⁻²⁶ Periodontal disease has risk factors in common with a number of other non-communicable diseases (NCD) and conditions, and focusing on the common behavioral and environmental risk factors would be instrumental in the effective prevention of periodontal disease.

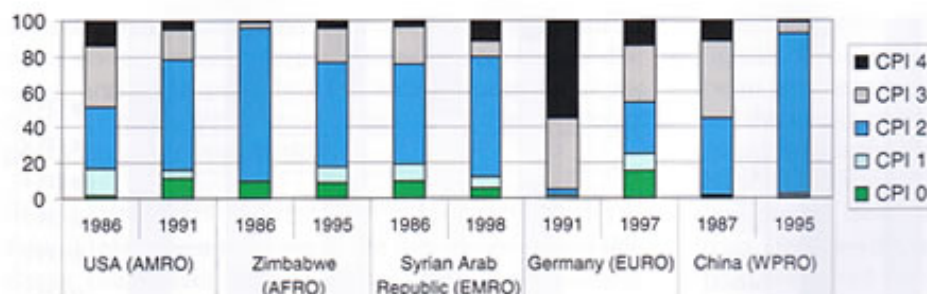


Figure 7.

Time trends in mean percentage of maximal CPI scores in 35 to 44 year olds of selected countries.⁸

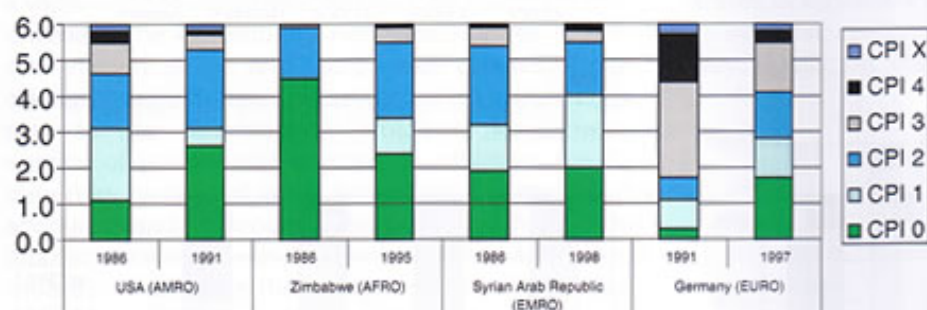


Figure 8.

Time trends in mean number of sextants with CPI scores in 35 to 44 year olds of selected countries.⁸

COMMON RISK FACTORS FOR CHRONIC DISEASES AND PERIODONTAL DISEASE

Oral health and systemic health are closely related. This may be due to the fact that severe oral diseases and non-communicable chronic diseases have common risk factors such as tobacco use, diet, excessive alcohol consumption, stress, and poor hygiene practices.¹ In addition, bidirectional interrelationships between oral and general diseases have been demonstrated, for example, in the case of periodontal and systemic diseases.

Tobacco

The use of tobacco has been implicated in a large number of diseases. Smokers more often develop cancers of the lung, mouth, throat, pancreas, kidney, and urinary tract and have coronary heart disease and stroke, respiratory diseases, diabetes, and ulcers than non-smokers.²⁷ It is estimated that smoking causes about 30% of all cancer diseases and deaths and 90% of all lung cancers.^{27,28} Smokers also have a high risk of periodontal disease and lesions of the oral mucosa.^{29,30} Studies have shown that smoking accounts for more than half of the periodontal cases among the U.S. adults.³¹

Diet

Several chronic diseases show increasing incidence rates in developed and developing countries, and they

are the main cause of premature mortality. Most chronic diseases, such as cardiovascular disease, diabetes, cancers, obesity, and dental disease, are strongly related to diet,^{20,32,33} and a series of studies has concluded that this is particularly due to diets rich in saturated fatty acids and non-milk extrinsic sugars and diets low in polyunsaturates, fiber, and vitamins A, C, and E. Severe vitamin C deficiency and malnutrition may result in aggravated periodontal disease conditions. However, relatively few reports are available on the role of diet and nutrition in the etiology of periodontal disease.³² It is necessary to investigate further the evidence of an association between diet and periodontal disease.

Alcohol

High alcohol consumption increases the risk of a wide variety of conditions such as increased blood pressure, liver cirrhosis, cardiovascular disease, diabetes, and cancers of the mouth.³³ Recent research also indicates that excessive alcohol consumption is associated with increased severity of periodontal disease.^{21,23} Alcohol consumption, tobacco use, and unhealthy diet commonly go together. People who consume tobacco are more likely to drink alcohol and eat a diet high in fats and sugars but low in fiber and polyunsaturated fatty acids. People who have a high consumption of tobacco and alcohol are thus more likely to be at a higher risk of severe periodontal disease and oral cancer.

Stress

It is well known that cardiovascular disease, diabetes, and other chronic diseases are related to psychosocial factors,^{34,35} but there is also evidence that stress is linked to periodontal disease.¹⁹ Moreover, life events are associated with periodontal disease, possibly through physiologic responses that increase susceptibility to periodontal disease.³⁶

PERIODONTAL AND GENERAL HEALTH

Among the associations observed between oral health status and chronic systemic diseases, the link between periodontal disease and diabetes mellitus is the most consistent.^{37,38} Diabetes mellitus is a heterogeneous

group of disorders with different causes but all characterized by hyperglycemia. Type 1 diabetes mellitus is due to destruction of the insulin-producing cells. Type 2 diabetes mellitus is the result of insulin resistance coupled with relative beta-cell failure.³⁷ It is recently reported that type 2 diabetes comprises ~90% of all cases of diabetes mellitus in the population of several countries.^{38,39}

Approximately 177 million people worldwide have diabetes mellitus, and this number may well double by the year 2030.³⁹ Much of this increase will occur in developing countries and be due to population growth, aging, unhealthy diets, obesity, and sedentary lifestyles. Currently, most people with diabetes in developed countries are aged 65 years or older, whereas in developing countries most diabetics are 45 to 64 years of age.^{39,40} Available data suggest that the prevalence of diagnosed and undiagnosed diabetes mellitus in older subjects approaches 20%.⁴¹

In the child populations of many countries, diabetes also adds to the burden of disease, and type 2 diabetes mellitus has been described as a new epidemic. In the U.S., an overall 33% increase in type 2 diabetes mellitus prevalence was documented in children over the past decade.⁴² In 1992, type 2 diabetes mellitus was rare in most child populations; however, in 1999, the incidence of type 2 diabetes mellitus ranged between 8% and 45%, depending on geographic location.⁴²

DIABETES MELLITUS AND PERIODONTAL DISEASE

It is widely documented that subjects with diabetes mellitus have a higher risk of periodontal disease, and periodontal disease has been considered the sixth complication of diabetes.²⁴⁻²⁶ Extensive studies have reported significant associations between diabetes and the severity of periodontal disease.^{37,38} Taylor et al.⁴³ concluded from a literature review of severe periodontal disease and diabetes mellitus that not only was there a greater prevalence of periodontal symptoms but the progression of periodontal disease was also more aggressive or rapid.

Most studies on periodontal health were carried out in populations with type 1 diabetes, whereas relatively few reports highlight the relationship between periodontal disease and type 2 diabetes.²⁵ One epidemiologic study has been conducted among the Pima Indians.⁴⁴ Significantly poorer periodontal health was reported in type 2 diabetics, and the relative risk of periodontal disease in subjects with diabetes was 2.6, controlling for confounding factors such as age and gender. In studies of subjects with type 2 diabetes, the odds of a destructive loss of attachment were about three times higher than among non-diabetics.⁴⁵

In a longitudinal survey, poor control of type 2 diabetes was positively associated with a high risk of

change in the periodontal bone score as compared to subjects without type 2 diabetes.²⁵ The findings of the Pima Indian study⁴⁴ have been supported by recent reports. In a study of Brazilian individuals with poorly controlled type 2 diabetes, significantly higher levels of periodontal pockets and loss of attachment were found compared to controls.⁴⁶ The cumulative odds ratio of having severe bone loss at follow-up after more than 2 years was 11.4 in diabetics when compared to individuals without diabetes.²⁵

ORAL HEALTH KNOWLEDGE, ATTITUDES, AND PRACTICES IN DIABETICS

The level of knowledge about oral health among diabetics is shown to be relatively low compared to non-diabetics.²² Additionally, Karjalainen et al.⁴⁷ found that irregular oral hygiene behavior in diabetics may lead to high amounts of dental plaque and subgingival calculus, and irregularity in dental visits was associated with poor metabolic control and organ complications. Poor metabolic control also increased the risk of periodontal disease among patients with diabetes.⁴⁸ Furthermore, Syrjälä et al.⁴⁹ reported that diabetic patients with high dental self-efficacy, high frequency of toothbrushing, and low dental plaque level had relatively better HbA1c levels. Diabetes self-efficacy is known to correlate with dental self-efficacy and related health behaviors.⁵⁰

WHO AND THE PREVENTION OF PERIODONTAL DISEASE

WHO plays a major role in assuring a strong science base for public health action. The WHO's mission focuses on detecting, assessing, and monitoring threats to public health, building country capacity, and applying health systems research. The organization provides assistance to countries in developing effective community-oriented disease prevention and health promotion programs.

The WHO Global Strategy for prevention and control of non-communicable disease is, to our knowledge, a new approach to managing and controlling chronic diseases.^{1,39} Based on the common risk factors approach, improvements in periodontal health may be achieved by countries along with a better control of chronic disease, such as diabetes mellitus, and intervention in relation to tobacco use, alcohol consumption, and unhealthy diet. As emphasized by the World Health Report 2002 on reducing risks and promoting healthy lifestyles,³⁹ chronic disease prevention programs can efficiently use the same health promotion mechanisms and principles of surveillance for measuring progress.

The WHO Global Oral Health Program contributes to intervention in relation to risk factors through the implementation of the WHO Framework Convention

for Tobacco Control⁵¹ and the WHO Global Strategy on Diet, Physical Activity, and Health.³³ The WHO gives priority to the rising impact of diabetes mellitus in the world, especially in developing countries, through support to national diabetes control programs. A national diabetes control program is a public health program designed to reduce diabetes incidence and mortality and improve the quality of life of diabetics through the systematic and equitable implementation of evidence-based strategies for prevention, early detection, diagnosis, treatment, and palliation, making the best use of available resources. According to the WHO approach, national health authorities should ensure, therefore, that prevention of periodontal disease is made an integral part of the prevention of diabetes and other chronic diseases, as well as of health promotion.¹ The Oral Health Program has initiated several activities that may help national health authorities incorporate oral health into general health programs and diabetes prevention.

ORAL HEALTH INFORMATION SYSTEMS

At WHO, information systems are now being designed for the surveillance of global trends in oral disease, general health, and common risk factors. The WHO Global Oral Health Program has initiated the integration of the existing oral health database with other WHO health databases and surveillance systems on common risk factors. This takes place within the frame of the WHO Global Info Base System,⁵² and data are to be cross-analyzed by country and disease and risk factors. Thus, the countries are encouraged to provide data on oral health status and risk factors on a regular basis for program evaluation and planning purposes.

The WHO Global Oral Health Program and the member states can benefit from a strengthened information system in several ways:

1. Establishment of a modern, integrated information system will provide an important platform for global public health initiatives in periodontal disease control through the following: a) the regular update of the WHO Global Oral Health Data Bank, including periodontal disease data; b) integration of the WHO Global Oral Health Data Bank with the WHO data banks on general health, chronic disease such as diabetes, and common risk factors; and c) update of the WHO Oral Health Surveys Basic Methods, including guidelines for assessment of risk factors such as tobacco, poor oral hygiene, diet/nutrition, and systemic disease.

2. The program provides assistance to countries in common risk behavior analysis and surveillance to help them incorporate periodontal disease prevention in national health programs on prevention of diabetes and tobacco control. The work also comprises the development of indicators and tools for assessment

of the impact of diabetes and tobacco control on periodontal health.

3. The WHO Global Oral Health Program can support countries in translation of the evidence of relationships between oral and systemic health. To translate knowledge into action, the program may focus on the following: a) analysis of policy and analysis for policy in relation to common risks and periodontal health; and b) effective involvement of oral health professionals in prevention programs through the analysis of barriers and constraints.

4. The WHO Global Oral Health Program has intensified the work toward the evaluation of community oral health promotion programs. The database may help evaluate the outcome and processes related to community demonstration projects for sharing experiences in relation to improved periodontal care and health.

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