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Prevention methods and programmes for oral diseases

Report of a WHO
Expert Committee

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**WHO EXPERT COMMITTEE ON PREVENTION METHODS AND
PROGRAMMES FOR ORAL DISEASES**

Geneva, 12-16 September 1983

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PREVENTION METHODS AND PROGRAMMES FOR ORAL DISEASES

Report of a WHO Expert Committee

A WHO Expert Committee on Prevention Methods and Programmes for Oral Diseases met in Geneva from 12 to 16 September, 1983. The meeting was opened by Dr H. Hellberg, Director, Health for All Strategy Coordination, on behalf of the Director-General. He stressed the compelling need to increase the application of preventive programmes in oral public health practice, to maintain improvements in oral health in industrialized countries, and to stem increases in dental diseases in developing countries.

For the purposes of the meeting, "prevention" was considered to mean a procedure or course of action that prevents the onset of disease, whereas "control" implied reversing or stabilizing disease conditions. Though both terms apply to the various diseases and conditions considered in the report, control has been emphasized in relation to periodontal diseases, i.e., reversing or stabilizing gingivitis and retarding or holding in check the progression of destructive periodontal disease. Furthermore, community-based programmes are usually structured to provide complementary therapeutic treatment of disease as well as prevention. In this report, emphasis is placed on the high priority that should be given to preventive or control programmes in order to minimize the need for curative, restorative, and therapeutic treatment of oral diseases.

The Committee's discussions centred on:

- established methods for the prevention and control of dental caries;
- methods available for the prevention but more especially the control of gingivitis and periodontal diseases;
- the role of health education and health promotion in the prevention and control of oral diseases; and
- guidelines for setting priorities in planning and selecting procedures/regimens for preventing oral diseases.

1. PROBLEM, BACKGROUND, AND PERSPECTIVES

1.1 Patterns of disease distribution

Epidemiological data available to WHO show large differences in the prevalence of dental caries in various areas of the world. The latest information from the WHO global oral data bank, as of March 1983, confirms two major trends in oral health status:

- deterioration for most of the developing countries;
- improvement for most of the highly industrialized countries.

In the developing countries, periodontal disease prevalence remains high and dental caries prevalence continues to increase, especially in urban populations. In industrialized countries, reductions in dental caries prevalence have occurred, while the prevalence of periodontal diseases may be falling to moderate or even low levels, although this trend cannot be substantiated fully on the basis of the available data.

Table 1 documents decreases in dental caries prevalence that have occurred in large areas of several industrialized countries. Table 2 gives data on increases that have been noted in developing countries and Table 3 shows the differences between urban and rural groups in these countries. The prevalence rates are based on the number of decayed, missing, and filled (DMF) teeth at 12 years of age. Table 4 presents data on periodontal conditions for different populations in both developing and industrialized countries in terms of the WHO Community Periodontal Index of Treatment Needs (CPITN).¹ These data do not relate, in most cases, to representative samples, but give important indications of variations and trends in oral disease experiences.

1.1.1 *Dental caries*

Dental caries results from a complex interaction among three factors: bacteria, diet, and host susceptibility. Bacteria and plaque must be present on the tooth surface; these plaque bacteria produce acid by fermenting ingested refined carbohydrates, especially sugars.

¹ AINAMO, J. ET AL. Development of the World Health Organization (WHO) Community Periodontal Index of Treatment Needs (CPITN). *International dental journal*, 32: 281–291 (1982).

Table 1. Caries prevalence trends in highly industrialized countries

Country	DMF teeth at 12 years			
	Highest		Lowest	
	Index	Year	Index	Year
Australia	9.3	1956	2.1	1982
Canada	7.4	1958-60	2.9	1979
			(13-14 years)	
Finland	7.5	1975	4.0	1981
Japan	5.9	1975	2.0	1979
New Zealand	10.7	1973	3.3	1982
Norway	12.0	1940	4.5	1979
Sweden	7.8	1937	3.4	1979
Switzerland	9.6	1961-63	1.7	1980
USA	7.6	1946	2.0	1980

Source: WHO global oral data bank.

Table 2. Caries prevalence trends in developing countries or territories

Country/territory	DMF teeth at 12 years			
	Lowest		Highest	
	Index	Year	Index	Year
Chile	2.8	1960	6.3	1978
Ethiopia	0.2	1958	1.5	1975
French Polynesia	6.5	1966	10.7	1977
Iran (Islamic Republic of)	2.4	1974	4.9	1976
Israel	2.4	1966	3.7	1976
Jordan	0.2	1962	2.7	1981
Lebanon	1.2	1961	3.6	1974
Mexico	2.7	1972	5.3	1976
Morocco	2.6	1970	4.5	1980
Philippines	1.4	1967-68	2.9	1981
Thailand	0.4	1960	2.7	1977
Uganda	0.4	1966	1.5	1982
Zaire	0.1	1971	2.3	1982

Source: WHO global oral data bank.

This acid causes localized demineralization of the enamel surface and if the process is not checked it will result in progressive destruction of the tooth.

Because dental caries is a widespread disease that eventually leads to pain and tooth loss if untreated, effective control can be achieved only through an approach based on prevention. Such an approach is possible in every country because a number of effective and relatively simple preventive methods have been developed.

Table 3. Caries prevalence in urban and rural areas in developing countries/territories

Country/territory	Year	DMF teeth at 12 years	
		Rural	Urban
Burma	1982	0.8	3.1
Cameroon	1982	1.4	1.8
China	1981	0.6	1.9
Jordan	1981	2.2	3.4
Morocco	1982	2.5	4.3
Oman	1978	0.7	2.5
Saudi Arabia	1979	1.3	2.2
Somalia	1979	0.3	1.5
Sudan	1979	0.4	1.4
Syrian Arab Republic	1980	1.3	3.4
Thailand	1977	1.6	3.0
United Arab Emirates	1981	1.2	2.6

Source: WHO global oral data bank.

Table 4. Community Periodontal Index of Treatment Needs (CPITN)

Country/territory	Year	Age 15/15–19 years	Age 35/35–44 years	
		Sextants with calculus	Sextants with calculus	Sextants with pocketing
Bangladesh	1981	3.4	5.7	1.2
China	1981	3.5	—	—
France	1982	0.1	1.4	0.0
Italy	1982	2.8	—	—
Morocco	1982	1.9	—	—
New Zealand	1981	2.0	—	—
Nigeria	1983	4.0	5.9	4.7
Norway	1982	0.8	—	—
Philippines	1982	2.7	4.4	0.0
Republic of Korea	1982	3.6	4.7	0.3
Samoa	1982	4.0	5.7	0.7
Sweden	1982	3.0	—	—
Syrian Arab Republic	1982	1.6	—	—
Tonga	1982	3.7	5.5	1.4

Source: WHO global oral data bank.

Prevention of dental caries aims to modify one or more of the three factors mentioned above.

1.1.2 Periodontal disease

In general, the term “periodontal disease” refers to any disease peculiar to the periodontium or parts thereof. While chronic

marginal gingivitis and periodontitis are the most common categories, other forms of destructive periodontal disease, such as acute necrotizing ulcerative gingivitis and juvenile periodontitis, occur. Indeed, some of these forms of the disease are sufficiently prevalent to constitute a public health problem in some countries.

Nevertheless, chronic gingivitis and chronic periodontitis account for most of the disease reported in epidemiological studies. There is little doubt that the initial gingival lesion and its subsequent progression are strongly associated with the presence of bacterial plaque at or beneath the gum margin. However, the general mechanism involved and the factors associated with the progression of the disease are unclear. The host response appears to explain some of the variation seen in disease levels and severity between individuals and communities. In general, it is agreed that gingivitis is a necessary precursor of periodontitis, which can progress through pocket formation to the destruction of alveolar bone, though much remains to be defined concerning the rate and variability of that process. The presence of periodontal pockets makes control of the disease more difficult.

1.2 Oral health objectives for the year 2000

In the context of health for all by the year 2000, the WHO global goal for oral health of no more than 3 DMF teeth at 12 years of age was first formulated in 1979 and four other goals were added two years later in collaboration with a special Working Group of the International Dental Federation (FDI). The establishment of these WHO/FDI global goals helps focus the efforts of countries aiming at oral disease prevention.

The five global goals are:

<i>Age</i>	<i>Goal</i>
5-6 years	50% should be free of dental caries
12 years	3 or fewer decayed, missing, or filled teeth
18 years	85% should retain all their teeth
35-44 years	A 50% reduction in 1981 levels of edentulousness
65 years and over	A 25% reduction in 1981 levels of edentulousness

It is stressed that these global goals were established after careful review of available information and taking into account the time span involved, as well as the realities of achieving changes in oral health status of populations. They are intended as a guide for

countries in developing their own goals. Countries are being encouraged to collect baseline data as rapidly as possible so that they can then choose national goals that relate to existing levels of disease and programmes to achieve those goals. Thus, those countries that have already achieved lower levels of disease should set more ambitious goals, especially for the younger age groups, while those where dental caries is already increasing should set realistic goals, even though they may represent higher disease levels than the global goals.

The Committee appreciated the need to develop global goals for periodontal diseases. However, this presents many difficulties, given the current level of knowledge concerning the etiology and epidemiology of the various periodontal diseases. It was noted that the European Economic Community (EEC), the USA, and the Western Pacific Region of WHO have already established some guidelines. Global, regional and national goals should be developed in a similar manner.

1.2.1 *EEC countries*

The following periodontal health goals for the populations of EEC countries were based on an evaluation of existing conditions and on an educated guess allowing for a considerable but yet realistic improvement by the year 2000.¹ The available epidemiological data were assessed as insufficient and Member States were encouraged to use the CPITN (see section 1.1) to obtain reliable baseline data as soon as possible.

1. *At age 18, 90% will have acceptable gingival health to the extent that each person will have at least 3 healthy sextants (CPITN = 0)*

With increased oral health awareness the gingival conditions already seem to have improved in many West European countries. Persons who will be 18 years old in the year 2000 were born in 1982. It seems realistic to assume that this new generation can reach the defined goal, which requires good enough oral hygiene to ensure also

¹ FRANDSEN, A., ED. *Proceedings of a workshop on public health aspects of periodontal disease, 3-5 December 1982, Copenhagen*. Chicago, Quintessence Publishing Company Inc., 1984.

that no more than moderate disease occurs in the remaining sextants.

2. *At age 35–44, 75% will have acceptable gingival health to the extent that each person will have at least 3 healthy sextants (CPITN = 0)*

The persons who will be in this age group in the year 2000 were 17–26 years old in 1982. They already have better oral health than did the generation of their parents. It seems realistic to assume that this goal can be reached if concerted action is taken. Reaching the goal would ensure that deep pocketing (CPITN = 4) would occur in no more than 5% of the persons in this age group.

3. *At age 65 and over, no more than 10% should have one or more sextants with deep pockets (CPITN = 4)*

In 1978, for example, in the United Kingdom, between 70 and 80% of persons in this age group were edentulous. The persons who will be in this age group in the year 2000 were 47 or over in 1982. As there will still be many edentulous persons in the year 2000, the goal cannot be expressed in terms of healthy dentitions. The goal that no more than 10% will have deep pockets implies that sustained efforts are needed to improve the quality of the remaining dentitions. Indirectly, and with time, this approach will lead also to an increase in the number of teeth.

1.2.2 USA¹

1. By 1990, the prevalence of gingivitis in children aged 6–17 years should be decreased to 18%. (In 1971–74, the prevalence was about 23%.)

2. By 1990, the prevalence of gingivitis and destructive periodontal disease in adults should be decreased to 20% and 21%, respectively. (In 1971–74, among adults aged 18–74 years, 25% had gingivitis and 23% had destructive periodontal disease.)

3. By 1990, at least 75% of adults should be aware of the necessity for both thorough personal oral hygiene and regular professional

¹ *Promoting health/preventing disease. Objectives for the nation.* Washington, DC, U.S. Department of Health and Human Services, Public Health Service, Office of Disease Prevention and Health Promotion, 1980 (DHHS (PHS) Publication No. 81-50157).

care in the prevention and control of periodontal disease. (In 1972, only 52% knew of the need for personal oral hygiene and only 28% were aware of the need for dental check-ups.)

1.2.3 *WHO Western Pacific Region*

At the WHO Western Pacific regional course on oral epidemiology, held in Singapore in 1982, it was suggested that a realistic goal for the Member States in that Region would be 25% or less of the population aged 15–19 years with a CPITN of 2. It should be possible to achieve this goal through improved regular oral hygiene by children and adolescents.

2. ESTABLISHED METHODS OF ORAL DISEASE PREVENTION

The two most prevalent oral diseases are dental caries and periodontal disease. The methods described and recommended in this report for the prevention and control of these diseases are those for which there is clear evidence of their efficacy and effectiveness in community-based programmes. The Committee recognized that selection and application of one or more of the methods must be based upon needs and resources in any given country and region.

2.1 Methods for preventing dental caries

The use of fluoride is recognized as the most effective means available for the prevention of dental caries in community-based programmes. Current knowledge indicates that the benefits of fluoride are produced by one or more of the following mechanisms:

- fluoride incorporated into enamel during tooth development produces an enamel crystalline structure more resistant to acid action;
- fluoride, by its presence in the oral environment, reduces the metabolism of sugars by bacteria, thus in turn reducing acid production and plaque growth;
- fluoride, by its presence in enamel and plaque, encourages the “repair” of the early caries lesion by reprecipitation of enamel crystals—the process commonly known as “remineralization”.

Methods of fluoride application and other preventive methods are discussed in sections 2.1.1–2.1.9 and summarized in Table 5. The methods described in sections 2.1.1–2.1.4 provide both systemic and topical benefits to teeth (only one method should be utilized). Those described in sections 2.1.5–2.1.7 are predominantly topical and may be combined with any one of the methods from sections 2.1.1–2.1.4 or with another predominantly topical method.

2.1.1 *Fluoridation of public water supplies*

Water fluoridation is the upward adjustment of the fluoride concentration of the community's central water supply to the optimum level for the prevention of tooth decay. The dental benefits of fluoridation, usually described in terms of reduction of disease prevalence and severity in childhood, continue into adult life. The repeated topical action of fluoride, in addition to the systemic benefits obtained during tooth development, is probably responsible for these continued benefits.

Some fluoride, though often only traces, is found in drinking-water from all sources. In concentrations between 0.7 and 1.2 mg/litre, the optimum concentration varying with climate, fluoride reduces tooth decay by 50–65% in population groups consuming such water continuously from birth and where the pre-fluoridation disease level was high or very high on the WHO global oral health data bank scale.¹ A prediction of the percentage reduction that would be achieved in a population whose initial caries level was moderate or low (i.e., 2–4 DMF teeth at 12 years) is less easy. It is known that reductions to the level of 1.7 DMF teeth at 12 years of age have been achieved in at least two cities in Europe, but in populations where caries is generally decreasing. However, no long-term evaluation of effectiveness of water fluoridation in populations with low but increasing disease levels has been reported. In such cases, it should be recognized that the effect of water fluoridation may not be a reduction in the caries level but only a halt in the rate of increase or a levelling off of the upward trend.

Some 50 years of epidemiological studies have established the effectiveness and safety of community water fluoridation as a public health service. Standards have been developed for optimum

¹ WHO global oral health data bank ranges at 12 years: very low: 0.0–1.1; low: 1.2–2.6; moderate: 2.7–4.4; high: 4.5–6.5; very high: 6.6 and over.

Table 5. Methods for the prevention of dental caries

Preventive method	Concentration or amount of fluoride	Reported reduction in dental caries ^a and gingivitis (%)	Frequency and duration of application
Fluorides			
<i>Systemic and topical benefits</i>			
Community water fluoridation	0.7–1.2 mg/litre	50–65	Lifetime consumption
School water fluoridation	4.5 times optimum for community water fluoridation	40	Through school years
<i>Dietary fluoride supplements:</i>			
Drops or tablets (home)	Depends on age of child and fluoride concentration of water	50–80	Birth to at least 14 years
Tablets (school)		25–40	Through school years
Fluoridated salt	250 mg/kg	60	Lifetime
<i>Topical benefits only</i>			
<i>Professionally applied topical fluoride</i>			
	20 g/kg sodium fluoride; 80 g/kg stannous fluoride; Acidulated phosphate fluoride (12 g/kg F); fluoride varnishes	30–40	Once or twice a year, depending on individual's rate of tooth decay
<i>Self-applied fluoride:</i>			
Mouth rinses (home, school)	0.5 g/l sodium fluoride daily 2 g/l sodium fluoride weekly or fortnightly	20–50	At least through school years
Fluoride dentifrices (toothpastes)	1–2.5 g/kg	20–30	Lifetime
Sealants			
Applied to occlusal surfaces	—	40–99 (occlusal surfaces only)	Prevents pit and fissure de- cay after permanent teeth erupt (ages 6–7, 12–13 years); replace as needed

Control of sugar-containing foods and drinks

Control of sugary foods at school;
reduction in frequency of intake;
reduction of national consumption

Proportional to reduced
frequency of intake

Lifetime

Oral hygiene measures

Closely supervised (school)
Brushing
Flossing

Lifetime
Lifetime

Unsupervised (school + home)
Brushing
Flossing

Lifetime
Lifetime

Source: WHO global oral health data bank.

^a Percentage caries reductions reported from short-term (2-3 years) clinical trials may underestimate the effect of lifetime use of a fluoride procedure. However, it should also be appreciated that if a fluoride procedure is terminated, for example when children leave a school-based programme, its effect may be short-lived.

concentrations of fluoride in drinking-water in different climates. Adequacy of piped water systems, as well as sufficiency of trained technicians are essential factors for successful water fluoridation.

2.1.2 *Fluoridated salt*

Fluoridated salt is table salt to which measured amounts of fluoride have been added prior to distribution and marketing. A number of studies in different countries have shown that consumption of salt containing 90–350 mg of F per kg of salt substantially reduces dental caries experience. The concentration generally recommended today is 250 mg of F per kg of salt. Further studies may define more precisely what concentration of fluoride in salt is optimal for caries prevention; studies are also continuing to define the variation in concentration necessary for different countries, depending on the level and range of salt consumption.

Fluoridated salt is not suitable for general use in countries where the majority of public water supplies are fluoridated or where there are water sources containing optimal levels of naturally occurring fluorides. However, it is suitable for developing countries where there are few public water systems. The technology for adding fluoride to salt is well tested and simple enough to be used in most countries, but effective application of this measure also depends on the ability to control salt-conditioning plants, as communities living near the sea often prepare their own salt. It has been stated that the addition of fluoride to salt entails such a small increase in the cost of production that fluoridated salt is usually sold at almost the same price.

2.1.3 *Fluoride tablets*

In communities where the drinking-water is deficient in fluoride, daily ingestion of dietary fluoride supplements from birth until after eruption of the second molar (usually by age 13–15) can provide protection against dental caries of approximately the same magnitude as that derived from the consumption of fluoridated water or salt. While there is some variation in the dosage schedule recommended in different countries for dietary fluoride supplements, this variation reflects different opinions of authorities rather than different needs. Supervised distribution at schools is almost the only way to ensure the regular consumption over a long period that is

essential for optimum effectiveness. Even then, the first few years of permanent teeth formation will be unaffected by this procedure.

2.1.4 Fluoridation of school water supplies

One alternative to the fluoridation of community water supplies, in areas where such supplies are lacking, is to fluoridate the drinking-water of schools. This water is fluoridated at a higher concentration than is a community supply because children consume only a proportion of their total drinking-water at school. Comparative studies of different concentrations have led to the recommendation that 4.5 times the optimum community water concentration is the desired level. However, this method has been infrequently used because of the cost of individual installations for each school and the need for sufficient technical resources.

2.1.5 Mouth rinsing with dilute solutions of fluoride

Mouth rinsing with fluoride solutions is a feasible and effective method for the prevention of dental caries in schoolchildren. The findings of more than 30 studies in several countries indicate that the incidence of dental decay can be reduced by about 35% when a supervised mouth-rinsing procedure is used daily, weekly, or fortnightly. In most of these studies in school programmes, children have rinsed either daily with a 0.5 g/l sodium fluoride solution or weekly or fortnightly with a 2 g/l solution. It should be noted that the weekly regimen is considered the most practical because less time is required by supervising personnel than for the daily regimen and it is more convenient than the fortnightly regimen.

2.1.6 Fluoridated toothpastes

Mouth cleaning in some form is a standard cultural practice in most societies. The use of effective fluoridated toothpastes, therefore, has the major advantage that there is no need to introduce a new concept into the community. Routine use of fluoride dentifrices is recommended practically everywhere, except for young children living in areas of endemic fluorosis. The findings of over 100 clinical trials indicate that the incidence of new carious lesions can be reduced by 20–30%, though evidence from widespread use over a long period of time indicates that reductions may be even greater.

2.1.7 *Operator-applied fluoride compounds*

Fluoride compounds that require application by an operator are effective, but this approach to caries control is inherently more expensive than community-based measures. Operator-applied fluoride compounds are particularly suitable for use with special groups. In the form of gels, solutions, and varnishes they have been tested and accepted to varying degrees.

2.1.8 *Combined use of fluorides*

The multiple actions of fluoride provide the rationale for its combined use in differing forms and concentrations. The use of various topical fluorides (operator-applied, mouth rinses, and toothpastes) has been shown to be effective in fluoridated areas, providing benefits beyond those received from the fluoridated water alone. Some of the most spectacular reductions in caries have occurred in countries combining the use of water fluoridation and fluoridated dentifrices, e.g., Australia, Canada, New Zealand, Singapore, and the USA.

2.1.9 *Other methods of caries control*

Pit-and-fissure sealants. Sealants are plastic materials applied to the pit-and-fissure surfaces of posterior teeth, principally the occlusal surfaces where over half of all caries lesions occur. The results of many studies show that sealants will prevent occlusal caries as long as they are retained, a condition that depends on a meticulous though simple application technique.

Studies have shown that a high proportion of single applications of sealant, when correctly applied, will be retained for a period of years. Sealants can also be placed over early carious lesions to prevent them from developing further.

As a one-to-one procedure requiring personnel with some degree of training, the use of sealants can be relatively costly. However, the application of sealants may fill a role in many community preventive programmes, even when resources are limited, for the following reasons:

(a) Whether caries is increasing or decreasing, most caries in children occurs on fissure surfaces. Fluoride has less effect on fissure caries than it has on smooth surfaces, so in many countries fissure

caries is likely to remain a sizeable problem for some time yet, even where fluoride programmes have started. Thus, pit-and-fissure sealants are valuable in association with fluoride regimens designed to control smooth-tooth-surface caries.

(b) If caries is diagnosed early, effective sealant placement removes the need for amalgam restoration, and in many developing countries would even prevent subsequent tooth loss. Where fissure caries is a sizeable problem, sealants may be the most economical and efficient way of both preventing and treating it.

Sealants in use in the 1980s are easier to apply than their first-generation predecessors, and future sealants are likely to be easier still. For all of these reasons, administrators in developing countries should not arbitrarily dismiss sealants as a "high-technology" approach of no relevance to their situation.

Control of cariogenic diets. *In vitro*, animal, and human studies support the widely held view that caries can develop only in the presence of sugars and other refined carbohydrates, especially sucrose. There is strong epidemiological evidence that the prevalence and incidence of caries in the community are likely to be high if a high proportion of total energy intake comes from foods containing a great deal of sugar. However, this association between sugar intake and dental caries, while direct, is not linear and may be affected by the nature of the diet, frequency of ingestion, and other variables. Caries is more directly related to the frequency of consumption of sugary foods than it is to total consumption.

Epidemiological evidence strongly supports the view that there is little, if any, relation between nutritional adequacy and dental caries; the world's lowest rates of dental caries are found in countries where malnutrition is widespread, and the highest rates in countries that have higher standards of living. Caries is related to diet (defined as the total oral intake of substances that provide nourishment and/or energy), rather than to the nature of the nutrients absorbed.

Replacement of sucrose in processed foods by artificial sweeteners is one approach to reducing sugar consumption, particularly if frequently consumed snack foods containing artificial sweeteners are available. However, biological, toxicological, economic, legal, and technical considerations, as well as taste preferences, complicate the issue. In Switzerland, one country that follows a dentally oriented public policy, manufacturers may label their products "safe for

teeth" if in laboratory tests they do not lower the pH of interdental plaque below 5.7 for up to 30 minutes after ingestion. Such products are usually sweetened with nonacidogenic xylitol, or slowly fermenting sorbitol, mannitol, maltitol, or Lycasin (a starch derivative).

In many countries, legislation and regulation to control production, importation, labelling, advertising, and marketing of certain foods tend to restrict the availability of sugary foods and help consumers to exercise informed choice. In addition, appropriate subsidies and tax credits to encourage food manufacturers to use low-sugar foods or sugar substitutes could limit consumption of sugar and alter the availability of sugar in products frequently used as snacks.

Oral hygiene instruction. Self-performed mechanical oral hygiene has been shown to be an ineffective way of preventing caries. While some associations have been found between DMF and plaque scores, these associations are often slight and may be indirect. A great deal of instructional effort is usually required before children brush effectively, and the optimum frequency of brushing for caries control is likely to be unrealistically high.

Toothbrushing for caries control is effective when fluoride toothpaste is used, though this is due to the fluoride rather than the actual brushing (cf. section 2.1.6). Therefore, education should emphasize the frequent (at least daily) use of a fluoridated toothpaste rather than the mechanics of brushing. But because of the importance of oral hygiene in the control of periodontal disease (see section 2.2), educational programmes to encourage brushing are worth while. However, these different goals should be considered before a decision is made to begin an oral hygiene education and instruction programme.

2.2 Methods for the control of gingivitis and periodontal disease

It is likely that most of the periodontal disease seen in the world involves a chronic inflammation of the gingiva only (gingivitis) or gingivitis associated with some loss of epithelial attachment and alveolar bone (periodontitis).

Because periodontal disease prevention and control require positive, deliberate action at the personal level, the effectiveness of efforts to control the progression of the disease is dependent on a

wide range of social factors. Today, the only method available for controlling periodontal disease is the frequent physical removal or disruption of dental plaque by the individual, using oral hygiene implements (toothbrushes, traditional brushing sticks), as well as the removal of subgingival calculus by trained personnel where indicated. Chemotherapy has served only as an adjunct to other methods in controlling gingivitis.

2.3 Prevention and control of other oral conditions

2.3.1 Oral cancer and potentially precancerous lesions

Cancer of the oral mucosa is fortunately rare. However, in view of its serious prognosis plus the accessibility of oral tissues, which makes detection relatively easy, primary health care workers should be aware of its existence and the importance of rapid referral and know how to detect potentially precancerous oral lesions, e.g., leukoplakia and erythroplakia. Ulcerations and hyperplastic conditions not responding to local or specific treatment should always be regarded as suspicious and as possible precancerous or cancerous lesions. In some developing countries, special attention should be paid to the early detection of Burkitt's lymphoma because of its predilection for the jaws. As the etiology of this lesion is still debatable, although a viral involvement has been suggested, no specific preventive measure can be defined.

In addition to screening and referral for care as appropriate, the most important preventive activity needed is education of the public and of health care workers. People should be made aware of the strong positive association between the use of tobacco (smoking or chewing) and oral mucosal diseases, and they should be encouraged to give up such harmful habits.

2.3.2 Necrotizing ulcerative gingivitis

Necrotizing ulcerative gingivitis (NUG) is rare today in industrialized countries. When it occurs in such countries it usually presents in a relatively mild form, mainly in young adults. However, a much more severe form occurs predominantly in children in socioeconomically underprivileged communities. The high incidence and gravity of the sequelae call for special attention to this lesion in

certain developing countries. Available evidence suggests that, in children suffering from this condition, the necrotic gingival lesion, if not contained, spreads rapidly with eventual involvement of the facial tissues, leading to cancrum oris (or noma). This poses a serious problem in terms of surgical treatment, management, and rehabilitation. It should be recognized that malnourished children, especially those suffering from protein deficiency or the more serious kwashiorkor, who frequently have poor oral hygiene, are at high risk of developing NUG with the attendant serious sequelae (noma) when affected by measles or any of the other common viral diseases. It is therefore essential that primary health care workers operating in developing countries should be trained to recognize the early stages of NUG in children and should immediately institute appropriate measures to improve the victim's oral hygiene status and refer the patient at once to qualified health personnel for treatment with appropriate therapeutic agents.

2.3.3 *Miscellaneous lesions/diseases*

Papillary atrophy of the tongue, angular cheilosis, generalized hypertrophy of the gingival tissue, and enlargement of the major salivary glands are some of the oral conditions not infrequently encountered in socioeconomically disadvantaged societies. Primary health care workers operating in such communities should be made aware of these lesions, especially in view of the potential relevance of some of them to the diagnosis/management of nutritional disorders, systemic diseases (such as the endocrinopathies), and abnormal reactions to therapy with certain drugs. Some oral mucosal conditions result from mechanical trauma. An incorrect toothbrushing technique may lead to gingival abrasion, gingival ulcerations, and/or frictional keratosis of the attached gingiva or excessive gingival recession. Prevention of these conditions is totally dependent on the provision of appropriate information to the public.

2.3.4 *Dental fluorosis*

Fluorosis of dental enamel occurs when excess fluoride is ingested during the years of tooth calcification—essentially the first seven years of life. The affinity of fluoride for calcified tissue leads to its deposition in bones and teeth during the developmental stages of those tissues; dental fluorosis, therefore, does not develop or

progress after teeth erupt. At its lowest levels, fluorosis is barely discernible as faint opaque lines, but at its most severe results in extensive dark stains on pitted, friable teeth. At the severest levels of dental fluorosis associated with lifetime daily intakes of 20–80 mg of fluoride, there can also be systemic signs of heavy fluoride deposition in the skeleton.

Dental fluorosis is prevented through avoidance of excessive fluoride ingestion during the first seven years of life. Although the most common source of excessive fluoride is probably drinking-water, fluoride intake from all sources must be assessed. Such sources may include tea drinking and unusually fluoride-rich staple foods, such as fish (especially when bones and skin are eaten). Fluoride supplements inappropriately prescribed, provided, and taken, when there are other sources of sufficient dietary fluoride, can also contribute to fluorosis.

When a water supply contains undesirably high levels of fluoride, one solution is to find a new source of drinking-water with a lower fluoride content, if that is possible. If not, the water can be chemically defluoridated in a water-treatment plant, even though such treatment is moderately expensive. There is a need for the development of cheap, efficient, and simple methods for defluoridating drinking-water in those developing countries where the worst fluorosis problems are found.

Water fluoridation and the use of fluoride supplements may be inappropriate in communities where the staple diet contains high-fluoride foods. Similarly, fluoride supplements should not be prescribed for children who drink fluoridated water at home or school, or who consume fluoridated salt. Any fluoride dietary supplement given to children below the age of six years should be used under parental and professional guidance. The use of fluoride toothpaste in areas of endemic fluorosis is not recommended for children up to six years of age.

2.3.5 Other types of impaired enamel structure

Impaired tooth enamel structure, which may be prenatally or postnatally induced, presents clinically in several forms, including hypoplasia, as well as enamel abrasion, attrition, and erosion. In some cases, the etiological basis is clearly defined and such conditions are readily amenable to prevention and control, e.g., controlled consumption of acidic fruits and juices to reduce acid

erosion, correction of faulty dietary habits, and cleaning procedures for enamel abrasion and attrition. In the case of hypoplastic defects, especially of the primary dentition, the etiological factors are still not very clearly defined. This enamel lesion is more frequently encountered in developing countries than in affluent ones. Even in the developing countries, available epidemiological evidence suggests that impoverished communities are more at risk than more privileged areas. This indicates that acquired host factors may play a crucial role in the causation of the lesion. Apart from the aesthetic aspects, the importance of this lesion lies in the potential vulnerability of affected teeth to caries-inducing factors. From the prevention point of view, health instruction to mothers of infants should emphasize the detrimental effects of sugar in feeding bottles or comforters sucked by children.

3. ROLE OF HEALTH EDUCATION AND HEALTH PROMOTION

The Declaration of Alma-Ata adopted at the International Conference on Primary Health Care jointly sponsored by WHO and UNICEF and held in Alma-Ata, USSR, in 1978, states in Article IV that "The people have the right and duty to participate individually and collectively in the planning and implementation of their health care". The Conference also listed "education concerning prevailing health problems and the methods of identifying, preventing and controlling them" as the first of the eight recommended activities making up primary health care.¹

Health education and promotion are indispensable in achieving both individual and community oral health. They are inseparable from one another and should at all times form part of all programme planning, implementation and evaluation.

Although the educational opportunities associated with preventive programmes are numerous and ever-changing, it must nevertheless be emphasized that health education and promotion do not exclude the more traditional activities, such as instruction in oral

¹ *Alma-Ata 1978. Primary health care. Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 6-12 September, 1978. Geneva, World Health Organization, 1978 ("Health for All" Series, No. 1).*

hygiene, but offer an expanded role for promoting health through education, consistent with WHO's and Member States' health policies and programmes in other areas.

The ultimate responsibility for oral health, given the nature of available preventive methods, must be shared by individuals, families, health professionals, institutions, and local and national authorities. Health education can help to increase knowledge and to reinforce desired behaviour patterns but, to be successful, must be integrated with other influences on health—economic, social, legal and environmental—all of which affect public access to, and acceptance of, preventive programmes.

3.1 Definitions

The broad, pervasive roles of health education and health promotion in disease prevention are described in a WHO publication.¹ For the purposes of this report, they are defined as follows:

Health education: any combination of learning opportunities and teaching activities designed to facilitate voluntary adaptations of behaviour that are conducive to health.²

Health promotion: organizational, political, and economic interventions designed to facilitate behavioural and environmental adaptations that will improve or protect health.²

3.1.1 Health education

The behaviour to be adapted or modified may be that of individuals, groups (such as families, health professionals, organizations, or institutions), or entire communities. Any one person may be involved as an individual or as part of a formal or informal community.

Strategies designed to influence the behaviour of individuals or groups will vary greatly depending upon the specific disease concerned and its distribution in the population, as well as upon the

¹ WHO Technical Report Series, No. 690, 1983 (*New approaches to health education in primary health care: report of a WHO Expert Committee*).

² GREEN, L.W. National policy in the promotion of health. *International journal of health education*, **22**: 161–168 (1979).

characteristics and acceptability of available methods for preventing or controlling that disease.

Health education is not a substitute for a preventive service—it is the educational component of such a service designed to develop understanding and acceptance of its value. Indeed, the oral health promotional measures or procedures themselves, such as a fluoride programme or legislation requiring a preventive procedure in a community, serve as valuable educational tools. For example, active participation in a school-based, self-applied fluoride programme helps the participants learn about the value of the measure, provides excellent teaching opportunities for educators, and encourages acceptance of the procedure as an important part of school routine.

It is clear that education is necessary, but education *alone* is insufficient to achieve optimum oral health. The target population must have access to proven preventive procedures. The process of ensuring this access involves health promotion. Thus, both health education and health promotion are required to attain and maintain oral health in a community.

3.1.2 *Health promotion*

People are influenced by factors often outside their control, such as working conditions, the availability of consumer products, other economic and environmental factors, and social norms and customs. The realization that these factors have an impact on preventive health practices and health services leads to the development of the concept of health promotion. This is intended to reinforce the effect of health education by creating an environment that supports the development of the attitudes and behaviour needed to improve health.

The numerous measures available for promoting oral health include: community water fluoridation, salt fluoridation or other fluoride regimens; controlling the frequency of consumption of sugary snacks and altering the sugar content of snack foods; conducting supervised oral hygiene activities at school with the necessary implements provided; provision of routine dental services in schools or the workplace; and legislation or regulations making a preventive measure mandatory. Health promotion thus includes activities, not traditionally called “health education”, that may be needed to ensure that a particular programme is implemented or a preventive method used. This may involve persuading a politician,

health executive, or administrator to allot funds or to prepare and support enabling legislation for preventive programmes, and modifying curricula and training courses for the health and other personnel who will staff the programme.

3.2 Combining health promotion and health education

Both health promotion and health education are essential for initiating and maintaining successful, effective, preventive oral health programmes because of the nature of the available means for preventing dental caries (fluorides and sealants) and for controlling gingivitis and periodontal diseases (oral cleansing implements). Education is necessary to arouse interest, provide new knowledge, and stimulate programme implementation and participation at all decision levels.

Similarly, a strong educational component will be needed in a preventive programme to maintain interest, acceptability, understanding, and participation. Adults, health professionals, and policy-makers will have to be educated, for example, to appreciate the need for protective fluoride services in a school or community programme for children or adults; periodic reinforcement through education and information is required in order to maintain the programme and to stimulate continued interest. Clearly, people cannot behave in the desired way and oral disease cannot be prevented unless the specific protective measures themselves are provided or made easily accessible.

3.3 Health promotion and education in programme planning and implementation

The planning process is the framework in which oral health needs are determined, goals and priorities set, and programmes to achieve those goals drawn up. The WHO manual *Planning oral health services*¹ provides specific guidelines for planning, monitoring, and

¹ *Planning oral health services*. Geneva, World Health Organization, 1980 (WHO Offset Publication, No. 53).

evaluating oral care services, and section 4 of this report deals with the choice of preventive strategies for different situations. Additionally, the planning process itself provides an educational opportunity; involving local people in the planning process is a fundamental health education method. This process includes: (a) collecting information on specific problems, as seen by the community; (b) establishing measurable objectives; (c) defining priority target populations; (d) assessing resources and problems; and (e) evaluating the degree to which stated objectives have been achieved. Thus, health promotion and education should be seen as a vital and dynamic planning strategy as well as essential components of the whole programme.

In the preparation of oral health programmes, possible interventions must be evaluated to determine whether they are appropriate to the given country or community and its needs, social characteristics and resources; their practicality and acceptability in different settings (e.g., in public health clinics, dental offices, schools, places of work, or the home) must also be assessed, and the efficiency with which interventions can be carried out, given the ever-present constraints of time, personnel, and financial resources.

The involvement in the planning process of community leaders and representatives of those groups towards whom the programme is directed helps to ensure that it is more readily accepted and that better use is made of programme resources. This approach means that a wide range of community adults participate actively rather than passively in making group decisions about their own oral health and that of their communities. In the process, the dental professional and/or educational specialist acts as a catalyst and organizer. Use of the planning process as an educational strategy should help correct the error so often made in efforts to improve oral health, namely the failure to involve community leaders in actively defining community health problems and in finding appropriate and acceptable solutions.

Experience has shown that such efforts to increase community participation in the planning process, i.e., to encourage people to become actively involved in planning and making decisions about the programmes in which they will be expected to participate, have resulted in more successful programmes. Health workers need to make special efforts to this end, since in many parts of the world people have been taught to defer to professional wisdom in decision-making. Such community involvement implies a sharing of

power and responsibilities for oral health. Once communities have been sensitized and involved in their own decision-making processes and in setting their own priorities, they can collectively implement their local programmes, together with dental and other health personnel, using all available resources. When a health problem, such as dental caries or periodontal disease, is not perceived as a problem by the community, it will take time to develop the understanding that it can be prevented or controlled, rather than accepted as normal or inevitable.

3.4 Health education: principles and methods

Five general principles of health education in community oral health programmes are:

(1) Every available preventive oral health procedure includes educational components.

(2) Education of a variety of different target groups, such as policy-makers, the food manufacturing industry, all health care providers, parents, school personnel, primary health care workers, programme participants, and school students should be an integral part of any regulatory effort, legislation, or preventive service programme.

(3) Educational materials should be designed to gain or focus attention, to provide new knowledge, to facilitate interpersonal and group discussion, and to reinforce or clarify prior knowledge and behaviour. Materials such as leaflets, news releases, posters, films, and slide series are appropriate educational aids.

(4) Oral health education should be built into general health education programmes.

(5) In all community and school-based settings, oral health instruction should be consistent and compatible with scientific knowledge as well as with the local culture, the educational system, and social goals.

The methods used in community health education can be divided into the following four broad categories:

(1) one-to-one communication;

(2) group presentations of information and group discussion and decision-making, e.g., in schools or at community meetings, seminars, and workshops;

(3) community organizational strategies, such as forming committees to solve local problems, holding meetings for professionals and/or the public to generate interest in solving problems, working with community leaders to commit available resources to a programme, or assisting with or organizing community self-surveys of oral health needs; and

(4) disseminating information through mass communication channels, including the use of pamphlets, posters, newspapers, newsletters, radio and television.

Any one or a combination of these methods can be used selectively at different times in an oral health programme, depending upon the objectives to be achieved, the behaviour to be influenced, and available funds. Educational efforts using many different educational methods should be directed towards those associated with the programme, directly or indirectly, to ensure accurate knowledge and understanding and to maintain interest and participation.

3.5 Evaluation

As with any component of a health programme, health promotion and education must be evaluated to ensure that resources are being used wisely. Evaluation methods should be defined before the programme is implemented, as part of the planning process. Usually, the most important expected outcome of a programme—improved oral health status of a community—should be evaluated directly using the standard indices, especially DMF teeth and CPITN. It is, however, also necessary to monitor and evaluate specific activities in order to identify those aspects of a programme that are worth while and those that should be modified or terminated.

The inherent difficulties of collecting reliable data for evaluating many health promotion and education activities and the costs involved may lead administrators to neglect this aspect of a programme. In order to reduce expenses to a minimum, different aspects or approaches can be tested on a local basis before being extended to the whole community or population. It is still essential, however, to keep a careful watch on the use of resources and, whenever feasible, to assess periodically the effectiveness of different component activities.

3.5.1 Community orientation—the SI index

A clear, unambiguous, and universally relevant classification of oral health and treatment procedures could improve communications between health policy-makers, the community, and the dental profession and facilitate the evaluation of community oral health programmes.

The status/intervention index (SI index) (Table 6) devised by the Human Performance Institute, Atami, Japan, provides a system for the classification of oral health status along with the corresponding oral care interventions necessary for restoring health. The index is in the form of a scale from 0 to -0.9 , in which 0 represents the absence of need for any oral care and -0.9 the upper limit of oral care. With regard to the latter, it should be noted that the types of intervention required beyond this state of oral health lie outside the realm of dental surgery and oral health care.

Table 6. Classification of oral health status and intervention categories by means of the SI index

Scale	Oral health status	Type of intervention
0	Perfect oral health	No need for any care
-0.0	Unknown	Periodic examinations
-0.1	Presence of plaque, gingival bleeding	Self care after instruction by qualified health personnel
-0.2	Early (reversible) stage of caries, calculus, stain	Surface care (e.g., scaling and fluoride application)
-0.3	Positional and cosmetic defects and dentofacial anomalies	Orthodontic care, tooth straightening and repositioning
-0.4	Affections of tooth-supporting tissues, periodontal pockets, loose teeth	Tooth root cleaning and smoothing, care of periodontal pockets to restore tooth stability
-0.5	Dental caries, decay of enamel and dentine	Filling of teeth and placement of crowns
-0.6	Affections of pulp and pulp chamber	Pulp care
-0.7	Teeth decayed beyond restoration, dental impaction, dental fractures, trauma and swelling	Surgical care of oral tissues: extraction of teeth, removal of oral lesions, repair of trauma
-0.8	Absence of 1–3 consecutive teeth requiring replacement in order to improve chewing ability or appearance	Fixed tooth replacements, enamel-bonded crown abutted or implanted
-0.9	Few to many teeth missing or completely edentulous	Fitting of partial and full dentures

The higher negative numbers on the scale represent progressively worse oral health status on the one hand, and increasingly complex and invasive oral care interventions on the other. Moreover, as the

interventions become more and more complex, the cost of treatment also rises, and so does the risk of treatment failure and error in treatment. There is also more pain and discomfort during and after the treatment, as there is in the absence of it. All these factors have been carefully included in the design of the index.

The health status categories provide a basis for classifying the diagnoses of oral health conditions for individuals, and subsequently the numerical system of diagnosis can be used for keeping epidemiological records. Furthermore, since for each status category there is a corresponding list of interventions, the SI index can also be used for classifying materials and instruments needed for specific status/intervention categories.

Another advantage of the SI index is that, when used together with appropriate models of oral tissues showing oral diseases and results of typical interventions, it can serve as a simple tool for oral health education and promotion. Such education will enable people to make informed decisions about the kind of oral health care needed. This ability is particularly needed at the community level in developing countries, where oral health services and resources for them are often limited.

4. PLANNING ORAL HEALTH PROGRAMMES AND SELECTING APPROPRIATE PREVENTIVE STRATEGIES

This section provides an introduction to the special considerations involved in planning oral health programmes and selecting appropriate oral disease preventive strategies. Guidelines are given for the choice of appropriate preventive procedures and technology for use in communities with different disease levels and available resources. In considering this matter, the Committee reviewed presentations of preventive programmes in China, Democratic Yemen, Indonesia, Mozambique, Sierra Leone, Singapore, Syrian Arab Republic, and Thailand.

4.1 The planning process

The goal of the planning process should be to achieve the greatest possible improvement in the oral health of the community for the available resources. The least costly preventive programme should be chosen that will achieve the specified aims; thus, programmes requiring few or no additional personnel, e.g., water fluoridation, will be preferred to those requiring supervisory personnel, e.g., mouth rinsing; the latter, in turn, will be preferred to those requiring trained dental personnel, e.g., professionally applied fluoride.

Administrators are referred to the WHO manual *Planning oral health services*¹ for guidance on the various steps involved in planning and implementing an oral health programme, but a number of aspects call for emphasis here, as follows:

(1) The planning/monitoring process is a dynamic continuum. Dramatic changes in oral health status are now occurring both for better and for worse. Thus, it is not sufficient to implement programmes on a “once-and-for-all” basis because the success of a programme will change disease levels and a different strategy may then be more appropriate and efficient. Rapid and economical monitoring surveys of the WHO Pathfinder type² can ensure that such trends are recognized early and appropriate action undertaken to respond to the changed situation. However, effective activities should be continued for the benefit of future generations.

(2) A carefully conducted situation analysis should be undertaken to identify oral health needs and demands and the constraints that limit choice of programmes. This involves collecting data on oral health status; evaluating existing oral health services, and the personnel and resources available for implementing the proposed programmes; and identifying the social, cultural, and economic factors that may facilitate or impede implementation of a programme. An important outcome of the situation analysis is a decision as to the oral health *goals* that can be achieved; this should be expressed quantitatively in terms of accepted indices. In the case of dental caries, the goals might be expressed in terms of a reduction in tooth loss and decayed teeth. For periodontal disease, they could

¹ *Planning oral health services*. Geneva, World Health Organization, 1980 (WHO Offset Publication, No. 53).

² For a description of this type of survey, see: *Oral health surveys: basic methods*. Geneva, World Health Organization, 1977, p. 16.

be defined as reducing the prevalence of advanced disease in older persons and gingivitis in younger people.

(3) As pointed out in section 3.3, local community involvement in the planning process is needed in order to gain accurate information from community members on their perceived needs and likely demands for care; it also presents an opportunity for health promotion and education within the community.

(4) The question of costs and efficiency must be studied, since all preventive procedures involve costs, some more so than others. The total costs of a programme can often be difficult to quantify, but will obviously include salaries and costs of materials, equipment, shipping, and transport. Less obvious but still important costs are those for use of space (especially if the building used was intended primarily for some other purpose, e.g., as a school) and depreciation of equipment, and fractions of salaries if staff carry out duties other than those concerned with the prevention programme. Most difficult of all to estimate is "opportunity cost", which results from the fact that if the staff are working in the prevention programme they are *not* doing something else of value. Administrators should be aware that difficulty in quantifying these indirect costs will mean that the true programme costs are usually underestimated. At the same time, future costs for treatment of disease must also be balanced against the almost always lower costs of preventing it.

The administrator's concerns centre not only on the programme's costs, but also on its *efficiency*, i.e., the benefits of a programme—improvements in oral health, and other favourable outcomes—relative to its costs. Related concepts are *cost-effectiveness*, defined as the least expensive way of achieving a stated objective, and *cost-benefit*, the monetary value of the benefits achieved relative to the costs involved. Benefits are much more difficult to quantify than costs because the monetary value of benefits has to be based on the value assigned by the recipients to caries reduction and other relevant factors. Because the concepts of cost-effectiveness and cost-benefit can become relatively complicated, and because there can be some overlap between the two, the terms efficiency and effectiveness are often preferred as ways of expressing the value received in return for resources expended.

Table 5 (page 14) summarizes the results achieved by various caries preventive procedures of proven effectiveness. It should be remembered, however, that for all fluoride delivery methods, except salt and water, the reductions in disease cited in the Table

relate to use of the vehicle in clinical trials, i.e., under controlled research conditions designed to determine “effectiveness”. When a biologically active agent or procedure is then made part of a regular programme, the public health benefit, i.e., the “community effectiveness”, needs to be evaluated separately. This is because public health programmes are conducted under real-life conditions with a broad range of people, and are subject to the logistic limitations of existing services and personnel.

Thus, although the broad guidelines and the examples of the more frequently encountered country situations given below can help in identifying the most appropriate strategies, it is not possible to give more than general estimates of the community effectiveness of some of the methods. Furthermore, information on the efficiency of many of the methods over the long term is not available. For these reasons, all programmes should be carefully monitored.

4.2 Examples of strategies

The personnel, funds, material, and equipment available for preventive programmes will vary greatly from one situation to another. In the guidelines given in sections 4.2.1 to 4.2.6, the available resources are broadly classified as minimal (and increasing), moderate (and increasing), and plentiful. Disease levels and trends most commonly found are categorized in terms of prevalence level and trend. There are at least three general situations with regard to caries prevalence: it may be (a) stable and very low or low, (b) increasing, or stable and high, or (c) decreasing. In the first situation, all that is required is careful and regular monitoring, together with education to ensure that the stability is maintained. In the second, the dental health administrator should do all that is possible within local constraints to control and reduce dental caries. In the third, the dental health administrator should continue to give emphasis to prevention but should be careful not to continue with inefficient programmes because the resources saved could then be put to better use in other health fields.

The following are examples of strategies and procedures in countries with the resources and disease situations described in chapter 4 of *Planning oral health services* (see also section 3.3). They are presented as guidelines for action under the different circumstances of disease levels, available resources, and defined goals.

4.2.1 *Community with minimal resources, low or very low caries prevalence, with no indication of increases, and high or very high periodontal disease prevalence*

Shortage of resources will usually allow such communities to mount only extremely limited preventive programmes that require very few oral care personnel.

Strategy. Monitor disease levels and take every opportunity to increase public awareness of the value of a clean and healthy mouth, particularly by including this activity in primary health care activities.

4.2.2 *Communities with minimal but increasing resources, low but increasing caries prevalence, and moderate to very high periodontal disease prevalence*

Periodontal disease prevalence could range from very high to moderate in different socioeconomic groups.

Strategy. In addition to the approach recommended in section 4.2.1, primary health care personnel should be trained to remove subgingival calculus and plaque and give oral hygiene instruction. If water or salt fluoridation is feasible, it should be used. Use of fluoride toothpaste should be encouraged, but no other programmes of caries control except, possibly, mouth rinsing in urban schools, would be advised.

4.2.3 *Communities with low/moderate resources, with caries already at a low or even moderate-to-high level and increasing, and moderate-to-very high periodontal disease*

Such communities are unable to mount personnel-intensive prevention programmes, but are faced with rising caries prevalence in addition to an existing periodontal disease problem.

Strategy. Community-wide water or salt fluoridation should be used where possible. The use of fluoride dentifrices should be encouraged where appropriate and fluoride mouth rinsing should be introduced, under supervision, especially in urban areas or for other high-risk groups. Every effort should be made to keep annual sugar consumption below 20 kg per person¹ and key groups (health

¹ As proposed for the United Kingdom by the National Advisory Council for Nutrition Education. *Proposals for nutritional guidelines for health education in Britain*. London, Health Education Council, 1983.

workers, teachers) should be educated about the dangers of frequent consumption of food and drink containing sugars. Where possible, regulations should be introduced to control advertising that encourages children to eat sugary snacks.

4.2.4 Communities with moderate and increasing resources, low/moderate or high and increasing caries prevalence, and moderate to very high periodontal disease

These communities are faced with similar disease problems to those described in section 4.2.3, but they do have a higher level of resources.

Strategy. In addition to the approaches described in section 4.2.3, fluoride rinsing should be introduced where water or salt fluoridation is not possible. If fluoride toothpaste is in widespread use, fluoride mouth-rinsing programmes may provide some additional caries reduction, but may also be uneconomic. If increasing caries is found predominantly in pits and fissures, the training of auxiliaries or non-dental personnel to apply fissure sealant should be considered. Auxiliaries or other non-dental personnel could also be trained to provide oral hygiene instruction and to remove subgingival calculus, if resources allow. Where annual sugar consumption is above 20 kg per person, the marketing of low-sugar foods and snacks containing non-sugar sweeteners should be encouraged. Oral hygiene instruction programmes should be introduced, using supervised non-dental personnel.

4.2.5 Communities with plentiful resources, increasing or high caries prevalence, and moderate-to-high periodontal disease prevalence

These communities are usually found in industrialized countries, where oral disease problems are apparent. Periodontal disease is likely to be higher in lower socioeconomic groups, even if it is moderate generally.

Strategy. In addition to the approaches described in section 4.2.4, school water fluoridation may be introduced where salt or water fluoridation is not possible. Fluoride mouth rinsing, or other programmes, such as supervised brushing with fluoridated toothpaste, should be economically feasible and provide added benefit. Personnel should be trained to apply fissure sealants to the

posterior teeth of caries susceptible children, and they can also be used in programmes of tooth cleaning and oral hygiene instruction.

4.2.6 Communities with low or moderate and decreasing caries prevalence, and low/moderate or high periodontal disease prevalence

Such communities usually have relatively plentiful resources; decreasing caries prevalence is thought to be chiefly a result of successful use of fluoride.

Strategy. The programmes described in section 4.2.5 should be continued, except that fluoride-rinsing programmes should be stopped when caries prevalence levels of 12-year-olds drop below DMFT = 2.6, since the added benefit from the rinsing programme may not be worth the cost of operating it; as caries prevalence drops, the residual lesions are almost entirely pit-and-fissure lesions, and less amenable to the beneficial action of fluoride. At these caries levels, in fact, programmes of fissure sealant application should be beneficial and may be economic. Auxiliary personnel can also be employed in programmes of professional tooth-cleaning and in oral hygiene monitoring and instruction. Adequate attention to monitoring and to health promotion and education is still essential in this situation in order to ensure that effective caries prevention programmes are not abandoned because they appear to be no longer needed; continued reinforcement is essential.

5. WHO GLOBAL POLICY/PROGRAMME FOR ORAL HEALTH

The planning, development, and successful continuation of oral disease prevention programmes in developing countries is dependent on the availability of expert consultative planning services and of fluoride analytical services for standard checking of monitoring methods. It is also necessary in such programmes to have access to data showing the extent to which the programme measures are applicable and acceptable in different cultures and resource situations. The WHO collaborating centres listed in Annex 1 are intended to help meet these needs and a start has also been made in establishing demonstration, training, and research centres in various countries. A WHO International Collaborative Oral Health

Development Programme has also been set up to provide support to country action programmes.

5.1 WHO network of collaborating and demonstration, training, and research centres

As WHO's country, regional, and global programme for oral health has evolved, with its major emphasis on prevention, a network of collaborating centres has been developed and others are envisaged that will cover a wide range of capabilities. These centres have contributed greatly to the programmes of WHO and Member States by providing services that would not otherwise have been available, either for technical or economic reasons, including laboratory services and advice on methodology, information services, consultation, and guidance.

Demonstration, training, and research centres have been established in the Syrian Arab Republic (Damascus) and Thailand (Chiang Mai), which, although they are national centres, also have an important intercountry role. These centres concentrate on practical aspects of the three elements of their function but are also responsible for technical collaboration among developing countries. They thus have a country, intercountry, regional and interregional rôle, since problems in oral health vary, for the most part, in intensity rather than in kind, so that standard strategies, approaches and methodologies can be widely applied. Both are involved in the following activities: training courses for national and neighbouring country personnel on planning, epidemiology and preventive programme methodology; in-service training with practical field work for all levels of oral care personnel; epidemiological studies of caries, periodontal diseases, and fluorosis; the WHO collaborative study of metabolism and ingestion of fluoride from all sources; field demonstration trials of preventive agents and regimes; and health services research to evaluate alternative oral care delivery models.

The establishment of further demonstration, training, and research centres is planned.

5.2 Coordination of the WHO network with bilateral collaborative projects

Because of the different trends in industrialized and developing countries, a special opportunity exists to take advantage of bilateral

collaboration. Already the network of collaborating centres and demonstration, training, and research centres, together with WHO's oral health regional and global programmes, has developed a number of standard methodologies of measurement, planning and prevention, and these are being extended to cover other aspects, such as alternative manpower production and community care systems. If coordinated bilateral collaboration, focusing on specific obstacles to the achievement of national goals, is incorporated into that network, the whole strategy of prevention and complementary care can be optimized. The majority of bilateral collaborative projects would be directed towards the development of efficient preventive programmes and of appropriate manpower, with the accent on primary health care and integration of oral health with other health programmes and services.

5.3 Country action programmes and WHO's supporting role

The Thirty-sixth World Health Assembly in May 1983 adopted a resolution¹ requesting the Director-General of WHO to: "mobilize available resources in setting up the international collaborative oral health development programme in order to respond effectively to requests from Member States regarding all aspects of their national oral health strategies, thus taking advantage of a special opportunity to redeploy human and other resources to achieve health for all."

To that resolution the following annex was appended:

"FOUR-POINT COUNTRY ACTION PROGRAMME

"1. Establish a coordinated planning process in oral health, using the standard WHO system for analysing oral health situations.

"2. Within national plans thus formulated, emphasize prevention at the primary health care level and integrate oral health into the general health infrastructure, including a relevant referral system.

"3. Identify obstacles to achievement of national plans.

"4. Use the WHO international collaborative oral health development programme mentioned below to overcome those obstacles.

¹ Resolution WHA36.14. Oral health in the Strategy of Health for All. *Thirty-sixth World Health Assembly, Geneva, 2-16 May 1983. Resolutions and decisions, annexes.* Geneva, World Health Organization, 1983 (document WHA 36/1983/REC/1), p. 13.

“ROLE OF WHO IN SUPPORT OF COUNTRY ACTION PROGRAMMES

“1. Establish a WHO international collaborative oral health development programme, as outlined by the Director-General,¹ incorporating the optimal deployment of all resources available to the Organization.

“2. Collaborate with Member States in performing situation analyses, in developing national policies, goals, plans and programmes in the light of these analyses, and in identifying obstacles to achievement of those goals.

“3. Participate with governments in identifying the activities required and support needed through the WHO international collaborative oral health development programme.

“4. Promote and coordinate health services research and other research required to ensure the achievement of national goals in oral health.”

5.4 Collaboration with other international agencies

In these coordinated efforts there are possibilities for WHO to obtain valuable support from a variety of international agencies, both within the United Nations system, such as UNICEF and the World Bank, and outside it.

5.5 Expansion and strengthening of the network

There is everything to gain in further extending and strengthening the network of collaborating centres and demonstration, training and research centres, both on a geographical basis and according to special subject areas. Furthermore, the demonstration, training, and research centres are disseminating the standard strategies and methodologies, and this should result in the establishment of national centres of excellence as a further extension of the network.

6. RESEARCH NEEDS

It was evident to the Committee that there are still many gaps in our knowledge of how oral diseases can be effectively prevented and

¹ Programme for oral health and future strategies. *Thirty-sixth World Health Assembly, Geneva, 2–16 May 1983. Resolutions and decisions, annexes.* Geneva, World Health Organization, 1983 (document WHA36/1983/REC/1), Annex 3.

effective programmes implemented and maintained. Research is therefore needed, particularly on ways of improving the efficacy of existing prevention and control measures, and on developing acceptable, appropriate, and economic oral health services to deliver them, as follows:

6.1 Fluoridation and the use of fluorides

1. Studies on the caries preventive action of fluoride with particular emphasis on the identification of the respective roles of fluoride ingestion before and after the teeth have erupted.
2. Studies on the metabolism of fluorides in persons in poor health, e.g., suffering from malnutrition and other debilitating conditions, compared with normal physiological metabolism.
3. Development of appropriate technology for the defluoridation of domestic water supplies.
4. Development of inexpensive, technologically simple mechanisms for delivering fluorides to communities with very limited resources.
5. Studies on the cost-effectiveness of the use of combined fluoride regimes.
6. Determination of the most effective fluoride levels in dentifrices.

6.2 Oral health education and promotion

1. Investigations into the knowledge, opinions, and practices of providers of oral health care.
2. Development of education and training programmes in, and monitoring of, the provision of oral health care by appropriate health personnel, both dental and non-dental.

6.3 Public health dentistry

1. Research into environmental or physicochemical factors highlighted by sharp contrasts in disease prevalence or by the discovery of unusual conditions.
2. Evaluation of traditional remedies used in maintaining or improving oral health.
3. Evaluation of the efficacy, bacteriostatic properties, fluoride content, etc., of chewing- and brushing-sticks.

4. Development of screening methods for the identification of high-risk groups for dental caries, destructive periodontal disease, and precancerous and cancerous lesions.
5. Studies on the etiology of the enamel opacities and hypoplasia highly prevalent in certain population groups.
6. Development of inexpensive and effective fissure-sealant products that can be handled by non-dental personnel.
7. Studies on the relationship between oral cancer, including Burkitt's lymphoma, and the oral habits peculiar to various cultures.

6.4 Periodontal health and disease

1. Studies on the role of malnutrition, communicable diseases, and immunological impairment in etiology and pathogenesis of necrotizing ulcerative gingivitis and noma.
2. Studies on the prevalence and incidence of tooth loss resulting from periodontal disease.
3. Investigations into the role of subgingival calculus.
4. Determination of the value of antiseptics.

7. CONCLUSIONS AND RECOMMENDATIONS

The prevalence of oral diseases, especially dental caries, throughout the world is changing dramatically. Levels of caries have dropped in regions of traditionally high prevalence while in developing countries, the levels are rising. The reasons for these changes have not yet been established, but they are probably related, on the one hand, to the greater use of fluorides and, on the other, to increased consumption of sugar by persons not protected by fluoride.

These changes are creating contrasting problems that require quite different solutions. The traditional approach is to treat the disease, and reliance on professional services is therefore extensive. It is becoming increasingly apparent in developed countries, particularly as the prevalence of disease is reduced, that the use of professional personnel is a very expensive way of gaining a modest return in disease prevention.

Although not all the etiological factors are known with certainty, either for dental caries or for periodontal disease, enough is known today to bring about a dramatic reduction in both diseases, if not to eliminate them completely.

There is little doubt that future preventive strategies will depend increasingly on government policies and public health measures, in addition to individual effort, and will involve the use of non-dental personnel under the supervision of dental professionals.

Effective methods exist for preventing dental caries and, to some degree, for controlling periodontal diseases. Health promotion and education are of critical importance in implementing and maintaining these measures in community programmes. Involving local people in collective programme planning is the key to subsequent programme acceptance and participation; it is essential, therefore, to ensure that the opinions and contributions of local communities are integrated into the planning process.

A high priority in oral health throughout the world today is the application of known preventive technologies where they are not now being used, and the maintenance of effective programmes in countries where disease prevalence, especially of dental caries, has been reduced. Finally, research is needed on the operational aspects of achieving these goals—research on the effective and appropriate application of known preventive technologies that can, if acceptable and supported by the population, improve oral health.

To further a global initiative aimed at achieving the goals referred to above, the Committee recommended that:

1. The WHO oral health programme expedite the preparation of a manual on oral disease preventive programmes, which will be of assistance to health personnel and administrators throughout the world in designing appropriate prevention programmes for their localities.
2. High priority be accorded to health education and promotion as part of programme planning, implementation, and maintenance.
3. Oral health personnel work together with other health and community workers to encourage the development of country policies and to generate a political will favourable to preventive oral health programmes.
4. Oral health programme planners encourage, initiate, and support local community involvement in the programme planning process, beginning with the identification of problems and priorities,

rather than simply encouraging participation in programmes designed solely by health professionals.

5. More emphasis be given, in professional dental education and in the education of all health care personnel, to the prevention of dental caries and the control of periodontal diseases.

6. Comprehensive preventive programmes be developed and implemented, with local community involvement, for preventing dental caries and controlling periodontal diseases.

7. Full use be made of the International Collaborative Oral Health Development Programme.

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Annex 1

LIST OF COLLABORATING CENTRES FOR ORAL HEALTH

Institution	Main area of activity
Institute of Dental Research, United Dental Hospital of Sydney, Sydney, NSW, Australia	Prevention and epidemiology of oral diseases. Study of ingestion and metabolism of fluorides
Stomatology Institute of Beijing Medical College, Beijing, China	Research and training in preventive dentistry
Faculty of Stomatology, Medical Academy, Erfurt, German Democratic Republic	Research on prevention of dental caries and periodontal diseases
Department of Odontostomatology, Faculty of Medicine and Surgery, University of Milan, Milan, Italy	Oral epidemiology
Medical Research Council of New Zealand, Wellington, New Zealand	Prevention and epidemiology of oral diseases
National Institute of Medical Research, Yaba, Lagos, Nigeria	Study of ingestion and metabolism of fluorides
Central Institute for Research on Stomatology, Moscow, USSR	Epidemiological studies of oral diseases
Medical Stomatological Institute, Moscow, USSR	Development of oral health manpower
University of Leeds, School of Dentistry, Department of Oral Biology, Leeds, England	Oral epidemiology
National Institutes of Health, National Institute of Dental Research, US Department of Health and Human Services Bethesda, MD, USA	Research on preventive measures for dental caries and periodontal diseases

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667	(1981) The role of the health sector in food and nutrition Report of a WHO Expert Committee (92 pages).....	6.—
668	(1981) Disability prevention and rehabilitation Report of a WHO Expert Committee (40 pages).....	3.—
669	(1981) Evaluation of certain food additives Twenty-fifth report of the Joint FAO/WHO Expert Committee on Food Additives (48 pages).....	3.—
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