PREVENTION
OF ORAL DISEASES

WORLD HEALTH ORGANIZATION
GENEVA
1987
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PREFACE

Information on changes in oral health status has been collected for many countries over nearly two decades, in WHO's Global Oral Data Bank. Analysis of this information has demonstrated two clear trends, one towards better oral health where a high priority has been given to prevention, predominantly in highly industrialized countries, and the other towards a deterioration in oral health where oral disease promoting factors have increased and prevention has not been given sufficient emphasis.

The successes in preventing oral diseases have embodied most of the approaches of primary health care, involving community action and application, self-care activities, involvement of a variety of health and lay personnel, and promotion through the media. These approaches are available for all populations, providing a range of methods so wide that an appropriate selection can be made to improve or maintain excellent oral health in any community.

This book deals with all the accepted prevention methods and has been prepared as a guide for health administrators. The methods should be implemented within the standard framework of oral health situation analysis, goal setting, and coordinated planning with the emphasis on prevention and monitoring/evaluation.
1. INTRODUCTION

Oral health problems arise mainly as a result of two oral diseases: dental caries and periodontal disease. Although the prevalence of these two diseases is changing, it remains true that virtually every adult in the world has experience of either dental caries or periodontal disease, or both.

Satisfactory oral health is difficult to achieve throughout the developing world not only because of increases in oral disease but also because of the lack of preventive programmes and complementary dental services and shortages of manpower and other resources. In developing countries it is common to find only one out of every hundred carious teeth filled, in some countries the score is virtually zero. Patients with periodontal disease in developing countries receive little or no guidance as regards prevention or treatment.

In many industrialized countries, preventive programmes have been highly successful, oral health services are well organized, and care is available for most, if not all, of those who need it. However, oral health services in these countries were developed initially on the restorative/rehabilitative approach. That approach was enormously expensive and did not cope adequately with the problems — on average more than fifty per cent of the elderly are toothless — until the focus was placed on prevention. It is clear that combating oral disease mainly by increasing manpower and by improving treatment systems has not achieved the desired levels of oral health despite ever-increasing expenditure.

This book therefore promotes the far more successful preventive approach which can be implemented in countries at all levels of development. The three most important preventive measures are oral hygiene, optimal use of fluorides, and dietary control of sugars.

Personal oral hygiene is the single most effective measure for periodontal disease prevention, and it also has an important role in
caries prevention since fluorides can also be applied through personal care. Whereas community water fluoridation programmes require a certain technological sophistication, self care is effective, available to all, and thus of greater importance globally to improved oral health. The whole area of health education and promotion aimed at optimizing self-care and minimizing intervention is of prime importance in reinforcing the message offered by this book.

2. AIMS AND OBJECTIVES OF THIS BOOK

The aim of this book is to provide oral health administrators and other personnel working with oral disease preventive programmes with a simple but comprehensive guide for their everyday work, from the design of a programme through to its evaluation.

The objectives of this book are:

(a) to introduce the essential elements of the planning process, including manpower planning and costing;

(b) to encourage administrators to select appropriate preventive measures for their communities;

(c) to encourage planners and oral health personnel to evaluate and compare their results;

(d) to review current preventive programmes in given communities with a view to improving and extending them.

3. APPROACH

The planning and implementation of oral health programmes - both curative and preventive - can be a complex and confusing process unless certain steps are followed in a logical sequence. The main part of this book is concerned with the planning and implementation of preventive programmes; these activities differ only in detail from
those involved in the planning and implementation of curative services, which have been described in a previous WHO publication.¹ The steps described here are:

- Problem identification
- Setting of objectives
- Selecting preventive measures
- Implementation of programmes
- Evaluation of preventive programmes.

The interaction of these processes is illustrated in Fig. 1. Running throughout the planning process described, and all preventive programmes, there is an educational component which is of concern to both the organizers and recipients of the programmes. All preventive programmes also have implications regarding manpower of different types.

It is important to note that a preventive measure can be empirically conceived and successfully implemented without knowing how it operates; this may be by:

(a) controlling or eradicating the causative agents, or what are sometimes called etiological factors;

(b) controlling or eradicating any contributory factors, which of themselves do not cause the disease but either allow other agents to initiate the disease or contribute to its severity;

(c) increasing resistance to attack by the causative agent.

These mechanisms are well illustrated in the prevention of dental decay and are discussed fully in Annexes 1 and 2.

Another important aspect of the prevention of disease is the stage at which preventive measures are instituted. For example, it is sensible to initiate preventive measures before any signs of disease have developed. This is called primary prevention. However, once the disease has developed, intervention is required to promote recovery and thus to shorten the illness and avoid terminal consequences. This is called secondary prevention and must by definition include all clinical treatment. If the illness has progressed to a conclusion
that results in loss or impairment of function in one way or another then intervention is required at an appropriate stage during the illness, or at the end, to limit the amount of functional impairment or to restore function in the damaged area or system. This is called tertiary prevention.

Frequently, all three kinds of prevention, primary, secondary, and tertiary, are applicable for a single disease. This is the case with dental decay where fluorides are used to prevent onset (primary prevention), fillings to stop the disease spreading and causing a dental abscess or tooth loss (secondary prevention), and tooth replacement by an artificial substitute to rehabilitate the patient if the disease causes tooth loss (tertiary prevention).

This book is focused on primary prevention, as this is the most effective and desirable type of prevention, though some associated aspects of secondary or tertiary prevention are also included.

Preventive programmes may be implemented by oral health administrators at national, district or local levels. The preventive programme may be large or small, comprehensive or restricted, focusing on total populations or specific target groups. The choice depends on needs, resources, and programme goals. It describes the most important preventive measures and the planning process itself. This book describes only those preventive methods and programmes that have been fully supported by research findings and can thus be recommended.

In addition to the most prevalent diseases - dental caries and periodontal disease - prevention in the oral health area is concerned with the moderately prevalent set of conditions termed dentofacial anomalies, including malocclusion, and the variably prevalent or regionally important diseases and conditions under the headings of:

- Oral cancer and pre-cancer
- Defects of the dental hard tissue

- Maxillo-facial trauma

- Other oral diseases and conditions.

This book, however, deals only with preventive programmes that are relevant to sizeable community problems and for which demonstrable improvements are attainable. Thus, it does not deal with genetic counselling for facial clefts or dentofacial anomalies, or with limitation of habits not clearly associated with oral diseases or conditions.

The World Health Organization is willing to assist oral health administrators in the planning and design of preventive programmes. On request, guidance, materials, and analysis services can be provided for reprogramming and monitoring surveys.

4. PROBLEM IDENTIFICATION

Before any preventive programme can be designed for a particular oral disease or condition, the problem must be clearly recognized and understood. This process of recognition and understanding will involve the study of each specific oral disease or condition in its social context. To do this, data must be obtained concerning the following variables:

- demography and population dynamics

- environmental conditions

- manpower and physical resources available

- oral health status.
FIG. 2. ORAL HEALTH SITUATION ANALYSIS: WHO RECORD SHEET

1. Demographic and related facts

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual increase:</td>
<td>%</td>
<td>%</td>
<td></td>
<td>assumed constant</td>
</tr>
</tbody>
</table>

Per capita income: 197 US$

Number of schools and schoolchildren

<table>
<thead>
<tr>
<th></th>
<th>No. children</th>
<th>No. classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special</td>
<td></td>
<td></td>
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</tbody>
</table>

Total government expenditure on health: 1977 US$
% of the total government budget

2. Health manpower and facilities

<table>
<thead>
<tr>
<th>General 1979</th>
<th>Oral</th>
</tr>
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<tbody>
<tr>
<td>Personnel</td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td></td>
</tr>
<tr>
<td>specialists</td>
<td></td>
</tr>
<tr>
<td>general</td>
<td></td>
</tr>
<tr>
<td>Pharmacists</td>
<td></td>
</tr>
<tr>
<td>Nurses</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>General 1980</th>
<th>Oral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td></td>
</tr>
<tr>
<td>Dentists</td>
<td></td>
</tr>
<tr>
<td>Hygienists</td>
<td></td>
</tr>
<tr>
<td>Technicians</td>
<td></td>
</tr>
<tr>
<td>Armside</td>
<td></td>
</tr>
<tr>
<td>assistants</td>
<td></td>
</tr>
</tbody>
</table>

3. Oral disease data

<table>
<thead>
<tr>
<th>Caries 12 years</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>N</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Periodontal Disease 12 years</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>N</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment 12 yrs</th>
<th>15 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>N</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
</tr>
</tbody>
</table>

4. Oral health services data

<table>
<thead>
<tr>
<th>Type</th>
<th>Attendance</th>
<th>Fillings</th>
<th>Extractions</th>
<th>Surgery</th>
<th>Prophylaxis</th>
<th>Other periodontal care</th>
<th>Endodontics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health centres</td>
<td>(Est5)</td>
<td></td>
<td>temporary fillings were recorded</td>
<td></td>
<td>non-specific items entitled treatment</td>
<td>and other</td>
<td></td>
</tr>
<tr>
<td>Medical Centre</td>
<td>Estimated</td>
<td>trauma cases involving fractured jaw(s) per year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Oral health services data
To facilitate the collection of these data and to avoid omissions and inaccuracies as far as possible, WHO has developed a simple recording sheet (Fig. 2). It should be stressed, however, that the particular emphasis adopted during the collection of these data will depend upon the specific problem under investigation.

In addition to collecting demographic and related data, such as information about population size, age structure (in broad standard age groups where available), school-age population attending school, and population distribution (rural, periurban, urban), it is important to assess:

- general disease levels (assessed using statistics such as the infant mortality rate)
- prevalence of other diseases in the country or community
- per capita income
- degree of literacy in the population
- trends in living standards
- level of use of substances harmful to oral health.

These data are not only important in defining the extent of the problem and its effects on the population, but are also useful when planning the manpower needed for preventive programmes.

5. SETTING OBJECTIVES

Objectives should be selected following careful consideration of the data gathered during the analysis of the national or local situation. The objectives of a preventive programme should be realistic and based on the resources available both financial and others. They must also be compatible with the objectives of other
sectors of the health service. During programme development and the selection of preventive measures, at any level, the following questions need to be answered.

(a) Which oral health problems should be prevented?

(b) Which oral health problems can be effectively prevented?

(c) Which are the (target) groups for the planned programme?

(d) How quickly can the objectives be achieved?

(e) What resources (financial, physical, and manpower) are, or could be made, available to the programme?

The objectives for preventive programmes should be defined in measurable terms. They should form the basis for the listing and execution of specific preventive tasks and should be used to evaluate the effectiveness of the programme, including the costs involved and the benefits obtained. As an illustration, general long-term objectives could relate to:

- increasing the number of teeth present, on average, in a specific age group

- decreasing the percentage of the population who are edentulous in a specific age group.

Specific goals or objectives should be set for the prevention of dental caries, periodontal disease, and other oral diseases and conditions.

The achievement of goals for prevention must be considered on the basis of reaching and then maintaining the low levels of disease set out in the objectives. The duration of the initial phase will vary
according to the particular preventive method used, for example whether fluoride use is mainly systemic or topical.

Outlined below are examples of specific objectives that can be established for preventive programmes.

(a) **Prevention of dental caries**

A reduction in the incidence or prevalence of dental caries can be specified either in terms of an increase in the number of persons, by age group (or percentage of a population) free of caries, or by a decrease in the mean number of decayed, missing, and filled permanent teeth (DMF). A secondary goal might be to reduce the unmet need by specifying the size of the filled teeth component of DMF.

(b) **Periodontal disease**

Goals may be stated in terms of the percentage of the population, or mean number of sextants, with gingival bleeding, calculus and pocketing at a given age, or in a standard age group, and according to the community periodontal index of treatment needs (CPITN index).\(^1\),\(^2\)

Related to such goals are those for oral hygiene that are expressed either according to accepted indices measuring debris or plaque, or as the percentage of the population practising specific oral hygiene activities.

(c) **Oral cancer and mucosal conditions**

Objectives may be expressed in terms of the elimination of habits or agents predisposing to these conditions, or as a reduction in the

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number of persons or percentage of the population with specific conditions.

(d) *Accidents and industrial hazards*

Regulations on the use of seat-belts may be a goal in the prevention of facial fractures and other damage resulting from automobile accidents, as may be an actual expected reduction in incidence.

Goals may also be expressed in terms of the provision of mouthguards to people who are involved in contact sports, the limitation or elimination of oral health hazards in industry, and the provision of information and education to the population.

6. **SELECTING PREVENTIVE MEASURES**

The selection of a specific method of oral disease prevention depends upon the factors already discussed in sections 4 and 5. The selection of a specific method will depend upon the identification of oral health problems, the setting of goals or objectives to be achieved by the programme, and by an analysis of the advantages and disadvantages of alternative methods of prevention. The actual processes of problem identification, goal setting, and the selection of methods of prevention and programme design must, as far as possible, involve both oral health workers and representatives of the community, i.e., those who have the oral health problems.

At the national level, relevant data (see categories listed in section 4) should first be reviewed and national goals for oral health should be set. Secondly, broad preventive strategies have to be identified that are consistent with attainment of the set goals. Thirdly, oral health personnel and health planners need to be informed about goals and strategies and to understand how they were derived. The goals and strategies adopted at the national level must be consistent with the development of preventive oral health initiatives.
at the local level. At the national level, all policies should, as far as possible, enhance local initiatives, particularly with respect to the allocation of resources and materials.

At the local community level, health personnel must work within the community assisting local populations to identify their particular oral health problems. The local community can participate in both the setting of realistic objectives for the preventive programmes and the identification of appropriate methods of achieving them with the resources and materials available. Naturally the approach adopted will reflect local levels of development. The local oral health goals and preventive programmes selected should be consistent with the national goals and strategies that have been set in so far as is possible and appropriate.

The following factors should influence the way in which measures for a preventive programme are selected.

(a) Prevalence of oral disease and oral health care status.

(b) The type of manpower to be involved in the preventive programme.

(c) Funds (available and expected budget allocation).

(d) Systems of health care.

(e) Perceived need to reduce the diseases and conditions.

(f) General health of the population, including nutritional status.

(g) Diet, particularly sugar consumption.

(h) Chemical composition of drinking-water.
The most common preventive measures recommended by WHO can be grouped into the following areas:

- diet control
- oral hygiene instruction
- systemic uses of fluorides
- topical or surface application of fluorides, sealants, and varnishes
- secondary prevention.

Health education and promotion should accompany the introduction of preventive measures in all of these areas.

When selecting preventive measures, their cost and the availability of personnel should be considered (Table 1).

7. IMPLEMENTATION OF PREVENTIVE PROGRAMMES

Following the selection of one or more preventive measures, the next essential step is implementation (see Fig. 1); this includes preliminary planning, organization, selection of target groups, and estimation of manpower needs and costs.

7.1 Preliminary planning

Oral health administrators should make a preliminary outline of the whole oral disease prevention programme, prior to preparing detailed planning measures.
| TABLE 1. PREVENTIVE MEASURES: MASS MEASURES AND LIMITED MEASURES FOR SPECIFIC POPULATIONS |
|---------------------------------------------|----------------------------------|------------------|
| **Personnel involved**                      | **Cost per capita**              |
| **MASS MEASURES**                            |                                  |
| Fluoridation of water                        | Water plant engineer or operator | Low              |
| Fluoridation of salt                         | Salt plant engineer              | Low              |
| Fluoride toothpaste                          | Individual/family                | Low              |
| **LIMITED MEASURES FOR SPECIFIC POPULATIONS**|                                  |
| (e.g., children or institutionalized populations) |                              |
| Fluoride tablets                             | Dental auxiliary/family          | Medium           |
| Fluoride mouth-rinses                        | Dental auxiliary/family          | Medium           |
| Fluoride gel                                 | Professional                     | High             |
| Fluoride gels                                | Dental auxiliary/family          | Medium           |
| Fluoride varnish                             | Professional                     | High             |
| Fluoride varnishes                           | Dental auxiliary/family          | Medium           |
| Topical fluoride applications                | Dental auxiliary                 | High             |
| Fissure sealants                             | Dental auxiliary or professional | Medium           |

This preliminary plan is based on the results of the situation analysis of oral health problems and related data, and its form will also depend on the resources available. By working through the essential steps described in section 6 measurable objectives for prevention can be defined and appropriate strategies based on scope and feasibility can be selected. At this stage, it may become
apparent that the manpower and financial resources available are not sufficient for implementation of the preliminary programme design. If this is the case, it will be necessary to:

(a) reconsider the strategy and make new decisions that are compatible with the resources available and the development of manpower; and to

(b) design a detailed plan.

7.2 Organization and administration

The planning and implementation of preventive programmes are the responsibility of oral health administrators (chief dental officer of a country, district, etc.) who are usually dentists (stomatologists) by education and have experience in administrative work.

Planning procedures should, in any case, be in agreement with the policies of the government, ministry of health or other relevant ministries, such as the ministry of education, and local authorities. Local health services, planners, economists, and statisticians should also be encouraged to help.

An administrator should include the following activities in his/her checklist:

- approval of a programme for oral disease prevention by local authorities

- provision of funds

- appointment and training, as necessary, of the staff concerned

- identification of community activities

- development of the programme schedule
- delivery of the preventive procedures

- monitoring and evaluation of the programme.

7.3 Target groups

Groups of people who are at a high risk of developing oral disease should be identified for special attention, e.g., children, pregnant women, or factory workers. WHO and the International Dental Federation have established global goals for the year 2000 for certain index ages 5-6, 12, 18, 35-44, and more than 65 years. Apart from the first two index ages, which represent the preschool and primary school target groups the other index ages also have target-group significance. At 18 years, and for some years afterwards, programmes can be developed through the armed services, the workplace, and maternal and child health facilities. At 35-44 and 65 years and over invaluable assessment of the efficacy of oral health programmes can be made - of services on demand and in the workplace, and of services for the elderly (including domiciliary services). In developing countries, 15 may replace 18 years as an index age because adolescents leave school at an earlier age. In such cases, the early adulthood target age group is advanced by three years.

If it is not possible for the preventive programme to cover all children efforts should be concentrated on the group aged 6-7 years since their first molars will have just erupted and will need protection.

In large countries where there is a marked difference in the prevalence of dental caries and other oral diseases in different areas, the target groups are those that have the highest disease prevalence level or evidence of high risk.

For the less common oral diseases and conditions, possible target groups may be industrial workers exposed to specific industrial hazards causing certain oral diseases, specific groups of the
population that have been identified as having a high risk of developing oral cancer, young persons involved in contact sports, and automobile drivers.

7.4 Manpower needs

The implementation of a preventive programme in a community could be organized by the same personnel who are involved in the provision of oral health care services: dentists, operating auxiliary personnel, non-operating auxiliaries, and oral hygienists. In addition, non-dental manpower such as health educators, teachers, nurses, and water services personnel should also be involved.

The type and number of personnel needed to implement a preventive programme depend on its structure and scale. Table 2 shows the estimated manpower needed for different preventive measures and activities. More information on the subject of dental manpower calculations is provided in a WHO publication.¹

7.5 Cost estimation

The costs involved depend on the type and scale of the preventive programme; they include the staff salaries, equipment and materials costs, transport, and travel expenses. The main cost components of different preventive measures are summarized in Table 3. Among all preventive measures, the most expensive procedures are those that are professionally applied. The following information will be needed by a planner to calculate the overall cost of a programme:

- number of people to be covered by the preventive programme,

- preventive procedures employed,

### TABLE 2. PERSONNEL FOR A PREVENTIVE PROGRAMME

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Manpower type</th>
<th>Manpower calculation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and management of programme</td>
<td>Health administrator</td>
<td>One part-time for whole country</td>
<td>Time requirement for planning: 2 weeks first year; 1 week a year for 5 years</td>
</tr>
<tr>
<td></td>
<td>Oral health administrator</td>
<td>One part-time for whole country</td>
<td>Time requirement: quarter-time during 6 months of first year; 4 weeks per year for next 5 years</td>
</tr>
<tr>
<td></td>
<td>Consultants (as required)</td>
<td>One part-time for whole country</td>
<td>Time requirement: 1-4 weeks first year; 1 week per year for next 5 years</td>
</tr>
<tr>
<td></td>
<td>Economist</td>
<td>One part-time for whole country</td>
<td>Time requirement: quarter-time for 3 months of first year; 2 weeks for replanning and evaluation</td>
</tr>
<tr>
<td></td>
<td>Statistician</td>
<td>One quarter-time per oral health care system or 1 per 1000 personnel of all kinds involved in preventive programme</td>
<td>These times can vary considerably depending on the experience and efficiency of the persons and authorities concerned</td>
</tr>
<tr>
<td></td>
<td>Secretary</td>
<td>One to every planner</td>
<td></td>
</tr>
<tr>
<td>Oral health education</td>
<td>Dentists</td>
<td>One per 100 000 population for each category in the list</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2 (continued)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Manpower type</th>
<th>Manpower calculation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral hygiene instruction (tooth-brushing)</td>
<td>Oral hygienists, Other auxiliaries, Schoolteachers, Kindergarten nurses, Primary health care workers</td>
<td>One from this list per 2400 people for each category in the list&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Time requirement: 6 min tooth brushing per group of 30, or 30 min per week for one teacher&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Water/salt fluoridation</td>
<td>Engineers</td>
<td>Quarter-time worker per 100 000 people&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technicians</td>
<td>3 for every engineer&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Fluoride tablets</td>
<td>Health personnel, Schoolteachers, Nurses, Primary health care workers</td>
<td>One or two people of this kind per 100 000 people&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Topical fluoride (rinsing or toothpaste)</td>
<td>Therapists, Dentists, Public health care workers</td>
<td>One per 14 400 people&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Time requirement: 5 min per 30 children, per weekday&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Scaling</td>
<td>Dentists, Oral hygienists, Operating auxiliaries</td>
<td>One per 3000 patients</td>
<td>Time requirement: average of 30 min per person depending upon amount of calculus; heavy deposits require more time in adults</td>
</tr>
</tbody>
</table>

Table 2 (continued)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Manpower type</th>
<th>Manpower calculation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet control</td>
<td>Dentists</td>
<td>One part-time (quarter-time) per</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health workers</td>
<td>10 000 people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Doctors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>dieticians</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>educators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematic school oral health</td>
<td>Dentists</td>
<td>Depending on oral disease</td>
<td>Calculation of manpower requirements is discussed in a previous WHO</td>
</tr>
<tr>
<td>services</td>
<td>Operating auxiliaries</td>
<td>prevalence and type of care</td>
<td>publication&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>


- price of selected preventive materials,

- salaries of personnel,

- costs of equipment/facilities,

- transport,

- other costs.

Oral health administrators may need to estimate the cost-benefit ratio of a particular measure or programme. Some relevant information can be found in a previous WHO publication on this subject.<sup>1</sup>

### TABLE 3. COST COMPONENTS OF PREVENTIVE PROGRAMMES

<table>
<thead>
<tr>
<th>Activities and measures</th>
<th>Cost components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning administrative management</td>
<td>Salaries</td>
</tr>
<tr>
<td></td>
<td>Duty travel</td>
</tr>
<tr>
<td></td>
<td>Transport</td>
</tr>
<tr>
<td>Oral health instruction</td>
<td>Salaries</td>
</tr>
<tr>
<td></td>
<td>Aids for education</td>
</tr>
<tr>
<td>Oral hygiene education</td>
<td>Salaries</td>
</tr>
<tr>
<td></td>
<td>Oral hygiene aids</td>
</tr>
<tr>
<td>Local preventive procedures:</td>
<td></td>
</tr>
<tr>
<td>- scaling</td>
<td>Salaries</td>
</tr>
<tr>
<td></td>
<td>Instruments</td>
</tr>
<tr>
<td>- mouth-rinsing</td>
<td>Salaries</td>
</tr>
<tr>
<td></td>
<td>Materials</td>
</tr>
<tr>
<td>- toothbrushing, toothpastes</td>
<td>Toothbrushes</td>
</tr>
<tr>
<td></td>
<td>Oral hygiene aids</td>
</tr>
<tr>
<td></td>
<td>Toothpaste</td>
</tr>
<tr>
<td></td>
<td>Salaries</td>
</tr>
<tr>
<td>- varnishing, sealants, gels</td>
<td>Materials</td>
</tr>
<tr>
<td></td>
<td>Salaries</td>
</tr>
<tr>
<td>Fluoride tablets</td>
<td>Tablets</td>
</tr>
<tr>
<td></td>
<td>Salaries</td>
</tr>
<tr>
<td>School water fluoridation</td>
<td>Facilities for fluoridation</td>
</tr>
<tr>
<td></td>
<td>Salaries</td>
</tr>
<tr>
<td>Central water fluoridation, salt fluoridation</td>
<td>Facilities/fluoride</td>
</tr>
<tr>
<td></td>
<td>Salaries</td>
</tr>
<tr>
<td>Diet control</td>
<td>Sugar substitutes</td>
</tr>
<tr>
<td>Comprehensive oral health care</td>
<td>Salaries</td>
</tr>
<tr>
<td></td>
<td>Equipment/materials</td>
</tr>
</tbody>
</table>
8. EVALUATION OF PREVENTIVE PROGRAMMES

8.1 General

The evaluation process should be planned at the outset, have clear and measurable objectives, and should involve the recipients of the preventive programme (the population). Evaluation can be carried out at any stage during the life of a programme by comparing planned goals and measurable objectives with the results actually obtained.

The objectives of all the preventive methods used in a programme should be evaluated. This evaluation should assess not only the extent of any disease reduction achieved but also whether the various methods used to reach the stated objectives have successfully involved and motivated the population covered by the programme.

For the processes of evaluation and re-evaluation it is necessary to use the same indices and criteria that were used for the survey carried out at the beginning of the programme.

When comparing the stated goals of the programme with the actual level of prevalence of oral disease achieved, epidemiological surveys have to be undertaken. It is important:

- to examine the same age group of people (e.g., 12-year-old children) at the initial or baseline survey and at the point of evaluation,

- to use an adequate control group, if available, for comparison with the population involved in the preventive programme,

- to use the same or a well-calibrated team of examiners for the surveys,

- to use the same indices for oral disease assessment,
- to repeat the activity at no more than 5-year intervals.

For the prevention of specific diseases, comparisons could be made with equivalent groups of children who did not receive any preventive treatment or with children in the same age group who were present prior to the initiation of any preventive procedures. For example, it is possible to define the effectiveness of a preventive programme by comparing the DMF scores of 12-year-olds in the current year with the DMF scores of 12-year-olds who lived in the same community before the programme began.

8.2 Oral health education

As oral health education activities become more diverse and comprehensive, involving many sectors and agencies, they will become correspondingly more difficult to monitor and evaluate. However, a way must be found to give sufficient specificity to the health education component of primary health care, so that resources and activities can be centrally monitored and their impact evaluated. This will satisfy decision-makers that allocations are accounted for and that the new policies are successful.

For such an evaluation, both qualitative and quantitative indicators are equally important. In this connection, the "short list of indicators" suggested for use in the monitoring and evaluation of the global strategy for health for all by the year 2000 provides one indicator relating directly to health education policies. This indicator concerns the degree to which mechanisms for involving people in the implementation of strategies have been formed or strengthened, and are actually functioning. Such mechanisms might involve the activities of political parties and other organized groups such as trade unions, women's organizations, and farmers' or other occupational groups; they might also include measures to ensure that decision-making on health matters is adequately decentralized to the various administrative levels.
Evaluation should therefore include the following three levels:

1. **The content** (validity and appropriateness). Is the content of the educational message consistent with available scientific evidence and also appropriate to the resources of the people?

2. **The process** (acceptance by providers and by the target population). Do people make use of the preventive measures available to them?

3. **The outcome** (behavioural and other changes). Effective oral education should result, at best, in improved levels of oral health and, at worst, in no deterioration. The levels of oral health can be determined quite simply using various indices that measure, for example, the amount of dental decay or gum or other disease that has been experienced by individuals and/or the whole population. However, any changes in these indices will reflect not only the impact of the oral health education programme but also all preventive measures directed at improving oral health, and they are therefore not as specific as might be desired.

Examples are given below of evaluations that are specific to oral health education programmes.

1. **Dietary counselling**

   (a) Comparing patterns of food consumption (e.g., sugar) in communities before and after the implementation of a programme.

   (b) Establishing positive changes in food composition and quality.

   (c) Measuring the decrease in oral disease.
(d) Comparing the expenditure involved in the improvement of foodstuffs with the economic advantages of decreased levels of disease.

2. Oral hygiene instruction

To a certain extent, progress in the appropriate use of oral hygiene practices in a community could be evaluated on a short-term basis using simple criteria. Indicators that may be used to assess the effectiveness of the hygiene methods used and the impact on oral health are indices of oral plaque and debris that can be recorded before and after oral hygiene activities. The following additional indicators could also be of use:

(a) Statistics showing how many lectures, booklets and other oral hygiene educational materials were made available to the population.

(b) Figures showing how many people, or groups of people, are involved in oral hygiene educational programmes at different levels.

(c) Number of toothbrushes, amount of toothpaste, etc., used per person in a given country or community.

(d) Trends in oral health or disease in relation to improvements in oral hygiene.

8.3 Dental caries

Specific evaluation of the effectiveness of preventive programmes for dental caries can be obtained by assessing DMF scores in each age group, or by calculating the percentage of the population that is caries-free. In addition, evaluation of the effectiveness of preventive interventions can be made by:
- measuring fluoride levels in the water supply
- monitoring the fluoride concentration in the urine of persons consuming systemic fluorides
- assessing the retention of sealants.

This type of evaluation can be carried out at any time, whereas it has been suggested that an evaluation of disease impact should be made every 5 years after the start of the programme.

8.4 Periodontal diseases

The effect of a preventive programme for periodontal disease may be calculated using the mean number of sextants affected by disease using the community periodontal index of treatment needs (CPITN).

Initial evaluation of school- or group-based oral hygiene programmes may take place after 4-6 weeks of oral hygiene practice using the mean number of sextants with plaque per person. Subsequent evaluation should be carried out at three-monthly intervals to determine whether the observed changes are sustained.

The percentage reduction in tooth loss and changes in prevalence of periodontal disease can be used for general evaluation. Precise results are available only after long-term evaluation. The effectiveness of oral health education and oral hygiene instruction can be evaluated using short- and mid-term evaluation periods.

8.5 Other oral diseases

For the evaluation of preliminary or final results, oral health administrators should carry out two or more epidemiological surveys with the purpose of establishing the prevalence of a given harmful habit and the associated level of oral disease or trauma. A simple
oral health assessment form and questionnaire could be used. Relevant information is often available from official statistics.

Using smoking as an example, the following data are sufficient for the evaluation process:

(a) the percentage of smokers in the population;

(b) the percentage of patients with oral mucosal disease or other habit-related disease;

(c) the percentage of persons with teeth or dental tissues affected by the habit.

Evaluation of the results, using the percentage of people who have given up a harmful habit can be undertaken at any time after the beginning of the programme. The most valuable results are those that have been gathered over a long period (5-10 years or more) from a representative group of people in a given country or area.

More specifically, one method of assessing the effectiveness of a programme for the elimination of a harmful habit would be to investigate the effect of the interventions on the prevalence of oral cancer or other oral mucosal diseases. Any clinically significant decrease in the prevalence of oral disease, in the long term, could be considered as evidence of the success of the programme.

8.6 Evaluation schedule

Periodic evaluation is most important. It is recommended that dental plaque indices are used for short-term (up to 2 years) evaluation, and the DMFT/DMFS and the CPITN indices for long-term (more than 2 years) evaluation.
Preliminary evaluation should include an assessment of public acceptability of the preventive programme as well as the degree of participation of the population involved.

Medium-term evaluation may reveal some drawbacks and unexpected problems related to funds and manpower. At this stage it may be necessary to modify the programme or to set new goals and objectives.

Final evaluation of a preventive programme is possible only after a period of 5-10 years or more. Programmes must be monitored regularly to determine compliance and correct usage. In order to be able to make any necessary alterations to an ongoing project, some components of a programme may need to be reviewed yearly; for example, the effect (if any) of oral hygiene instruction given to children.

Final evaluation should include a cost-effectiveness analysis. The cost/effectiveness ratio is defined as the cost of programme implementation divided by the savings made in the costs of treatment.

8.7 Revision of the programme

On the basis of success of the programme, as determined by the specific disease indicators, the evidence of community participation, costs, and the availability of funds, manpower and materials identified in the evaluation process, any necessary revision or modification of the project can be undertaken.

The replanning process will involve the same elements as the original planning stage, the only difference being that the planner will already have available more precise data to use in the planning process and in the definition of the objectives.
9. EXAMPLES OF PREVENTIVE PROGRAMME PLANNING

Several examples are provided here to illustrate the topics discussed in the previous sections of this book. No set of examples can be expected to cover every circumstance or to deal with exceptions to the usual situation, except by occasional reference. Also, it is understood that preventive programmes may be planned on a national, local or special-group basis, subdivisions that cannot be dealt with in detail but for which guidance can, nevertheless, be obtained from the examples offered. The same set of situations is used for which examples were provided in an earlier WHO publication Planning Oral Health Services\(^1\) each based on a population of 5 000 000, which could represent a fairly small country or a moderate to large province.

While recognizing their deficiencies or generalizations, these examples are consistent with the information that can be obtained from the WHO Global Oral Data Bank in which there is usually a close linkage between stage of development, oral health manpower, and prevalence of the principal oral diseases. Thus, the least developed countries have very few oral health personnel, exhibit a very low to low prevalence of dental caries, and a moderate to high prevalence of periodontal disease. Moderately developed countries have a modest supply of oral health personnel, exhibit a low to moderate but increasing prevalence of caries, and a moderate to high prevalence of periodontal disease. Highly industrialized countries have a plentiful supply of oral health personnel, exhibit a relatively high but decreasing prevalence of dental caries, and a moderate to low prevalence of periodontal disease. These generalizations help to keep the examples simple and few in number, although exceptions in particular communities or nations may require that the planning of preventive programmes be modified accordingly. Only minimal details

are given for each example. The reader should refer to Planning Oral Health Services\(^1\) for a more extensive description or to the WHO Oral Health programme.\(^2\)

**EXAMPLE 1: MINIMAL RESOURCES**

1. **Situation analysis data**

<table>
<thead>
<tr>
<th>Population subdivisions</th>
<th>Population size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Total</td>
<td>5 000 000</td>
</tr>
<tr>
<td>School age</td>
<td>1 000 000</td>
</tr>
<tr>
<td>School</td>
<td>500 000</td>
</tr>
<tr>
<td>Rural</td>
<td>3 500 000</td>
</tr>
<tr>
<td>Urban</td>
<td>1 500 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Manpower involved in oral health</th>
<th>No. of staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Dentists</td>
<td>60</td>
</tr>
<tr>
<td>Operating dental auxiliaries</td>
<td>0</td>
</tr>
<tr>
<td>General health equivalents</td>
<td>20</td>
</tr>
<tr>
<td>(including traditional practitioners)</td>
<td></td>
</tr>
<tr>
<td>Schoolteacher equivalents</td>
<td>180</td>
</tr>
</tbody>
</table>

---


\(^2\) Oral Health, Division of Noncommunicable Diseases, World Health Organization, 1211 Geneva 27, Switzerland.
### C. Disease levels

<table>
<thead>
<tr>
<th>DMF teeth¹</th>
<th>Age</th>
<th>12 years</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- upper socioeconomic level</td>
<td>3.5</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>- lower socioeconomic level</td>
<td>2.0-2.5</td>
<td>3.0-3.5</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td>1.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Periodontal disease</th>
<th>Age</th>
<th>low prevalence</th>
<th>moderate to high prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban - upper socioeconomic level</td>
<td></td>
<td>low prevalence</td>
<td>moderate to high prevalence</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>low prevalence</td>
<td>moderate to high prevalence</td>
</tr>
</tbody>
</table>

No other oral disease of major importance

¹ DMF = decayed, missing, and filled permanent teeth.

2. **Goal setting**

(a) No increase in the prevalence of caries among urban dwellers and even a slight decrease in DMF teeth (to 3.0) for 12-year-olds from the upper socioeconomic level. The prevalence of caries in the rural populations will not be as high as in urban areas.

(b) Reduction of the moderate to high prevalence of periodontal diseases to low to moderate during the planning period.

(c) Availability to all schoolchildren of a specified oral hygiene routine; the demand for oral health services in the remainder of the population rising to 10% by the end of the planning period.

3. **Selection of preventive measures**

(a) A national oral health education programme and a special oral hygiene programme in all schools.
(b) A fluoride rinse or fluoride paste programme in urban schools associated with the oral hygiene programme.

4. Manpower requirements

For oral health education and supervision of oral hygiene activities, 1 individual is required per 100,000 population, i.e., 50 in the first year of the plan, rising to 68 after 10 years.

For daily oral hygiene in primary schools, 1 schoolteacher equivalent per 2400 schoolchildren (calculated on the basis of a schoolteacher year of 1500 hours) spread over approximately 38 weeks, with a rate of 6 min per tooth-brushing group of 30.\footnote{Six minutes per day means 30 min per week per 38-week school year for each group of 30 children. The ratio is, therefore, one teacher equivalent to $1500/19 \times 30 = 2400.$} For the school enrolment detailed above this activity requires about 160 teacher equivalents, rising to about 280.

It should be clear that these are teacher equivalents; no single teacher would spend more than half an hour per week on this activity.

For fluoride rinsing once a fortnight, allowing 10 min per group of 30, the requirement is one schoolteacher equivalent to 14,400 urban schoolchildren; thus a total of about 20 teacher equivalents, rising to about 45.

5. Evaluation and costing

Coverage of the target populations should be evaluated and a survey made to establish disease prevalence after 5 and 9 years.

Costing should cover at least:
- dental personnel salaries,
- other health staff salaries in man-year equivalents,
- schoolteacher salaries in man-year equivalents,
- materials, equipment, buildings and transport, capital, and recurrent costs,
- duty travel, office, and administration costs.

EXAMPLE 2: MINIMAL BUT INCREASING RESOURCES

1. Situation analysis data

<table>
<thead>
<tr>
<th>A. Population subdivisions</th>
<th>Population size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Total</td>
<td>5 000 000</td>
</tr>
<tr>
<td>School age</td>
<td>1 000 000</td>
</tr>
<tr>
<td>School</td>
<td>500 000</td>
</tr>
<tr>
<td>Rural</td>
<td>3 500 000</td>
</tr>
<tr>
<td>Urban</td>
<td>1 500 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Manpower involved in oral health</th>
<th>No. of staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Dentists</td>
<td>125</td>
</tr>
<tr>
<td>Operating dental auxiliaries</td>
<td>125</td>
</tr>
<tr>
<td>General health equivalents (including traditional practitioners)</td>
<td>50</td>
</tr>
<tr>
<td>Schoolteacher equivalents</td>
<td>180</td>
</tr>
</tbody>
</table>
C. Disease levels

<table>
<thead>
<tr>
<th>DMF teeth</th>
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<th>12 years</th>
<th>15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- upper socioeconomic levels</td>
<td>3.5</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>- lower socioeconomic levels</td>
<td>2.0-2.5</td>
<td>3.0-3.5</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td>1.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Periodontal disease
Urban - upper socioeconomic level
Others

low prevalence
moderate to high prevalence

No other oral disease of major importance

2. Goal setting

(a) No increase in the prevalence of caries among urban dwellers and even a slight decrease in DMF teeth (to 3.0) for 12-year-olds from the upper socioeconomic level. The prevalence of caries in the rural populations will not be as high as in the urban areas.

(b) Reduction of the moderate to high prevalence of periodontal diseases to low to moderate during the planning period.

(c) Availability to all schoolchildren of a specified oral hygiene routine; the demand for oral health services in the remainder of the population rising to 10% by the end of the planning period.

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4. **Manpower requirements**

For oral health education and supervision of oral hygiene activities, 1 individual is required per 100,000 population, i.e., 50 in the first year of the plan, rising to 68 after 10 years.

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It should be clear that these are teacher equivalents; no single teacher would spend more than half an hour per week on this activity.

For fluoride rinsing once a fortnight, allowing 10 min per group of 30, the requirement is one schoolteacher equivalent to 14,400 urban schoolchildren; thus a total of about 20 teacher equivalents, rising to about 45.

5. **Evaluation and costing**

Coverage of the target populations should be evaluated and a survey made to establish disease prevalence after 5 and 9 years.

Costing should cover at least:

\(^1\) Six minutes per day means 30 min per week per 38-week school year for each group of 30 children. The ratio is, therefore, one teacher equivalent to \(\frac{1500}{19} \times 30 = 2400\).
- dental personnel salaries,
- other health staff salaries in man-year equivalents,
- schoolteacher salaries in man-year equivalents,
- materials, equipment, buildings and transport, capital, and recurrent costs,
- duty travel, office, and administration costs.

**EXAMPLE 3: MODERATE STABLE RESOURCES**

1. **Situation analysis data**

<table>
<thead>
<tr>
<th>A. Population subdivisions</th>
<th>Population size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Total</td>
<td>5 000 000</td>
</tr>
<tr>
<td>School age</td>
<td>1 000 000</td>
</tr>
<tr>
<td>School</td>
<td>700 000</td>
</tr>
<tr>
<td>Rural</td>
<td>3 000 000</td>
</tr>
<tr>
<td>Urban</td>
<td>2 000 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Manpower involved in oral health</th>
<th>No. of staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Dentists</td>
<td>250</td>
</tr>
<tr>
<td>Operating dental auxiliaries</td>
<td>0</td>
</tr>
<tr>
<td>General health equivalents</td>
<td>50</td>
</tr>
<tr>
<td>Schoolteacher equivalents</td>
<td>240</td>
</tr>
</tbody>
</table>
2. **Setting goals**

(a) No increase in the prevalence of caries and even a decrease to 3.0 DMF teeth for 12-year-olds in groups where the level is higher than that at the start of the plan.

(b) Reduction of the moderate to high prevalence of periodontal diseases to low to moderate during the planning period.

(c) Availability to all schoolchildren of a specified oral hygiene routine; the demand for oral health services in the remainder of the population rising to 15% by the end of the planning period.

3. **Selective preventive measures**

   See Example 1 (page 30).

4. **Manpower requirements**

   See Example 1 (page 30).

5. **Evaluation and costing**

   Evaluation and costing are the same as for Example 1.
EXAMPLE 4. MODERATE INCREASING RESOURCES

1. Situation analysis data

<table>
<thead>
<tr>
<th>A. Population subdivisions</th>
<th>Population size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Total</td>
<td>5 000 000</td>
</tr>
<tr>
<td>School age</td>
<td>1 000 000</td>
</tr>
<tr>
<td>School</td>
<td>1 000 000</td>
</tr>
<tr>
<td>Rural</td>
<td>3 000 000</td>
</tr>
<tr>
<td>Urban</td>
<td>2 000 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Manpower involved in oral health</th>
<th>No. of staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of plan</td>
</tr>
<tr>
<td>Dentists</td>
<td>250</td>
</tr>
<tr>
<td>Operating dental auxiliaries</td>
<td>500</td>
</tr>
<tr>
<td>General health equivalents</td>
<td>100</td>
</tr>
<tr>
<td>Schoolteacher equivalents</td>
<td>300</td>
</tr>
</tbody>
</table>

1 The disease levels are identical with Example 2.

2. Setting goals

(a) No increase in the prevalence of caries and even a decrease to 3.0 DMF teeth for 12-year-olds in groups where the level is higher than that at the start of the plan.

(b) Reduction of the moderate to high prevalence of periodontal diseases to low to moderate during the planning period.

(c) Availability to all schoolchildren of a specified oral hygiene routine; workers should have access to dental services in large industrial plants; and the demand for oral health services by the remainder of the population should rise to 20% by the end of the plan.
3. **Selecting preventive measures**

(a) An intensified oral health education programme and a special oral hygiene programme in all schools.

(b) A fluoride rinse or fluoride paste programme in all schools associated with the oral hygiene programme.

4. **Manpower requirements**

See Example 1 (page 30).

5. **Evaluation and costing**

Evaluation and costing are the same as for Example 1.

**EXAMPLE 5: PLENTIFUL RESOURCES**

The demography is the same as for Example 3 except that the urban/rural differences are less marked and the urban percentage is moderately to markedly higher. Details are not given for this example because the options cover all the procedures listed in sections 4-8. Disease levels are falling for both caries and periodontal disease as the result of a preventive programme that includes the systemic use of fluorides and a community oral health promotion and education programme.

Maintenance (even extension) of this preventive programme will be the aim, with water or salt fluoridation as the first choice, complemented by school programmes employing fluoride rinses or fluoride pastes or by the ready availability of fluoride toothpastes.
Each of these alternatives requires a different planning of manpower, materials costs, and monitoring.

*

*

The reader will have noted that all our detailed examples call for only minor modifications on a single theme. Though all options are open to the administrator, for instance in Example 5, it should also be realized that partial use of those options may be made in the earlier examples. Promotion of fluoride toothpaste may be universal except for areas of endemic fluorosis which require special consideration. Water or salt fluoridation may be used in urban populations as in Examples 1 and 3, where caries prevalence is on the increase.

Traditional hygiene methods should also be included in any of the sample programmes where relevant and special preventive programmes need to be developed for population sectors in which fluorosis is endemic, or for special population groups (the handicapped and the elderly) or for other oral conditions and diseases that are identified as a community problem.
ANNEXES
Annex 1

HEALTH EDUCATION AND PROMOTIONAL EFFORTS FOR PREVENTIVE MEASURES

The success of preventive measures depends on their availability, as well as on their acceptance and use by individuals, health workers, and communities. To help ensure that all individuals benefit from preventive measures, well planned, vigorous educational and promotional efforts are required. Thus, there is an educational component to each preventive measure. Health education, by promoting optimal professional and public acceptance and use of known preventive measures, is the cornerstone of success. Health education may be especially necessary in preventing oral diseases because they are pervasive, and generally not life-threatening. This section explains what is meant by health education and health promotion, and describes how these processes are used to apply preventive measures.

In this publication the terms health education and health promotion are used as follows:

Health education is any combination of learning opportunities that facilitates voluntary changes of behaviour which lead to improved health. The behaviours of individuals, families, communities, or institutions may need to be changed. Education is needed during the initiation and at all subsequent stages of any community health measure.

Health promotion is any combination of educational, organizational, economic, and environmental activities that support behaviours leading to improved health. Health promotion either alters the environment in such a way as to improve health without specific individual actions, or enables individuals to take advantage of preventive measures or services. For example, offering a fluoride mouth-rinse programme in schools enables pupils to benefit from a measure to prevent caries with little
effort on their part. Similarly, the enactment of legislation requiring the use of seat-belts and safety-seats for infants in automobiles promotes general health.

While education is distinct from promotion, both are necessary components of programmes to prevent oral disease. Education helps to gain and maintain interest, provides new information, and reinforces pre-existing knowledge. Health promotion provides the preventive procedure and at the same time offers an opportunity to educate individuals, communities, and other health professionals about the value of the measure introduced. The aim of health promotion is to put preventive-oriented decisions into practice.

Objectives of oral health education and promotion

The ultimate objective of both oral health education and promotion is improved oral health and the effectiveness of these activities should be measured in terms of improvement in oral health status. Appropriate indices would be the level of caries incidence or severity, or the prevalence of gingivitis. Environmental changes that promote oral health can become short-term objectives and can therefore be considered as positive outcomes of health education and promotion; examples might be the installation of community water fluoridation or a reduction in the availability of sugary foods in a school.

Educational principles for improved oral health

(a) The content of all educational materials should be accurate, complete, and based on scientific evidence.

(b) Education should be an integral part of all preventive procedures, and educational messages should be reinforced periodically.

(c) Educational materials should be appropriate for each particular audience.
(d) Active involvement of the audience is the key to effective learning.

(e) Education alone is not a preventive measure.

**Methods of health education**

Health education methods include a variety of activities, such as:

- one-to-one communication, ranging from discussing the need for a fluoride programme with a local administrator to giving plaque removal instructions to an individual

- group presentations, e.g., oral hygiene instruction for schoolchildren or classroom teachers

- mass communication, using newspapers, posters, booklets, slides, video-tapes, films, radio, and television to propagate oral health messages.

Examples of what to teach include:

(a) **What is dental plaque?**

Plaque is a mass of bacteria and sticky material that attaches to the surfaces of teeth. Plaque development is normal but, if left undisturbed, may contribute to the process of tooth decay and the development of periodontal disease.

(b) **How can plaque be removed?**

Plaque must be removed mechanically, by the effective use of a toothbrush, chewstick or other cleaning device.

(c) **How often must plaque be removed?**
Plaque should be removed once a noticeable amount has accumulated, preferably daily.

(d) What is fluoride?

Fluoride is a naturally occurring material that promotes the proper growth and development of teeth and bones.

(e) How does fluoride work to prevent tooth decay?

Fluoride helps to remineralize decalcified tooth surfaces. Fluorides are most effective on the smooth surfaces of the teeth. The presence of fluoride increases the resistance of the tooth to the process of decay.

(f) How is fluoride used?

Effective sources of systemic fluoride include fluoridated drinking-water, fluoridated salt, fluoride tablets and drops, and school water fluoridation. Fluoride-containing products not intended for ingestion include toothpaste, mouth-rinse, and topical solutions applied by a dental worker.

(g) What are sealants?

Sealants are adhesive plastic materials that are applied to the chewing surfaces of back teeth to seal them and prevent tooth decay.

**Improvements in personal hygiene**

Just as improved levels of hygiene in the community and at the personal level have been accompanied by improvements in general health status, so improved levels of oral hygiene have been followed by improved gingival health. Concomitant with improved oral hygiene has
been the wider use of fluoride-containing toothpaste and this is associated with a reduction in the amount of dental decay.

The level to which personal hygiene is practised and the methods used are influenced by many factors, including family and social traditions and environmental and economic constraints. Individuals learn the practice of personal hygiene from a number of different sources, with varying degrees of success. Much is learnt in the home at an early age, but there are many other important sources of learning, such as from peers and schoolteachers. There are, therefore, many opportunities and settings that can be used to influence hygiene practices. Some of these are:

- mother and child health clinics;
- school settings for children, adolescents, and adults;
- workplaces;
- residential facilities;
- health care centres;
- mass organizations for children, adolescents, and adults;
- community centres (meeting places, libraries, places of worship, etc.).

Oral hygiene is a natural component of personal hygiene and should be included as part of any effort to improve personal hygiene. The methods of health education are appropriate for enabling people to learn how to improve their oral hygiene.

The educational message concerning personal oral hygiene will contain elements concerning:
- methods and devices for the mechanical removal of plaque;
- lifestyles affecting oral hygiene;
- personal use of fluorides;
- self-examination for predisposing factors and incipient disease.

Dietary and nutritional counselling

Just as oral hygiene is a component of personal hygiene, so dietary counselling for oral health is a part of general dietary and nutritional counselling, and thus a part of general health education. Information on diet should be included in health education messages. The consumption of certain types of food can directly affect the teeth, in particular sugars and other fermentable carbohydrates and acidic foods and drinks.

These components can be found in a variety of different foodstuffs, drinks, and medicines. When they are consumed frequently in the absence of preventive agents such as fluorides and sealants, damage to the teeth results. Dietary counselling should therefore focus on:

- the risks associated with the frequent consumption of sugars, fermentable carbohydrates, and acidic foods;
- the foods that contain sugars and fermentable carbohydrates, and that are acidic;
- frequency of consumption of these foods;
- the use of sugary foods as a reward;
- acceptable substitutes for cariogenic foods.
The adoption of a national nutrition policy, permitting coordination of nutrition, agriculture, and payment mechanisms, can help the population adopt positive dietary and nutritional practices. Activities to achieve such policies are good examples of health promotion.

Changing harmful practices

Harmful practices are habits and customs that are associated with, and may result in, a deterioration of oral health. These include but are not limited to:

- use of tobacco products and betel;
- traditional dental mutilation;
- inappropriate use of oral cleaning materials and devices;
- use of inappropriate oral cleaning materials and devices.

Changing these harmful practices will initially require educational programmes at all levels and settings using the methods and opportunities already discussed. Some of these changes may be reinforced by suitable legislation to discourage such harmful practices; an example is the prohibition of smoking, except in restricted areas.

Avoiding hazards

Avoidable hazards occur both in the workplace and in everyday life. While the individual maintains responsibility for avoiding hazards as far as possible, those in authority must accept responsibility for the control of certain environmental hazards.

Workplace hazards to dental and oral health include principally dusts and fumes, and direct trauma. These hazards are primarily a
threat to general health; every attempt should be made to identify them and legislation should also be enacted to control them. At the same time, educational activities should be instituted to promote personal involvement in protecting health.

Hazards in everyday life not already discussed in relation to diet and poor oral hygiene are related principally to direct trauma to the head and face. This may involve the fracture of teeth or bones and the laceration of soft tissues. Education to identify and avoid these hazards is the principal preventive measure. The effect of education is reinforced by the enactment of legislation requiring the use of protective devices, such as seat-belts and safety-seats for infants in vehicles, crash helmets for motorcyclists, and mouthguards in organized contact sports.
Annex 2

PREVENTION OF DENTAL CARIES

Definition

Dental caries is a bacterial disease of the dental hard tissues. It begins with acid demineralization of the outer enamel surface and, if not arrested or treated, the dissolution of enamel continues into the dentine and pulp with increasing cavitation and loss of tooth substance. Toothache is a common accompanying sign of decay. The end result is the total loss of the crown of the tooth, often associated with abscesses and other types of secondary infection.

Another variety of caries, root caries, begins on exposed root surfaces rather than on the crown. While there may be etiological and bacteriological differences between root caries and coronal caries, the course and outcome of both conditions are similar.

Principles of prevention

Caries occurs as the result of the interplay of three factors: (a) presence of bacteria; (b) presence of a suitable substrate (or bacterial nutrient); and (c) susceptible dental enamel. Time may be considered as a fourth factor, since the disease process, once started, does not become immediately clinically detectable. Prevention is therefore based on breaking the chain of events that promote the formation of caries:

- by modifying the cariogenic bacterial flora;

- by altering the substrate on which the causative bacteria thrive;

- by rendering the tooth enamel less susceptible.
The main methods of caries prevention are the various recommended uses of fluorides. Fluoride can be administered systemically or topically. Systemic administration should be used only after the fluoride intake from water and food has been assessed, since an excessive systemic intake of fluoride can lead to fluorosis in children. Combined programmes of both systemic and topical administration of fluoride are effective.

**Fluoridation of drinking-water**

Fluoridation is the addition of fluoride to drinking-water in order to bring the total fluoride concentration close to the optimum level. The optimum concentration range is from 0.7 mg to 1.2 mg of fluoride per litre, depending on the mean annual temperature in the locality. In moderate climates, the optimum concentration is around 1.0 mg of fluoride per litre. Most drinking-waters contain at least some naturally-occurring fluoride, while others contain undesirably high fluoride concentrations. The recommended fluoride concentration limits for average temperature ranges in the community are given in Annex 2 Table 1.

Controlled water fluoridation is recommended for communities that have an established, treated, central water supply and adequately trained waterworks operators, where people actually drink the piped water (rather than rainwater or private well-water), and where caries is present at least at low levels (1.2–2.6 DMF or higher for 12-year-olds), especially if the incidence of decay is increasing.

The technology of fluoridation is well established. The implementation of community water fluoridation is the responsibility of health administrators, water supply authorities, food industry authorities, and sanitary inspectors. Oral health administrators and

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1 More information about the use of fluorides for dental caries prevention is provided in the bibliography (Annex 9).
ANNEX 2 TABLE 1. RECOMMENDED FLUORIDE CONCENTRATIONS FOR AVERAGE TEMPERATURE RANGES

<table>
<thead>
<tr>
<th>Annual average of maximum daily air temperatures</th>
<th>Fluoride concentration mg/litre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>°C</td>
<td>°F</td>
</tr>
<tr>
<td>10.0 - 12.05</td>
<td>50.0 - 53.0</td>
</tr>
<tr>
<td>12.0 - 14.6</td>
<td>53.8 - 58.3</td>
</tr>
<tr>
<td>14.6 - 17.6</td>
<td>58.4 - 63.8</td>
</tr>
<tr>
<td>17.7 - 21.4</td>
<td>63.9 - 70.6</td>
</tr>
<tr>
<td>21.5 - 26.2</td>
<td>70.7 - 79.2</td>
</tr>
<tr>
<td>26.2 - 32.5</td>
<td>79.3 - 90.5</td>
</tr>
</tbody>
</table>


dentists should play an active role in the planning and implementation of water fluoridation. The responsibilities of oral health administrators are:

(a) In the initial phase:

- to inform people of the benefits of fluoride for their teeth and its safety for oral and general health

- to encourage authorities and administrators to start water fluoridation.

(b) Before beginning central water fluoridation:

- to assess the current levels of fluoride intake from existing water supplies

- to carry out an epidemiological survey in order to assess the prevalence of dental disease, at least dental caries and endemic dental fluorosis
- to determine the optimum concentration of fluoride based on the average maximal daily temperature of the area.

(c) After the establishment of water fluoridation in cooperation with appropriate authorities:

- to institute a surveillance programme to ensure that the established concentration of fluoride in drinking-water is being maintained at recommended levels

- to monitor the levels of caries and fluorosis at pre-set intervals

- to develop a programme for the continuing education of water-plant operators.

Water fluoridation is considered to be a highly cost-effective method of controlling dental caries in those communities that have municipal piped-water supplies and the means to maintain them. It was recommended as a public health measure by the World Health Assembly in 1969, 1975, and 1978. Resolutions in favour of fluoridation have also been passed in the WHO Regions.

If central water fluoridation is not possible, it might still be possible to fluoridate the drinking-water of schools. The recommended concentration of fluoride is 4.5 times the optimal concentration for public water supplies in any climate. This level is derived from several studies carried out in the United States of America, and is based on the proportion of total water intake consumed at schools in that country. If that proportion is not applicable in a particular culture then suitable adjustments should be made.

Salt fluoridation

Salt fluoridation is, like fluoridation of public water supplies, a convenient method of administering fluoride in areas deficient in that element. It is especially suitable where salt distribution is
systematic and controlled, such as in countries with a national system of salt distribution. The concentration recommended is 250 mg of fluoride per kilogram of salt. Only one of the following three methods should be used for a defined population – fluoridated salt, water fluoridation or fluoride tablets – since they are all predominantly systemic methods of administering fluoride.

**Fluoride tablets**

The term "fluoride tablets" is a generic term used to describe the systemic administration of fluoride using tablets, lozenges, or drops. The action of fluoride tablets, when taken as recommended, is equivalent to that of fluoridated water and salt.

Fluoride tablets may be prescribed to children aged from 6 months to at least 13 years, who are not receiving fluoride systemically in any other way. Recommended dose levels are shown in Annex 2 Table 2.

<table>
<thead>
<tr>
<th>Age</th>
<th>Fluoride level (mg/litre) in water supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>6 months – 2 years</td>
<td>0.25</td>
</tr>
<tr>
<td>2-3 years</td>
<td>0.50</td>
</tr>
<tr>
<td>3-13 years</td>
<td>1.00</td>
</tr>
</tbody>
</table>

The ingestion of fluoride tablets must be supervised to ensure that they are taken daily in the prescribed doses.

Contraindications for the use of fluoride tablets are the same as for salt and other sources of systemic fluoride, i.e., they should not be used when the amount of fluoride obtained from drinking-water and other food sources is already at an appropriate level.
Professionally applied fluorides

In this case high-concentration fluoride preparations (solutions, varnishes or gels) are applied direct to the teeth by dental professionals or auxiliaries. Because they are individually applied, the procedure is more expensive per capita than mass-application methods, and their use should, therefore, be restricted to selected susceptible individuals.

For professional application the following preparations are recommended: 2% neutral sodium fluoride (0.9% fluoride ion); 8% stannous fluoride (2% fluoride ion); or 2.8% acidulated sodium fluoride (1.23% fluoride ion). Stannous fluoride and acidulated phosphate fluoride are available as gels; all can be used as solutions. Fluoride varnishes contain sodium fluoride.

The application of fluoride gel is carried out by professionally trained personnel, including specially trained auxiliaries. Precautions are necessary to avoid excessive ingestion of fluoride gels.

Fluoride mouth-rinses

The use of mouth-rinses is a method of topical application of low concentrations of fluoride to the teeth. Effective regimens are:

- daily use of 0.05% sodium fluoride solution

- weekly or fortnightly use of 0.2% sodium fluoride solution.

Other compounds, such as stannous fluoride, have been successfully used in rinses. However, of these compounds sodium fluoride is the least expensive and its taste is the most acceptable.

The daily use of mouth-rinses is more expensive and does not seem to be more effective than weekly use. However, daily use is recommended for the home, because it fits well into the daily oral
hygiene routine, whereas the supervised weekly or fortnightly procedure is better for the routine of schools. The procedure is contraindicated for children below 6 years of age who tend to swallow at least some of the rinse.

**Fluoride dentifrices**

Toothpastes containing fluoride are available in many parts of the world. Properly formulated toothpastes contain stannous fluoride, sodium fluoride, sodium monofluorophosphate, or amine fluoride, with suitable abrasives to ensure that the fluoride is biologically available. The fluoride concentration is usually around 0.1%. Many studies have shown that the regular use of fluoride toothpastes with compatible abrasives is highly effective in preventing caries. A fluoride toothpaste is used just like any tooth-cleaning material, being brushed on to the teeth with a toothbrush, cleaning stick or other suitable oral hygiene aid. Normal home use is encouraged, although supervised brushing programmes can be set up in schools where appropriate.

Fluoride toothpastes can be used in conjunction with any of the systemic methods for administering fluoride (water, salt, or tablets), and can provide additional benefits when used with a topical fluoride preparation (professionally applied materials or mouth-rinses).

Fluoride toothpastes are not recommended for young children who may swallow excessive quantities and thereby risk fluorosis.

**Fissure sealants**

Fissure sealants are plastic materials which, when painted on to the pits and fissures of posterior teeth (the areas most susceptible to decay), set hard and obliterate the fissured area. Caries is thus prevented from progressing in these areas.
The technique for the application of sealants is simple, but it does require good access, good light, and a saliva-control system for keeping the tooth surface completely dry during the application. Annual checks and reapplications are advisable. Where a sealant remains intact, caries does not progress.

Sealants can be applied by auxiliaries as well as by dentists, or by primary health care workers after suitable training. The technique is relatively expensive, but highly effective. It is most effective when applied to the most caries-prone teeth, the first or second molars, soon after they erupt.
Annex 3

PREVENTION OF PERIODONTAL DISEASE

Definition

**Periodontal disease** is a generic name given to a group of inflammatory and degenerative conditions of the soft and bony tissue supporting structures of the teeth. All are bacterial in origin. Initial inflammation occurs as a result of the presence of plaque bacteria. The causative bacteria are normal inhabitants of the oral cavity that accumulate around the necks of the teeth in a visible white film called plaque. Plaque formation is normal. Soon after cleaning, the enamel is covered by pellicles of salivary origin. Within hours, these pellicles are colonized by bacteria to form plaque. Plaque will increase in bulk, if left undisturbed, to reach a maximum after about three days. If still undisturbed, its bulk does not change but its bacterial profile does. This "mature" plaque is most likely to lead to periodontal disease.

**Gingivitis** is the inflammation of the gingival tissues around the tooth without involvement of the underlying structures. Gingivitis is characterized by a readiness of the gingival tissues to bleed, sometimes spontaneously. Bleeding of the gums following toothbrushing is a characteristic diagnostic sign. Gingivitis is a reversible condition.

Undisturbed plaque can also become calcified by minerals in the saliva to form calculus. Calculus below the gingival margin, called subgingival calculus, is a major determinant of periodontal disease, following gingival inflammation, and is also associated with destructive periodontal disease conditions.

**Periodontitis,** or destructive periodontal disease, is the progressive loss of attachment of the gingival tissues and the subsequent loss of alveolar bone. If the disease progresses
unchecked, the affected teeth become mobile and will eventually be lost. Periodontal abscesses causing pain and loss are also frequently associated with periodontitis. While periodontitis does not seem to develop without being preceded by gingivitis, gingivitis does not always progress to periodontitis.

Principles of prevention

Current microbiological data and our knowledge of host-tissue responses have not yet shown any single microorganism or group of microorganisms to be the specific causative agent(s) in the development of gingivitis or periodontitis. Clinically, therefore, all dental plaque must be considered, and dealt with, as a potential disease-promoting factor.

The natural history of periodontal disease is not as well understood as that of dental caries, although both are plaque-induced diseases. The main prevention strategy for periodontal disease is, therefore, based upon the regular and consistent removal of plaque. This control of plaque development should be carried out mainly by the individual, although professional treatment is frequently necessary as well. The aim is to keep the mouth free of long-term plaque accumulations and thereby to restrict the disease to no more than the earliest, reversible, stages of gingivitis.

Oral hygiene instruction

It has been mentioned previously that plaque accumulates on the gingival areas of the teeth if it is not regularly cleaned off. The purpose of oral hygiene instruction is to teach people how to clean their own mouths effectively, and to persuade them to do so regularly so as to maintain gingival health. A reasonable level of oral hygiene is fundamental to the control of periodontal disease.

Materials used for cleaning the teeth and gums include traditional chewsticks and toothbrushes as well as electric
toothbrushes, toothpicks, and dental floss. Various cleaning agents, from commercial toothpaste to salt and baking soda, are used for their abrasive effects and as flavouring agents. Too much abrasive material can be damaging. Tongue cleaners do not remove plaque, but can result in a feeling of cleanliness and well-being.

While there is no universal approach or single technique for maintaining oral hygiene, the aim is to remove or disrupt plaque before it matures, and to do this consistently without damaging the oral hard and soft tissues.

The following principles form the basis for oral hygiene instruction:

1. Artificial aids are necessary for the control of plaque. The self-cleansing action of tongue and cheeks may remove loose food debris, but has little effect on plaque.

2. The method chosen, whether toothbrush or chewstick, is of less importance than the way in which it is used.

3. Toothbrushes and chewing sticks should be changed regularly, since cleaning the teeth with a worn implement is not effective.

4. Where prevention of dental caries is intended as part of the procedure, toothpaste with fluoride should be used as a cleaning agent wherever possible.

5. For effective cleaning of the spaces between teeth, it is desirable to use dental floss carefully.

6. Traditional oral hygiene practices, like using chewing sticks, should be encouraged in areas where their use is effective and customary.
7. There are a number of conditions that make it difficult for the individual person to maintain an optimal level of oral hygiene (e.g., untreated dental caries, gingivitis, periodontitis, malocclusion). These conditions should be corrected by a dentist wherever possible.

The choice of approaches for instruction depends on the objectives and level of activities planned. In those countries where oral hygiene education is new for the whole community, it is reasonable to start with oral health education using appropriate means for the widespread dissemination of information such as radio, television or films. The next step is to provide oral hygiene education for children in kindergartens and schools, and for adults in the workplace. It should be kept in mind that instruction alone will not guarantee good oral hygiene; in order to achieve positive results it is necessary to practise exercises with individuals or small groups. Ideally, schoolchildren should have regular, periodic reinforcement sessions; during the teaching process children need daily supervision for a period of one week to one month, depending on their age. Afterwards, periodic evaluation is sufficient. Both children and adults should be shown how to examine their mouths regularly in order to detect plaque; use of disclosing agents can be helpful for this. Pamphlets, brochures and radio and television can be useful ways of disseminating oral hygiene instruction, although personal instruction is usually considered to be more effective.

Scaling and cleaning

Scaling and cleaning (called prophylactic treatment in some countries) result in the removal of soft and hard deposits (i.e., plaque and calculus) from the tooth surfaces by a dentist or other trained person, using special hand instruments or ultrasound devices. Subgingival calculus, especially, can only be removed in these ways. The purpose of scaling and cleaning is the same as for personal oral hygiene practices, that is, the removal of accumulated plaque deposits. Scaling should be an integral part of an oral hygiene
instruction programme so that subsequent oral cleansing can be performed by the individual in order to avoid the reformation of calculus.

In countries where resources are limited, the use of trained personnel to provide this service is expensive, often too expensive for the country's economy. These services can only be considered as part of a preventive programme if good oral hygiene can first be established. Scaling should be carried out periodically, how often will depend on the individual's propensity for calculus formation.
Annex 4

PREVENTION OF ORAL CANCER

Definition

Oral cancer and precancerous lesions are neoplastic conditions that are caused by local chemical or mechanical irritants or may be of unknown etiology. Most oral cancers are squamous cell carcinomas.

In highly industrialized countries, oral cancer accounts for only 3-5% of all cancers in contrast to some developing countries where oral cancer has been estimated to account for up to 40% of all cancers. The most common sites of oral cancer, listed in order of frequency, are: lower lips (in males), lateral border and undersurface of the tongue, labial commissure, and buccal mucosa (the latter two sites particularly among betel-tobacco chewers). Cancer of the labial commissure and buccal mucosa is very often preceded by leukoplakia, i.e., white mucosal areas or patches.

The treatment of oral cancer and several other oral mucosal diseases may require extensive surgery and post-operative plastic surgery resulting in great psychological and physical stress for the patients and high cost for the community.

Principles of prevention

Unfortunately, given present knowledge of the etiology of some of these conditions and diseases, it is still impossible to prevent many of them. The most effective public health measures against these conditions can be taken at the secondary and tertiary prevention level, namely, early detection and prompt and adequate treatment. Most authorities, however, believe that the removal of local irritants (e.g., ill-fitting prostheses and restorations, excessive amounts of calculus, and other chronic chemical or mechanical irritants) is important in the primary prevention of oral cancer. This is
especially true for the cancerous and precancerous conditions that are clearly related to various specific habits involving tobacco from smoking (especially reversed smoking)\(^1\) to betel-tobacco chewing.

**Approach**

It is essential that dentists, auxiliaries, and primary health care workers are familiar with the clinical appearance of oral cancerous and precancerous conditions so that such cases can be referred for appropriate care through the proper channels.

A national or local oral cancer preventive programme may be developed as part of a general cancer preventive programme or as part of an oral health preventive programme. The objectives of such a programme would be:

- to reduce the number of new cases of oral cancer and precancerous conditions (elimination of predisposing habits or agents)

- to increase the early detection of oral cancer and precancerous lesions (screening of potential risk groups for early detection)

- to reduce the mortality rate among present and new cases of oral cancer (increase of appropriate treatment facilities).

The preventive programmes in question should include the following topics.

1. The public should be informed about:

   (a) the consequences of oral cancer;

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(b) the risk that oral precancerous lesions may develop into oral cancer;

(c) the importance of early diagnosis and comprehensive treatment of oral mucosal lesions.

2. People should be encouraged to give up harmful habits that may cause diseases of the oral mucosa (smoking, betel-tobacco chewing, etc.) through reinforcement of health education and health promotion supported by governmental fiscal policy and health promotion strategy.

3. Individuals with clinical symptoms that might be associated with the development of oral cancer or oral mucosal lesions should be kept under careful observation and control.

4. Effective facilities for early diagnosis and treatment of precancerous lesions of the oral mucosa should be established.

5. Local or traditional methods used for the prevention and treatment of oral cancer and oral mucosal disease should be applied only if they have been shown, scientifically, to be effective.

The selection and combination of specific methods for oral cancer and oral mucosal disease prevention depend upon the actual situation in any given country or area regarding disease prevalence, manpower, and resources.
Annex 5

PREVENTION OF OTHER DISEASES OF THE ORAL MUCOSA

Definition

The following are diseases of the oral mucosa that are of public health importance.

Infectious and parasitic diseases: vesicular stomatitis with exanthema, oral manifestations of syphilitic and gonococcal stomatitis, acute necrotizing gingivitis and stomatitis, cancrum oris (Noma), acute and chronic candidiasis, oral manifestations of actinomycosis, and Burkitt's lymphoma. The etiological agents for diseases in this group are bacteria, viruses, and fungi.

Nutritional and metabolic diseases: oral manifestations of scurvy, of protein malnutrition, and of angular cheilosis. Diseases in this group are caused by undernutrition or malnutrition.

Diseases of the digestive system: cancrum oris, leukoplakia, leukodema, leukokeratosis nicotina palati, oral submucous fibrosis. Diseases in this group are caused by specific habits (betel chewing, smoking, etc.), local chemical or mechanical irritants, or specific environmental conditions.

Principles and approach for prevention

The basic principles for prevention or for reduction in incidence of the oral mucosal diseases mentioned above are directly related to: improvement in personal hygiene; provision of safe water supplies; introduction of general sanitary measures; and improvement of the individual's nutritional status.
All of these preventive approaches should be - and normally are - included in most primary health care programmes. The health education and health promotion part of such a programme is particularly important in this context.

The practical preventive programme should be based on the primary health care approach ensuring community participation and governmental support through the formulation of national health policies and strategies.
Annex 6

PREVENTION OF DEVELOPMENTAL DEFECTS OF
DENTAL HARD TISSUES

Definition

Developmental defects of dental hard tissues are those that are caused by agents or factors interfering with the normal mineralization pattern during tooth formation.

The most common developmental dental hard tissue defects of public health interest are: dental fluorosis; intrinsic staining (in particular tetracycline staining); enamel opacities; enamel hypoplasia; amelogenesis imperfecta; dentinogenesis imperfecta; and odontogenesis imperfecta.

In this book, only dental fluorosis and intrinsic staining (tetracycline staining) will be dealt with in more detail.

Prevention of dental fluorosis

Endemic dental fluorosis is a specific disturbance of the formation of the enamel caused by an excessive intake of fluoride during the formative period of the dentition. Dental fluorosis is clinically characterized by lustreless, opaque, white patches in the enamel that may be striated, mottled, and/or pitted. The opaque areas may become stained yellow to dark brown. The affected teeth may show a pronounced accentuation of the perikymata and, in more severe cases, multiple pits and larger areas of hypoplasia of the enamel appear to such an extent that the normal morphology of the tooth is lost.

Since dental fluorosis is a defect acquired during the formative period of tooth mineralization (and is therefore irreversible), the treatment is entirely limited to the use of restorative procedures to improve the cosmetic appearance of the teeth. It should be emphasized
that dental fluorosis cannot be acquired after the crowns of the teeth have been fully mineralized, i.e., by the age of 6-7 years for incisors and 9-10 for other teeth. The prevention of dental fluorosis involves the removal of excess fluoride from the drinking-water and, in a fluoridated area, the elimination or reduction of fluoride ingestion from other sources including the inappropriate use of fluoride dentifrices and other preventive measures using fluorides. In very rare cases the source of the excess fluoride can be the air, dust, or certain foods. The amount of fluoride ingested is normally considered to be in excess when it exceeds twice the optimum level for a given climate.

Defluoridation of drinking-water is usually a rather expensive procedure. Even though community defluoridation plants and individual household defluoridation devices exist, it is still necessary to develop a cheap, efficient, appropriate technological method for defluoridating drinking-water in those areas where the prevalence and severity of dental fluorosis is of public health concern.

There are only a few preventive methods capable of reducing the incidence of fluorosis.

1. Active defluoridation of water supplies containing excessive fluoride concentrations, by means of a chemical reaction or physical absorption.

2. Identification of alternative water resources with low or optimum fluoride levels which - if there is a scarcity of water - could be mixed with the existing water source, at least, to produce a fluoride concentration that is within acceptable limits (i.e., less than twice the optimum).

3. For children who are exposed to industrial or environmental fluoride contamination (aluminium or phosphate mining and processing) special precautions should be taken to reduce exposure.
The reduction of total fluoride ingestion to a level resulting from ingesting drinking-water with a fluoride ion concentration of 0.7-1.2 mg/litre will dramatically reduce the prevalence and severity of dental fluorosis to a level at which no disfiguring condition occurs. It should be noted, however, that the full effect of a defluoridation project is not achieved until after 8-9 years of operation.

**Prevention of intrinsic staining of teeth**

Intrinsic staining of teeth occurs most commonly following the prescription of tetracyclines either during the last trimester of pregnancy or to infants and children (0-5 years of age). The colour of the staining is grey to dark brown, depending upon which type of tetracycline has been administered.

Since the colouring effect is incorporated into the tooth structure during mineralization, there is no way in which it can be removed, although an acceptable appearance can be achieved using restorative care. Prevention, therefore, is limited to avoiding the use of tetracyclines during tooth formation.

All health personnel should be encouraged to exercise careful judgement as to whether alternative antibiotics are available and could be used in treating infections in pregnant women (last trimester) and children of less than 6 years of age. The substitution of other antibiotics for tetracyclines will completely eliminate the occurrence of tetracycline-induced discolouration of the teeth.
Annex 7

PREVENTION OF ACQUIRED DEFECTS OF DENTAL HARD TISSUES

Definition

Acquired defects of dental hard tissues are those that are caused by mechanical or chemical injuries to the teeth after eruption. There is a large range of such defects; the ones of public health importance are: enamel attrition; enamel abrasion (including traditional and ritual mutilation); enamel erosion; traumas and fractures; and extrinsic staining.

As for any other disease condition, the prevention of acquired defects of dental hard tissues is dependent upon the identification and subsequent elimination of the causative agent or agents.

Health education is a very important element in all preventive programmes aimed at reducing or eliminating harmful habits or agents. The content of such programmes differs among different nations and population groups, and will depend upon the literacy, religion, and culture of the population as well as their access to the press and television.

Prevention of enamel attrition

Attrition is a condition associated with the loss of tooth substance due to masticatory activity. Attrition, therefore, is mostly located in the occlusal and incisal part of the teeth and is often seen in persons who eat very hard and coarse foods, or food that unintentionally contains hard particles (improper cleaning of vegetables or particles from milling stones, etc.). Excessive attrition is also seen in persons suffering from bruxism or those with malformation of the dental hard tissues (enamel hypoplasia, amelogenesis imperfecta, etc.).
There seems to be no direct primary preventive programme by which enamel attrition can be reduced or avoided. For the rare cases where the attrition can be associated with the improper preparation or cleaning of foods (in particular, vegetables and fruits), the health education part of the preventive programme should also be directed towards solving this problem.

Cases of attrition that are due to bruxism or defective enamel structure should be referred to a dentist for further diagnosis and possible treatment.

Prevention of abrasion

Abrasion is a condition associated with the loss of tooth substance and is usually caused by improper toothbrushing, use of inappropriate toothbrushes or other oral hygiene devices or materials, for instance the use of sand, charcoal, etc. A specific form of abrasion is the one purposely performed in some developing countries known as traditional or ritual mutilation (filing of teeth into different shapes, even total extraction in certain cases).

The only effective approach for the prevention of tooth abrasion is to advise on the proper method of toothbrushing and the use of appropriate oral hygiene devices and materials. Even though traditional and ritual mutilation of teeth is a vanishing tradition, the total elimination of this custom should be promoted.

Prevention of erosion

Erosion is a condition associated with the loss of tooth substance due to chemical dissolution. Defects of this nature can often be seen in persons working in factories where acid or acidogenic compounds are being used. Excessive consumption of fresh citrus fruits and juices can also result in erosion of the enamel, particularly the gingival part of the enamel of the upper incisors.
The prevention of erosion includes:

- introducing appropriate safety procedures in industries where acids or acidogenic compounds are being produced or used

- informing the public about the potential hazard of consuming excessive amounts of fresh citrus fruits and juices.

Prevention of trauma and fractures of the teeth and jaws

Traumas and fractures of the teeth and jaws usually result from acute injuries caused by traffic accidents, sports accidents, playtime accidents, and domestic accidents as well as by violence, etc.

The basic ways of preventing tooth and jaw traumas and fractures are:

- reducing the hazards that can cause accidents

- teaching the public methods of self-protection

- making safety equipment cheap and effective.

Specific measures should be reinforced by:

- encouraging governments to subsidize safety equipment such as cycle helmets, mouth-guards, safety seats for children, seat-belts, etc.

- informing people of the potential hazards in their environment

- teaching people how they can avoid and eliminate those hazards or how they can protect themselves

- informing industries, sports clubs, schools, kindergartens, etc. how they can help to prevent these hazards
- encouraging central or local authorities to set up rules for safety and accident prevention.

**Prevention of extrinsic staining of teeth**

Extrinsic staining (discoloration) of teeth is caused by colouring agents (from medicine, tobacco, betel-tobacco chewing, etc.) penetrating into the tooth surface.

Since the colouring or staining agent has penetrated the tooth surface post-eruptively, there is normally a good chance of removing it by polishing or, in more specific cases, by bleaching. The basic preventive principle, obviously, would be to stop using the harmful agent in question.

The only primary preventive approach to avoid extrinsic staining is either to eliminate the harmful habit or improve the oral hygiene so that the staining agent has no chance to penetrate into the enamel.
Annex 8

PREVENTION OF DENTOFACIAL ANOMALIES

Definition

Dentofacial anomalies are those conditions that include hereditary, developmental, or acquired malocclusion or misalignment of the teeth. The severity of malocclusion can vary from very simple to very complex. The discrepancy in reported prevalence figures for dentofacial anomalies between different countries may, to some extent, often reflect a more rigid interpretation of what constitutes a biological variation from normal optimal tooth alignment and occlusion. Prevalence figures of 30-35% in children aged 10-12 years are often reported.

Principles and approach for prevention

The prevention and treatment of dentofacial anomalies can be classified according to the three preventive levels, namely:

(a) corrective orthodontic treatment (tertiary prevention);

(b) interceptive orthodontic treatment (secondary prevention);

(c) preventive orthodontics (primary prevention).

There is no direct public health measure that will prevent the occurrence of malocclusion. Except for malocclusions of hereditary origin, the best preventive measure probably is the preservation of the natural dentition - both the primary and the permanent - in the most healthy state possible.

Habits such as prolonged or excessive finger-sucking or use of pacifiers and other related habits should be interrupted if adverse effects on the position of the teeth, occlusion or jaws are observed.
Annex 9

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General


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School Water Fluoridation


Salt Fluoridation


Milk Fluoridation


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