

New Priorities in Prevention of Oral Disease*

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The practice of public health traditionally has been concerned with prevention of disease. Water quality, adequate nutrition, pure foods, waste disposal, immunization, and maternal and child health programs have been the foundation of public health since its emergence as a recognized discipline. They still are. For example, response to one major present-day threat to the health of the public in the United States—the hazards posed by uncontrolled dumping of chemical waste—can be seen as the late 20th century version of the “sanitary movement” of the mid-19th century.

Dental public health, too, in its short history, has devoted much of its activities toward the prevention and control of oral diseases in the community. The greatest effort in this area has long been directed at preventing and controlling dental caries in schoolchildren.

The purpose of this paper is to raise the question of whether this traditional priority in dental public health is due for revision, because programs aimed at preventing caries are now achieving a high level of success in many areas. As a result the cost-effectiveness of some caries preventive procedures may be decreasing to the point where their continuation in these localities may not be the best way to use scarce resources. This paper suggests that greater attention should now be given to the prevention and control of periodontal disease both in dental public health and in the private sector as well.

THE CHANGING BACKGROUND IN DENTAL PUBLIC HEALTH

Many dental public health programs began as offshoots from Maternal and Child Health at state and local levels, an evolutionary development which encouraged the programmatic emphasis on children. Dental caries through the period of World War I to around 1960 was clearly a major public health problem in the United States;^{20,45,48,81} it is therefore not surprising that public health practitioners maturing during this period came to perceive dental public health principally in terms of controlling caries in children.

In recent years, however, the practice of dental public health is being affected by changes in at least three dimensions. The first is that social and political forces have led to severe budgetary restraints at federal, state, and local level; consequently dental programs in many areas have been curtailed or even terminated. This is serious enough, but perhaps even more serious is the apparent change in attitudes toward public funding of community projects, the result of supposedly more individualistic and introspective social character development in the United States. Time will tell whether this development will be long-lasting, but in the meantime it could affect many aspects of social functioning—including the practice of dental public health.

The second major dimension of change is the decline in prevalence and intensity of dental caries in the United States (and elsewhere in the economically developed world). This phenomenon became apparent a few years ago¹⁶ and is now sufficiently well documented^{15,22,39,60,69} that it has become generally accepted as a trend. How far this de-

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cline will go is conjectural, but caries levels do not yet seem to have reached their irreducible minimum. Is this decline permanent? While it is unwise to be too certain about such things, it seems unlikely that caries levels in children will climb back to those seen in the 1930-1960 period (assuming that water fluoridation and other uses of fluoride do not diminish from present levels).

The third area is the decline in fertility rates through the 1960s and becoming pronounced through the 1970s to the present.⁷⁹ Among the results are declining school enrollments in most areas so that the traditional constituency of dental public health programs is declining in numbers. Again, the permanence of this development is uncertain.

Hence, the wheel has virtually turned full circle over the last generation. In the mid-1950s, many reasonably well-funded programs in dental public health were trying to cope with a rising tide of caries in a rising tide of children. Nowadays, the tide of both caries and children is ebbing, and so is funding for public programs.

EFFECTIVENESS OF CARIES PREVENTION METHODS

The widespread use of fluoride is probably the predominant reason for the current decline in prevalence of dental caries throughout the industrialized world. It is generally accepted that water fluoridation has the greatest impact on the prevalence of caries across the community, more so than other uses of systemic or topical fluoride, dietary restriction or dental health education.⁷⁴

It has been long assumed that the effectiveness of water fluoridation comes from the incorporation of fluoride into the developing enamel prior to tooth eruption. More recent research, however, suggests that there are additional actions of fluoride occurring topically which may be at least as important.^{21,23,49,66} On the epidemiological level, this view is given some support in that the decline in caries levels is being seen in countries with extensive water fluoridation, such as the United States,^{15,22,27,39,60} New Zealand,^{41,42} and Australia,^{10,58} in both fluoridated and nonfluoridated communities within those countries. It is apparent in countries with little water fluoridation but extensive school-based programs of topical fluoride, such as the Scandinavian countries.^{23,40,57} It is seen even in Britain, which has little water fluoridation and few school-based preventive programs, but where the use of fluoride-containing dentifrices is high.^{2,5,63,64}

In the United States, the reductions in caries levels of 50-70 percent attributable to water fluoridation are based on data now 15-30 or more years old. These levels of reduction were recorded at a time when there was little other use of fluorides, such as mouth-rinses or dentifrices. It is not certain that new programs of community water fluoridation introduced in the United States today would give a comparable degree of reduction, because with the present level of community-wide use of fluoride,³³ most notably in fluoride dentifrices,⁷¹ the baseline prevalence of caries in nonfluoridated areas is lower than it was 15-30 years ago. In addition, the remaining lesions tend to be more concentrated than before in occlusal surfaces, those least responsive to the beneficial effects of fluoride.

Fluoride is effective when applied by a variety of methods.^{13,32,80} In addition, there is mounting evidence that the judicious use of combined fluoride therapy is even more effective—the whole's being greater than the sum of the parts.^{35,36,38} This finding is to be expected in light of current knowledge of the multiple actions of fluoride.

COSTS OF CARIES PREVENTION

The costs and cost-effectiveness of various caries preventive procedures were examined at the workshop at The University of Michigan in 1978.¹⁷ This workshop concluded that

water fluoridation was by far the most cost-effective procedure available to reduce the prevalence of caries in the community. Other procedures found to be cost-effective were school fluoridation, school-based tablet programs, and fluoride mouthrinsing programs. The workshop concluded that, in general, self-applied procedures were more cost-effective than professionally applied procedures. Some professionally applied procedures were considered marginally cost-effective, and there was some uncertainty expressed about the cost-effectiveness of fissure sealants, despite their clear benefits in preventing caries.¹⁴ Since that workshop more data are available on the combined use of fluoride,³⁵ and the cost-effectiveness of sealants has been reexamined.³⁴

Prevention of caries through dietary restriction traditionally has been done by exhortation, but this method is probably the least cost-effective of all potential approaches on the community level. Similarly, preventing caries in school-based programs of professional plaque removal, though effective in some hands,^{6,7,9} is highly expensive. While education for dietary control and better oral hygiene in children should probably not be ignored in public programs, the available evidence suggests that they are insufficiently cost-effective to be the first choice in a public program. Better returns perhaps may come from the development and use of sugar substitutes, an area receiving considerable research attention,⁷² or from labelling of sugar contents of processed foods or regulation of advertising. These actions would move dietary control into the community level rather than seeking life-style change by individuals. It is difficult to say much more in this area because of lack of knowledge on effectiveness of the measures described. This is not to say that these actions should or shouldn't be pursued—just that it is difficult to predict what the cost-effectiveness of the results might be.

ECONOMIC ISSUES IN CARIES PREVENTION FOR CHILDREN

Dental caries persists, and will continue to persist, as a public health problem in many communities. In many other communities however, prevalence has dropped to low levels—11 year-old children in one fluoridated city now average 3.35 DMF surfaces each, and only 0.32 of these DMF surfaces, on average, are interproximal.⁸² In such communities where caries prevalence is already low, the decision on whether or not to mount a caries preventive program should be made after consideration of marginal costs and benefits. Where DMF values are low to begin with, the marginal benefits in terms of additional DMF surfaces saved as the result of a caries-preventive program are also going to be low. As caries levels get lower, the marginal benefits diminish even further, and the cost of saving one DMF surface becomes even greater until at some point marginal costs will exceed marginal benefits.

The dental public health director has to decide at what point the cost of mounting a program will exceed the marginal benefits obtained. In real life this question is not easy to answer because few empiric data on cost-effectiveness in the field have been published. But with diminishing caries prevalence, the question becomes more than academic. Useful data would come from the operation of caries-preventive programs in the field, where dental public health directors should keep close account of costs and should also survey the target population at three to five year intervals in order to estimate the program's effectiveness. The formula presented by Heifetz²⁹ could then be applied to assess the cost of saving one DMF surface, and the empiric data obtained could provide a good idea of what kinds of costs and caries levels are involved. These computations do not demand a sophisticated grasp of economic theory, but this level of economics may be quite enough to allow public health directors to make a correct policy decision.

ROOT CARIES

Future attention is likely to be needed to control root caries in older populations. As mentioned earlier, the population of the United States is aging and more of those people are reaching old age with teeth in place, teeth which are vulnerable to root caries when the gingival recession associated with age and periodontal disease occurs. Root caries does seem to be preventable, or at least controllable, by fluoride therapy,⁷³ and so could be seen as a disease best controlled through community-based programs. Furthermore, because root caries is closely associated with periodontal disease, its control could probably best be included with programs designed primarily to control periodontal disease.

PREVENTION OF PERIODONTAL DISEASE

The most recent national data for the United States⁷⁸ show that 40 percent of dentate persons over age 45 suffer from destructive periodontal disease—three quarters of this group have four or more pockets. While it is difficult to determine whether the prevalence of periodontal disease is increasing or diminishing over time, data from a recent North Carolina survey suggest that periodontal disease status may have deteriorated over the last 20 years.¹¹ When these figures are added to the fact that the population is aging and that the prevalence of caries is declining, it seems evident that the new frontier for prevention lies in the control of periodontal disease.

There are some fundamental distinctions between the approach to controlling caries and the philosophy of controlling periodontal disease at the community level. Periodontal disease probably presents more difficulties. For one thing, simple and effective procedures analogous to the various use of fluorides for caries prevention do not exist for periodontal disease. In addition, primary prevention of periodontal disease at the community level is an unrealistic goal. "Control," implying the necessity to accept certain levels of the disease which are low enough not to interfere with function of esthetics, is probably more achievable. In practice, the approach to both prevention and control of periodontal disease is based on the same philosophy and similar treatment procedures. That is not so with caries, where primary prevention at the community level can be quite independent of treatment of established disease.

Current knowledge demands that prevention and control of periodontal disease be based on mechanical plaque removal. While the idea of a readily available mouthrinse to restrict plaque formation or to inhibit development of specific bacteria is highly attractive, such a product does not exist at present. There is limited use of antiseptic compounds such as chlorhexidine in some countries, but these products may not be used in the United States and in any case have little public health application.¹ Effective plaque removal requires the combined efforts of the individual concerned and dental professionals.

EFFECTIVENESS OF INDIVIDUAL SELF-CARE

Current research suggests that periodontal health can be maintained by a thorough oral cleansing carried out at 24-48 hour intervals.^{44,47} The type of toothbrush used does not seem critical,^{31,75} power brushes may be particularly useful for handicapped persons or others with limited manual dexterity.

There appears to be little difference between toothbrushing methods in their ability to remove dental plaque.^{25,28,30,62,65,68,70} The scrub method is the simplest available and no less effective than any other; it requires minimal manual dexterity and limited patient concentration. Despite the emphasis on flossing in dental health education, there

is little evidence to show that it adds much to the efficiency of brushing.^{30,62,70} Nor do the few studies available show any difference in the efficacy of waxed and unwaxed floss.^{12,24,43} Floss is probably helpful for many individuals with hard-to-clean contact areas, but the patient does need thorough training in its use.

EFFECTIVENESS OF PLAQUE REMOVAL BY PROFESSIONALS

Success in preventing gingivitis and caries in children has been reported by the Axelsson-Lindhe group in their studies at Karlstad, Sweden.^{6,7,9,51} They applied intensive prophylactic procedures every two weeks over a two-year period. In the third year, the time between these "professional cleanings," as the research group refers to them, was increased to four weeks for the 7-11 year olds, and to eight weeks for the 13-14 year olds. The continuing good results with this reduced frequency of cleaning was attributed to the background effects of the first two years.⁵¹

Qualified success from prophylaxis provided twice or four times per year was reported among adults in Norway in 1961.⁵⁶ In Axelsson and Lindhe's study with adults,⁸ the professional cleanings were carried out every two months for the first two years, and every three months for the remaining four years. Intensive oral hygiene instruction for home care accompanied the professional cleanings.

Suomi et al.,⁷⁶ studying Californian office workers, showed that a prophylaxis plus intensive oral hygiene instruction every two-four months lowered the levels of plaque and gingivitis relative to a control group, and slowed the rate of loss of attachment. In other American Studies, Lightner et al.⁵⁰ and Suomi et al.⁷⁷ concluded that beneficial results were proportional to the intensity of the prophylactic treatment received, though the differences between varying recall times in the young male groups studied were not pronounced.

At present the American Dental Association is working hard to induce people to seek professional care; these campaigns may be having some success. The recent survey in North Carolina, however, showed that dental practitioners reported that they spent only two percent of their time in periodontal treatment.¹¹ In light of the treatment needs described earlier, that allocation hardly seems adequate.

DENTAL HEALTH EDUCATION OF THE PUBLIC

Personal oral hygiene practices can be encouraged through public education, though unfortunately the benefits of public education aimed at changing individual behavior to date appear limited.^{19,26} Among the reasons for these limited benefits could be the inappropriate choice of methods and recipient age-groups.

Continued research by educational psychologists to help identify the most favorable age-groups and methods will assist in producing more effective dental health education of the public. It is not clear, for example, whether effective education directed at improving oral hygiene status in elementary schoolchildren could have lasting benefits, or whether such efforts would be better directed at teenagers, young adults, or perhaps even older adults. Effectiveness and cost-effectiveness of such programs will likely remain uncertain for some time. But the development of more effective means of improving oral hygiene status at the public level must still be supported as the only feasible and potentially cost-effective means of controlling periodontal disease in the long term.

COSTS OF PREVENTING PERIODONTAL DISEASE

The control of periodontal disease requires thorough and consistent oral hygiene

practices by the individual in combination with regular professional prophylaxis.^{53,54} Philosophies on controlling established disease are similar. Studies in the United States and Sweden suggest that the approach to maintaining periodontal health, sometimes after necessary corrective surgery, is through self-care plus professional cleaning at about three-month intervals—that is, four times per year.^{46,52,59,61,67} These professional prophylactic sessions are also used to reinforce the individual's own oral hygiene practices.

A pervading theme from these studies on treatment of periodontal disease is that for most older adults the one-per-year prophylaxis is not enough to control periodontal disease through life. There probably are exceptions for those with exceptionally good oral hygiene status,⁵⁵ but they are a relatively select few. Where plaque has become established subgingivally, professional treatment is necessary to control the disease.⁵³ Accordingly, long-term control of destructive periodontal disease, whether on a public health or a personal basis, usually requires some degree of professional intervention, both for treatment and for prevention/education. Furthermore, this regimen seems necessary up to four times a year over many years for those adults who already have established periodontal disease, though fewer recalls may be satisfactory for younger adults without established disease. Such a regimen is clearly highly expensive if carried out by dentists; the cost can be more acceptable if hygienists provide the service.¹⁸ Either way this regimen requires high motivation, even if the immediate cost of the care were to be covered by a third party. When the costs of this mass prophylactic care are added to those of research in, and implementation of, dental health education of the public, it is clear that effective control of periodontal disease at the community level does not come cheaply.

ECONOMIC ISSUES IN PREVENTION OF PERIODONTAL DISEASE

In contrast to the prevention of caries, any plans for prevention of periodontal disease in the community has to include the private dental practitioner. Prevention of periodontal disease is resource-intensive and the private sector is where the resources are. But because many potential patients will be discouraged from attending the dentist up to four times a year if the usual fee for prophylaxis must be paid each visit, some economic incentive must be added to the educative efforts. Hence, the involvement of third parties is crucial. At present, Delta, Blue Cross/Blue Shield, and some commercial companies do include zero or low out-of-pocket copayments for preventive and diagnostic services for adults, but usually these services are restricted to one dental visit per year for adults. Third parties may not be easy to convince that the same low level of copayment should be continued for an increased level of dental visits, because contract structure, cost, and administration would necessarily have to be altered from those seen at present. An important role for dental public health might be to take the lead in working with organized dentists, dental hygienists, and the third-party carriers to establish policies for recall frequencies based on age and disease status. The result could be that third-party carriers and dental practitioners may accept some form of "package deal" to cover the costs of an increased frequency of dental visits. This concept should also fit into the capitation approach.

Aside from the educational priorities and promoting the development of reimbursement policies to stimulate more frequent prophylactic treatment, dental public health must continue to provide and support the necessary treatment services it traditionally has. Patient treatment for prevention and control of periodontal disease may need to be concentrated, in times of diminishing public resources, on groups such as residents of nursing homes, institutionalized persons, the homebound, and the chronically ill. The

major challenge here will be to mount these programs in times of economic adversity.

A further consideration relates to the economic necessity of having the prophylaxes carried out by auxiliaries.¹⁸ Can dentists in private practice not only be convinced of the necessity to provide more frequent prophylaxes than is customary at present, but will they also hire sufficient numbers of auxiliaries to allow these services to be provided economically? Indeed, in the current economic recession when many dentists are concerned about a shortage of patients, will they be able to? There are even deeper implications for reorganization of dental care. For example, will the efforts to increase the frequency of prophylaxes for adults increase the pressure for development of independent contractual practice for hygienists, or even independent practice?

In summary, this brief look at some of the economic considerations in preventive goals and activities in the years ahead has raised a number of issues which affect all in dentistry. The general economic picture is less than optimistic, but nevertheless presents fresh challenges. The epidemiological and demographic facts help show what must be done as well as the changing world to which we must adapt.

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Aspects of the Practical Significance of Current Public Health Methods for the Prevention of Caries and Periodontal Disease*

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INTRODUCTION

In tackling this topic I'm taking this approach: (1) briefly, I'll state my interpretation of practical significance; (2) then dispense quickly with preventive methods of low practical value; (3) the practical significance of the principal dental public health methods of prevention will be stated; (4) the problem of ascribing some degree of practicality to specific public health methods when several factors are involved will be discussed; (5) consideration will be given to some precautions in assessing the effects of these procedures; and, finally, (6) implications of changing circumstances for preventive efforts that suggest altered approaches will be outlined.

PRACTICAL SIGNIFICANCE

Public health programs for the prevention of dental disease must not only demonstrate effectiveness and reasonable costs, but also must prove to be of "practical significance." Now the term "practical significance" may be interpreted differently by many and lead to differing expectations of what this topic includes. The subject will not be approached from the viewpoint that the practical significance of preventive programs is the extent to which prevention of dental disease has implications for the improved general health and well-being of the population and then attempt to derive some degree of practical benefit to specific preventive programs. One might wish that there were more solid links between poor oral health and various general health conditions in the hope of stimulating behavior that is compatible with good oral health. The state of the art is too limited to declare that groups of people who maintain natural dentitions are in fact any healthier or happier than those who lose their teeth, or that groups of people with an average of only five restorations are in any measurable way "better off" than groups with two missing teeth and 10 restorations. Thus, as used in this discussion, practical significance means

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