

Commentary

The Common Risk Factor Approach: a rational basis for promoting oral health

Aubrey Sheiham and
Richard Geddie Watt

Department of Epidemiology and Public Health, University College London, London, UK

Sheiham A, Watt RG: The Common Risk Factor Approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol* 2000; 28: 399–406.

© Munksgaard, 2000

Abstract – Conventional oral health education is not effective nor efficient. Many oral health programmes are developed and implemented in isolation from other health programmes. This often leads, at best to a duplication of effort, or worse, conflicting messages being delivered to the public. In addition, oral health programmes tend to concentrate on individual behaviour change and largely ignore the influence of socio-political factors as the key determinants of health. Based upon the general principles of health promotion this paper presents a rationale for an alternative approach for oral health policy. The common risk factor approach addresses risk factors common to many chronic conditions within the context of the wider socio-environmental milieu. Oral health is determined by diet, hygiene, smoking, alcohol use, stress and trauma. As these causes are common to a number of other chronic diseases, adopting a collaborative approach is more rational than one that is disease specific. The common risk factor approach can be implemented in a variety of ways. Food policy development and the Health Promoting Schools initiative are used as examples of effective ways of promoting oral health.

Key words: health promotion; oral health policy; risk factors

Aubrey Sheiham, Department of Epidemiology and Public Health, University College London Medical School, 1–19 Torrington Place, London WC1E 6BT, UK
Tel: 0207 391 1700
e-mail: a.sheiham@ucl.ac.uk

Submitted 1 November 1999; accepted 29 February 2000

This paper addresses the pressing question of which oral health promotion and preventive approaches dental workers should adopt. The question is particularly important for a number of reasons. In an era of evidence-based health care, there are valid reasons for questioning the effectiveness of current health education methods (1,2) and where it has been effective oral health education can increase oral health inequalities (3). Another reason for reassessing which approaches to use is that resources for oral health promotion are scarce in industrialised and underdeveloped countries. The methods which are being used are not only relatively ineffective, but expensive in terms of money and human resources. In addition, oral health interventions frequently duplicate, conflict with and are inconsistent with existing general preventive programmes implemented by other health professionals (4). The public is therefore increasing-

ly becoming sceptical and weary of health messages (5). The most important reason for questioning what is currently being done is that many oral health strategies are theoretically flawed (6). The strategies are based upon questionable concepts of what causes change in oral health related behaviours.

In contrast to the approaches used in oral health, the dominant theory about health and disease, is that health is mainly determined by socio-political factors (7–10). Avoiding the need for developing effective social policies for health in favour of a concentration on problems of individual health related behaviour is not only an oversimplification, but an evasion of responsibility. Concentration on lifestyle often obscures broader determinants of health. This criticism of the emphasis on individual lifestyle as a cause and solution of health problems is particularly relevant to dentistry (11). The main focus of

most oral health policy is on individual behaviour change. Such an approach diverts attention away from the underlying determinants of oral diseases.

Limitations of the lifestyle approach

Lifestyle is frequently considered a consciously chosen personal behaviour. Others interpret lifestyle as an expression of the social and cultural circumstances that condition and constrain behaviour, in addition to the personal decisions the individual may make (12). But apparently simple acts are enmeshed in more complex lifetime habits and social circumstances associated with lifestyle (13). Living conditions affect how lifestyles are sustained (14,15). Indeed Blane (1985) argues convincingly that the causative role of individual behaviours have been exaggerated. They should be seen "... as indicators of other factors which are more straightforwardly related to the social structure, and which are the true aetiological agents" (14). The importance of social structure is evidenced by the universal finding, in all societies, that mortality and morbidity follow a gradient. Health inequalities are not found only between the rich and poor, or between 'the deprived' and everyone else (16). Those in the higher ranks are healthier than those below them. The gradient has been stable over time despite changes in average income levels and life expectancy. More importantly, the gradient is continuous and does not have a threshold. It stretches up the social scale (17). People in the top stratum are healthier than those just below them, even though the latter are often of the same social class and have similar levels of education and income as the top group. Those in the second rung are in turn healthier than those just below them and so on, all the way down the employment hierarchy. What is more the gradient exists for most kinds of ill health and causes of death (18).

The universality of a social gradient in health and health behaviours suggests that health related behaviours are not a simple matter of free choice but significantly determined by the social environment in which people live and work. Those who study the details of lifestyle call for individuals to assume greater responsibility for their oral health. There are serious problems in modifying some behaviours to effect changes in lifestyles without tackling the larger and more pervasive socio-economic changes that are the preconditions for change. The Multiple Risk Factor Intervention Trial (MRFIT) showed that lifestyle behaviours were

problems related to the social and cultural milieu rather than problems of the individual (19,20). In MRFIT, optimal conditions existed for lifestyle change. Yet most of the highly selected subjects specifically chosen for their motivation were able to make only minimal changes in their eating and smoking behaviours over a six-year period. The methods used in the MRFIT were based upon the best current research on behaviour change. However failure to markedly change important health related behaviours by these conventional methods should be a warning bell to dental health educators.

Funding agencies are unlikely to support approaches to change aspects of behaviours specifically related to oral health. The agencies are more concerned with broad health promotion strategies focusing on reducing heart disease, hypertension, cancer, obesity, injuries and suicide. As will be demonstrated later in this paper, oral health problems have risk factors in common with a number of important chronic diseases and conditions such as cardiovascular disease, cancers and injuries. It is wasteful to target each disease separately when they have similar origins. Therefore a strong reason for alliances with other sectors involved in health promotion is to avoid duplication, increase effectiveness and efficiency and reduce isolation. Another reason is that the populations with the greatest burdens of *all* diseases are the deprived and socially excluded.

The solutions to the chronic disease problems are shared solutions. The strategies to mitigate the above mentioned problems are incorporated in the Ottawa Charter for Health Promotion (21). Community action and support, environmental change, legislation, improving personal skills, and empowering people to become stakeholders in society and collectively challenge the structures which determine their health. Significant control of dental diseases can mainly be achieved in terms of social policy. The task of oral health workers is to convince policy makers and society to undertake the specific social measures which are required to solve general and oral health problems, and to participate in the implementation of these policies.

The determinants of chronic diseases

Health promotion is directed at the underlying determinants, as well as the immediate causes of ill health (21). The immediate causes of the major dental diseases, caries and periodontal disease are diet,

plaque and smoking. Oral mucosal lesions, oral cancer, temporomandibular joint dysfunction and pain are related to tobacco, alcohol and stress and trauma to teeth and injuries (Fig. 1). As these causes are common to a number of other chronic diseases such as heart disease, cancer, and strokes, it is rational to use a common risk factor approach (22).

A common risk factor approach – an integrated approach

The key concept underlying the integrated common risk approach is that promoting general health by controlling a small number of risk factors may have a major impact on a large number of diseases at a lower cost, greater efficiency and effectiveness than disease specific approaches (23). Savings may be made by coordinating the work done by various specialist groups and organizations. Decision-makers and individuals will be more readily influenced by measures directed at preventing heart diseases, obesity, stroke, cancers, diabetes, as well as dental caries than if disease-specific recommendations are made alone.

One of the principles of health promotion is to focus on the whole population rather than on disease-specific at-risk groups (24). The new public health is no longer oriented to single diseases. Many community programmes have shifted from

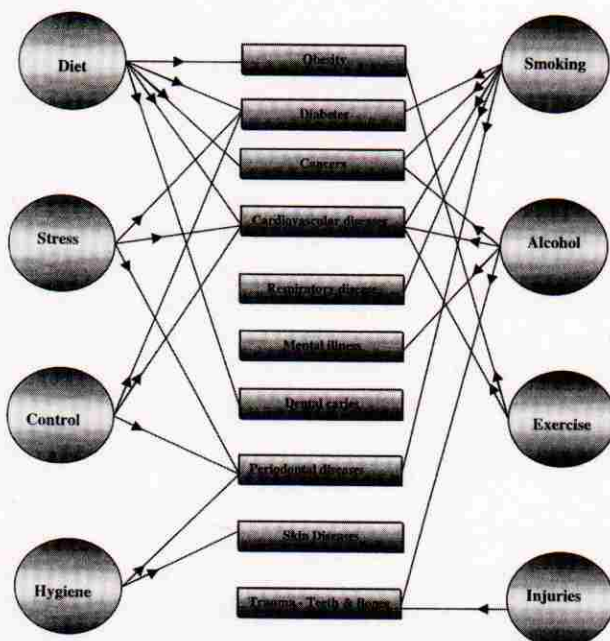


Fig. 1. The common risk factor approach.

vertical programmes towards a more horizontal approach, thus enlarging their scope to cover other non-communicable disease. There are basically two approaches for an equity oriented health policy. Focussing on actions to reduce specific diseases or on specific risk factors and public policies aimed at improving health conditions in general and among those at particular risk. The Common Risk/Health Factor Approach (CRHFA) distinguishes between actions aimed at reducing "risk factors" and actions promoting "health factors". The strategy includes efforts to improve health by reducing risks, promoting health and strengthening possibilities to cope with given risk factors – creating supportive environments, reducing the negative effects of certain risk factors and facilitating behaviour changes. A major benefit of the CRHFA is the focus on improving health conditions in general for the whole population and for groups at high risk. It thereby reduces social inequities.

Concepts of common risk factors must inform public health work and education. A number of chronic diseases such as heart disease, cancer, strokes, injuries and oral diseases have risk factors in common and many risk factors are relevant to more than one chronic disease. Such risk factor oriented strategies are more rational than those directed at specific diseases. Cardiovascular risk factors affect a number of diseases indicating that they have a much broader impact on health. Preventive strategies based upon CRFA will exert a favourable effect, not only on a single disease but simultaneously on several conditions (23).

Three approaches may be used based upon the epidemiology of common chronic diseases. Most chronic diseases have a multifactorial causation. Integrated action may be taken against a number of risk factors related to one or more diseases (23). Second, if one risk factor affects several diseases, the attack may be integrated across disease boundaries. The third approach overlaps with the first. Here some of the risk factors cluster in groups of people. Changing one of the factors may influence the others. For example, smoking, heavy drinking and poor diet tend to cluster in the same people. Changing their smoking behaviour may affect other behaviours.

The epidemiological basis for CRFA

The major risk factors for chronic diseases are smoking, diets high in saturated fats and sugars and low in fibre, fruit and vegetables, stress and

low control, alcohol, environmental hygiene, injuries and a sedentary lifestyle (25).

Diet

Many of the diseases which are increasing in industrialised and developing societies and are the main cause of premature morbidity and mortality are attributed at least in part to diet (26). Numerous expert committees have concluded that particular diets, namely those high in saturated fatty acids, non milk extrinsic sugars (NMES) and low in polysaturates, fibre and vitamins A, C and E are associated with conditions such as coronary heart disease, stroke, diabetes, cancers, obesity and dental caries (27–29).

Increasing scientific evidence from epidemiological, clinical and other relevant research has been accumulated to show that NMES are a causative factor in a range of diseases, especially dental caries. A considerable body of evidence has highlighted the key role of excessive NMES consumption on caries development (26, 27, 28, 30). A reduction in NMES intake is considered desirable in view of their cariogenicity, as well as other harmful effects on general health. Adverse health effects of excessive consumption of NMES are obesity, dental caries and diabetes. In an analysis of 115 expert committee reports which had formulated guidelines on diet and health from countries around the world, 97 recommended reductions in NMES to a maximum of 10% of energy intake (31), a target proposed by the World Health Organization (26).

Smoking

Smoking has been implicated in a large number of diseases. Smokers develop more cancers of the lung, mouth, throat, pancreas, kidney and urinary tract, coronary heart disease and stroke, respiratory diseases, diabetes and ulcers than do non-smokers. (32, 33). It is estimated that smoking causes about 30% of all cancer diseases and deaths and 90% of all lung cancers (33–35). Smokers also have more periodontal disease and other diseases of the oral mucosa (36–38).

Stress and control

It is well established that cardiovascular disease, diabetes mellitus and numerous other chronic diseases are related to sociopsychological factors (39–41). There is evidence linking stress to periodontal diseases and temporomandibular joint dysfunction (42,43). Life events are associated with

periodontal disease by affecting physiological processes and risk behaviours such as smoking and oral hygiene which increase susceptibility to periodontal diseases (44). Not only do some systemic diseases affect periodontal disease, but periodontal diseases may increase the risk of cardiovascular disease (45).

Alcohol

High alcohol consumption increases the risk of a wide variety of conditions such as raised blood pressure, liver cirrhosis, cardiovascular disease and cancers of the mouth, pharynx and oesophagus. Heavy long term use is also associated with mental illness, neurological disease and liver cancer. In addition, many social problems such as family violence, crime and injuries are linked with heavy alcohol use (46–48). Trauma to the head often includes fractures of the jaws and teeth.

Hygiene

Dirt causes inflammation of the skin and mucosa. Dental plaque is the main cause of gingivitis inflammation and periodontitis (49–51). The dental plaque bacteria and bacterial products in oral biofilms interact with the host, and lead to inflammation and tissue destruction. If left unchecked, the established gingival inflammation may, in some people, lead to periodontitis with loss of tooth support (51). Similarly, biofilms of bacteria on the skin, if not washed away, leads to pimples and more serious skin conditions.

Injuries

Injuries are responsible for many deaths in both developing and developed countries. Accidental injury is the most important cause of death among children and young people in the UK, Europe and USA (52). Injuries are also responsible for a large number of hospital admissions especially amongst the young and old. The prevalence of dental trauma amongst children and young people is significant and is largely related to injuries at home or school (53–55)

Exercise

Lack of physical exercise is a risk factor for a number of chronic diseases including coronary heart disease and obesity (56). In particular, exercise is related to overweight, which in turn affects insulin resistance, glucose tolerance and blood pressure. The syndrome is commonly referred to as the multiple metabolic syndrome (57).

Clustering of risk factors

Clustering is the co-occurrence of a number of characteristics in one individual. Overall risk factor patterns in populations include behavioural and demographic characteristics. The main risk factors for the major chronic diseases frequently cluster in the same individuals. Drinking and smoking commonly go together. People who smoke are more likely to eat a diet high in fats and sugars and low in fibre, polyunsaturated fatty acids, fruit and nutrient rich foods containing Vit A, C and E, take less exercise and drink more alcohol than non-smokers (58–60). Indeed the higher rate of cancer in smokers may be affected by their lower intake of nutrients with antioxidant properties (61) and their higher heart disease rates to lower intakes of polyunsaturated fatty acids (60). There was a positive relationship between smoking and sucrose (58, 62, 63). Non-smokers were more likely than smokers to take part in aerobics, jogging and swimming (64, 65).

The clustering of risk factors in individuals and groups, particularly those at the lower levels of the social gradient suggests that preventive approaches should be directed at clusters of risk factors common to a number of diseases and the social structures which influence individuals' health risks (66).

Policy Implications

A radical shift in the preventive approach to promote oral health is urgently needed. The isolated, compartmentalised and individualistically focused approach will never effectively promote oral health in all sections of the community. The common risk factor approach implemented through a comprehensive health promotion strategy based upon the principles of the Ottawa Charter is more likely to be effective than the present theoretically flawed methods (21,67). Table 1 outlines the key components of a health promotion strategic framework. By focusing action on the common underlying determinants of health, in partnership with a range of other agencies and the communities themselves, sustainable change will be achieved. Such an approach is dependent upon delivering a complementary range of strategies including health education, policy development, community action and legislation.

Examples of the CRFA in practice

Food policy

Caries levels amongst preschool children remain a public health problem in many parts of the world (68). Treatment services and conventional preven-

Table 1. Health promotion strategic framework

1. Focus upon common underlying determinants of health avoiding a victim blaming approach.
2. Community participation rather than professionally dominated activities.
3. Emphasis on addressing health inequalities to achieve sustainable improvements in oral health.
4. Working in partnership across sectors and disciplines.
5. Adopt range of complementary public health policies rather than individually focused health education.

Table 2. Food policy matrix

Partners Intervention	Producers	Processors	Manufacturers	Catering	Children & parents	Education and care staff	Local government	Health Services	National government
Education	✓	✓	✓	✓	✓	✓	✓	✓	✓
Substitution	✓		✓	✓			✓		
Pricing			✓	✓			✓		✓
Organisational policy				✓		✓	✓	✓	✓
Regulation	✓		✓	✓		✓	✓		✓
Community action					✓		✓		

Table 3. Prevention of injuries through Health Promoting Schools

1. Personal and social education aimed at developing life skills – focus upon conflict resolution, dealing with relationship problems and health skills in relation to the misuse of alcohol and drugs.
2. School policy on bullying and violence between students to create a supportive social environment within school.
3. Physical environment – play areas, sports fields all monitored for safety and security.
5. School health policy – resources and training for staff in first aide procedures.
6. Alcohol policy – restriction on alcohol consumption within school premises.
7. Provision of mouth guards – accessible and affordable sports protection.
8. Links with health services – procedures for emergency treatment established, screening programmes staff training and support in health issues.

tive programmes have had only a limited success in addressing this problem (69). Rather than focusing only upon caries prevention, an alternative approach is the development of a holistic nutrition programme which aims to improve the overall nutritional status of preschool children (70,71). Such an approach, if successful, will not only reduce NMES consumption and hence improve oral health but will also improve the overall quality of preschool childrens' diet and thereby promote their growth and future development.

The range of potential partners involved in a preschool health promotion nutrition programme is outlined in Table 2, together with the various actions that may be adopted. A wide range of sectors are involved in the food chain all of whom have a potential role. Rather than only focus attention on the consumers of food, this approach recognises the importance of influencing key groups from food producers, to manufacturers to government departments (72). Health education forms only one component part of the overall programme and can be targeted at a range of influential partners and professionals, not only the public. Other complementary actions can address cost and access issues in relation to food.

In Brazil food policies in state nurseries in a very deprived region have not only substantially reduced sugars consumption and improved the nutritional quality of the diet but have also successfully reduced caries increments over a one year period (73). Similar food policy guidelines have been introduced for residential homes for older people (74).

Health promoting schools

An emerging dental public health problem in many countries is trauma to teeth and jaws which is both expensive to treat and has a considerable impact on individuals quality of life (75). The causes of dentally related trauma in children is injuries at

school in relation to fighting, bullying and sports. The individualised approach to prevention of trauma to front teeth is to treat children with protruding teeth by orthodontics or encourage the use of gum guards. This approach has had a minor effect on preventing trauma.

The WHO Health Promoting Schools programme offers an alternative approach to tackling the problem of dental trauma amongst adolescents (76). Such an approach focuses upon the influence of the social and physical environment on health. The concept of the Health Promoting School places emphasis upon developing a range of complementary policies and actions to promote the health and well being of students, staff and the wider community involved in the school. A Health Promoting School can be characterised as a school constantly strengthening its capacity as a healthy setting for living, learning and working (76). In relation to injuries and the prevention of dental trauma a wide range of actions and policies are possible (Table 3). All these depend upon collaborative working between staff, students, parents, education authorities, local government and health professionals.

Conclusion

Further improvements in oral health and a reduction in oral health inequalities will only be secured through the adoption of oral health promotion policies based upon the common risk factor approach. Isolated individualistically focused oral health education interventions are ineffective, wasteful of limited resources and may increase inequalities. The CRFA addresses risk factors common to many chronic conditions within the context of the wider socio-environmental milieu. The potential benefits of such an approach are far greater than isolated interventions. Future research needs to evaluate the long term effects of this approach on oral health. To be effective in this style of working oral

health professionals need to develop a range of networking and communication skills to enable them to work collaboratively with other agencies and professionals.

References

1. Brown L. Research in dental health education and health promotion: a review of the literature. *Health Educ Quart* 1994;21:83-102.
2. Kay L, Locker D. Is dental health education effective? A systematic review of current evidence. *Community Dent Oral Epidemiol* 1996;24:231-5.
3. Schou L, Wight C. Does dental health education affect inequalities in dental health? *Community Dent Health* 1994;11:97-100.
4. Quick A, Sheiham H, Sheiham A. Sweet nothings – the information the public receives about sugar. London: The Health Education Council; 1980.
5. Sheiham A, Marmot M, Taylor B, Brown A. Recipes for health. In: Jowell R, Witherspoon S and Brook L, editors. *British Social Attitudes, The 1990/91 Report*. Aldershot: Gower; 1990. p.145-65.
6. Watt R, Fuller S. Oral health promotion – opportunity knocks! *Br Dent J* 1999;186:3-6.
7. MacIntyre S. The patterning of health by social position in contemporary Britain: directions for sociological research. *Soc Sci Med* 1986;23:393-415.
8. Krieger N. Epidemiology and the web of causation: has anyone seen the spider? *Soc Sci Med* 1994;39:887-903.
9. Blane D, Brunner E, Wilkinson R. Health and social organization. Towards a health policy for the 21st century. London: Routledge; 1996.
10. Wilkinson R. Unhealthy societies: the afflictions on inequality. London: Routledge; 1996.
11. Terris M. Epidemiology as a guide to health policy. *Ann Rev Public Health* 1980;1:323-44.
12. Green L, Kreuter M. Health promotion as a public health strategy for the 1990s. *Ann Rev Publ Health* 1990;11:319-34.
13. Graham H. Behaving well: women's health behaviour. In: Roberts H, editor. *Context in women's health counts*. London: Routledge; 1990.
14. Blane D. An assessment of the Black Report's 'explanations of health inequalities'. *Soc Health Illness* 1985;7: 423-45.
15. Davey Smith G, Bartley M, Blane D. The Black report on socioeconomic inequalities in health 10 years on. *Br Med J* 1990;301:373-7.
16. Acheson D. Independent inquiry into inequalities in health. London: Stationery Office; 1998.
17. Bartley M, Blane D, Davey Smith G. Beyond the Black Report. In: Bartley M, Blane D, Davey Smith G. editors. *The sociology of health inequalities*. Oxford: Blackwell; 1998. p. 1-16.
18. Marmot M. The social pattern of health and disease. In: Blane D, Brunner E, Wilkinson R, editors. *Health and social organization: towards a health policy for the 21st century*. London: Routledge; 1996. p. 42-67.
19. Multiple Risk Factor Intervention Trial Research Group. The multiple risk factor intervention trial risk factor changes and mortality results. *J Am Med Assoc* 1982; 248:1465-531.
20. Syme S. To prevent disease: the need for a new approach. In: Blane D, Brunner E, Wilkinson R. editors. *Health and social organization: towards a health policy for the 21st century*. London: Routledge; 1996. p. 21-31.
21. World Health Organization. The Ottawa charter for health promotion. *Health Promotion* 1. iii-v. Geneva: WHO; 1986.
22. World Health Organization. Risk factors and comprehensive control of chronic diseases. Report ICP/CVD 020(2), Geneva: WHO; 1980.
23. Grabauskas V. Integrated programme for community health in noncommunicable disease (Interhealth). In: Leparski E, editor. *The prevention of non-communicable diseases: experiences and prospects*. Copenhagen: WHO Regional Office for Europe; 1987. p. 285-310.
24. Rose G. *The Strategy of Preventive Medicine*. Oxford: Oxford University Press; 1993.
25. Dahlgren G, Diderichsen F. Strategies for equity in health: report from Sweden. *International Journal of Health Services* 1986;4:1-21.
26. World Health Organization. Diet, nutrition, and the prevention of chronic diseases. Report of a WHO Study Group. Technical Report Series No 797. Geneva: WHO; 1990.
27. National Advisory Council for Nutrition Education NACNE. *Proposals for nutritional guidelines for health education in Britain*. London: The Health Education Council; 1984.
28. Department of Health. Dietary sugars and human disease. Report of the Panel on Dietary Sugars of the Committee on Medical Aspects of Food Policy. Report No 37, London: HMSO; 1989.
29. Department of Health. Dietary reference values for food energy and nutrients for the United Kingdom. Report of the panel on dietary reference values of the committee on medical aspects of food policy. Report No 41. London: HMSO; 1991.
30. Loesche W. Dental caries: a treatable infection. Springfield: Charles C. Thomas; 1982.
31. Freire M, Cannon G, Sheiham A. Sugar and health: an analysis of the recommendations on sugars and health in one hundred and fifteen authoritative scientific reports on food, nutrition and public health published between 1961-1991. London: Joint Department of Dental Public Health London Hospital Medical College and University College London, Monograph Series No 1; 1992.
32. Royal College of Physicians of London. *Smoking or health?* London: Pitman Medical Publishing; 1977.
33. Peto R, Lopez A, Boreham J, Thun M, Health C, Doll R. Mortality from smoking worldwide. *Br Med Bull* 1996; 67:51-6.
34. Fielding J. Smoking: health effects and control. *N Eng J Med* 1985;313:491-8.
35. La Vecchia C, Boyle P, Franceschi S, Levi F, Maisonneuve P, Negri E, et al. Smoking and cancer with emphasis on Europe. *Eur J Cancer* 1991;27:94-104.
36. Salvi G, Lawrence H, Offenbacher S, Beck J. Influence of risk factors on the pathogenesis of periodontitis. *Periodontol* 2000 1997;14:173-201.
37. Gelskey S. Cigarette smoking and periodontitis: methodology to assess the strength of evidence in support of causation. *Community Dent Oral Epidemiol* 1999;27:16-24.
38. EU working group on tobacco and oral health. *Oral Dis* 1998;4:48-67.
39. Kessler R. Stress, social status and psychological distress. *J Health Sociol Behav* 1979;20:259-72.

40. Kune S. Stressful life events and cancer. *Epidemiology* 1993;4:395-6.
41. Marmot M, Wilkinson R. Social determinants of health. Oxford: Oxford University Press; 1999.
42. Monteiro da Silva A, Oakley D, Newman H, Nohl F, Lloyd H. Psychosocial factors and adult onset rapidly progressive periodontitis. *J Clin Periodontol* 1996;23:789-94.
43. Steed P. Etiological factors and temporomandibular treatment outcomes: the effects of trauma and psychological dysfunction. *Funct Orthod* 1997;14:17-20.
44. Croucher R, Marcenes W, Torress M, Hughes F, Sheiham A. The relationship between life events and periodontitis. A case control study. *J Clin Periodontol* 1997;24:39-43.
45. Beck J, Garcia R, Heiss G, Vokonas P, Offenbacher S. Periodontal disease and cardiovascular disease. *J Periodontol* 1996;67(Suppl):1123-37.
46. Department of Health. Sensible Drinking. The report of an inter-departmental working group. London: HMSO; 1995.
47. Ashworth M, Gerada C. ABC of mental health: addiction and dependence - II: Alcohol. *Br Med J* 1997;315:358-60.
48. Andreasson S, Brandt L. Mortality and morbidity related to alcohol. *Alcohol Alcohol* 1997;32:173-8.
49. Loe H, Theilade E, Jensen S. Experimental gingivitis in man. *J Periodontol* 1965;36:177-87.
50. Theilade E, Wright W, Jensen S, Loe H. Experimental gingivitis in man. II A longitudinal clinical and bacteriological investigation. *J Periodont Res* 1966;1:1-13.
51. Van Dyke T, Offenbacher S., Philstrom B., Putt M, Trummel C. What is gingivitis? Current understanding of prevention, treatment, measurement, pathogenesis and relation to periodontitis. *J Int Acad Periodontology* 1999;1:3-15.
52. Saving lives: our healthier nation. London: Stationery Office; 1999.
53. Andreason J, Ravn J. Epidemiology of traumatic dental injuries to primary and permanent teeth in a Danish population sample. *Int J Oral Surg* 1972;1:235-9.
54. Borssen A, Holm A. Traumatic dental injuries in a cohort of 16 year olds in northern Sweden. *Endo Dent Traumatol* 1997;13:276-80.
55. Marcenes W, Al Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9-12 year old schoolchildren in Damascus, Syria. *Endo Dent Traumatol* 1999;15:117-23.
56. Prentice A, Jebb S. Obesity in Britain: gluttony or sloth? *Br Med J* 1995;311:437-9.
57. Liese A, Mayer-Davis E, Haffner S. Development of the Multiple Metabolic Syndrome: an epidemiologic perspective. *Epidemiol Rev* 1998;20:157-72.
58. Fehily A, Phillips K, Yarnell W. Diet, smoking, social class, and body mass index in the Caerphilly heart disease study. *Am J Clin Nutr* 1984;40:827-33.
59. Gregory J, Foster K, Tyler H, Wiseman M. The dietary and nutritional survey of British adults. Office of Population Censuses and Surveys. London: HMSO; 1990.
60. Nuttens M, Romon M, Ruidavets J, Arveiler D, Ducimetiere P, Leclerc JM, et al. Relationship between smoking and diet: The MONICA-France project. *J Intern Med* 1992;231:349-56.
61. Cade J, Margetts B. Relationship between diet and smoking - Is the diet of smokers different? *J Epidemiol Community Health* 1991;45:270-2.
62. Paul O, MacMillan A, McKean H, Park H. Sucrose intake and coronary heart disease. *Lancet* 1968;ii:1049-54.
63. Bennett A, Doll R, Howell R. Sugar consumption and cigarette smoking. *Lancet* 1970;i:1011-4.
64. Whichelow M, Golding J, Treasure F. Comparison of some dietary habits of smokers and non-smokers. *Br J Addict* 1988;83:295-304.
65. Thompson D, Warburton D. Lifestyle differences between smokers, ex-smokers and non-smokers, and applications for their health. *Psychol Health* 1992;7:311-21.
66. MacIntyre S. The Black Report and beyond: what are the issues? *Soc Sci Med* 1997;44:723-45.
67. Watt R, Sheiham A. Inequalities in oral health: a review of the evidence and recommendations for action. *Brit Dent J* 1999;187:2-8.
68. Pitts N, Palmer J. The dental caries experience of 5-, 12- and 14-year old children in Great Britain. Surveys coordinated by the British Association for the Study of Community Dentistry in 1991/92, 1992/93 and 1990/91. *Community Dent Health* 1994;11:42-52.
69. Nadanovsky P, Sheiham A. The relative contribution of dental services to the changes and geographical variations in caries status of 5- and 12-year-old children in England and Wales in the 1980s. *Community Dental Health* 1994;11:215-23.
70. Caroline Walker Trust. Nutritional Guidelines for under 5's in child care: report of an expert working group. London: The Caroline Walker Trust; 1998.
71. Health Education Authority. Smiling for life. London: Health Education Authority; 1999.
72. Sanderson M. Strategies for implementing NACNE recommendations. *Lancet* 1984;ii:1352-6.
73. Rodrigues C, Watt R, Sheiham A. The effects of dietary guidelines on sugar intake in 3 year olds attending nurseries. *Health Promotion International* 1999;14:329-35.
74. Caroline Walker Trust. Eating well for older people: practical and nutritional guidelines for food in residential and nursing homes and for community meals. Report of an expert working group. London: Caroline Walker Trust; 1995.
75. Andreasen J, Andreasen F. Textbook and color atlas of traumatic injuries to the teeth. 3rd ed. Copenhagen: Munksgaard; 1994.
76. World Health Organization. Health Promoting Schools: a healthy setting for living, learning and working. Geneva: WHO; 1998.

