

Lifestyle and Oral health

Bharathi Purohit¹ Abhinav Singh^{1*}

1. Peoples College of Dental Sciences, Department of Public Health Dentistry, Peoples University, Bhopal, India

* E-mail of the corresponding author: bharathipurohit@yahoo.com

Abstract

The term 'lifestyle' is a diffuse concept often used to denote the way people live, reflecting a whole range of social values, attitudes and activities. Lifestyles are learnt through social interaction with parents, peer groups, friends and siblings and through school and mass media. Health requires the promotion of healthy lifestyle. Many current-day health problems especially in developing countries are associated with lifestyle changes. Behaviours such as smoking, physical exercise, activity in everyday life, alcohol consumption, diet, self-care practices, social contacts, and work-style are important contributing factors to population health status and variations in ill health with age. Lifestyle has been associated with oral health; specifically dental caries, periodontal disease, number of teeth and edentulousness. Several oral diseases are linked to noncommunicable chronic diseases primarily because of common risk factors. Worldwide strengthening of public health programmes through the implementation of effective measures for the prevention of oral disease and promotion of oral health is urgently needed. The challenges of improving oral health are particularly great in developing countries.

Keywords: Lifestyle and oral health, dental caries, periodontal disease, developing country

Introduction

The term 'lifestyle' is a diffuse concept often used to denote the way people live, reflecting a whole range of social values, attitudes and activities. It is composed of cultural and behavioral patterns and lifelong personal habits (e.g., physical activity, diet, smoking, alcoholism) that have developed through processes of socialization.

Lifestyles are learnt through social interaction with parents, peer groups, friends and siblings and through school and mass media. Health requires the promotion of healthy lifestyle. Many current-day health problems especially in the developed countries (e.g., coronary heart disease, obesity, lung cancer, drug addiction) are associated with lifestyle changes. In developing countries such as India where traditional lifestyles still persist, risks of illness and death are connected with lack of sanitation, poor nutrition, personal hygiene, elementary human habits, customs and cultural patterns.

It may be noted that not all lifestyle factors are harmful. There are many that can actually promote health. Examples include adequate nutrition, enough sleep, sufficient physical activity, etc. Health is both a consequence of an individual's lifestyle and a factor in determining it. Lifestyle, a concept describing value-laden, socially conditioned behavioral patterns, has a rich history of study in anthropology and sociology. Only recently has it taken on special significance in epidemiology and community health. With mid century shift from acute infectious diseases to chronic, degenerative diseases as the leading causes of death came a new perspective in epidemiology. No longer could the predominant diseases be controlled by the isolation and suppression of a single germ or agent. The causes of most chronic diseases tend to be multiple and elusive. They defy simple environmental control measures because they involve people's pleasures and comforts, their social relationships, and ultimately, for some, their habits and addictions.

Behaviours such as smoking, physical exercise, activity in everyday life, alcohol consumption, diet, self-care practices, social contacts, and work-style are important contributing factors to population health status and variations in ill health with age. The concept of prevention, like the concept of health, is a cultural and social construct. It will be increasingly important to locate prevention policies in the broad context of social and economic policy if current knowledge on the role of these health determinants is to be applied for the benefit of entire populations. Oral diseases are, to a notable extent, behavioral diseases. The concept of lifestyle makes it possible to study behavior in a broader sense.

Lifestyle as determinant of dental health behaviour

The studies have shown that lifestyle can be understood in many different ways. An individual health behavior

has been labeled as lifestyle on the one hand, while the most comprehensive lifestyle concept comprises more than only health behavior (Maas & Kuypers 1977, Aaro 1986). The indicators of lifestyle vary, but smoking, alcohol consumption, dietary habits and physical activity are the ones most commonly used. Even though health-related lifestyle comprises only one part of the overall lifestyle (Aaro 1986), the focus on health-oriented lifestyle is a rational approach for analysis (Abel 1991).

Health behaviors, such as smoking, alcohol consumption, dietary habits and physical activity individually or in combination are associated with general health. These components of lifestyle are also associated with dental health behaviors, and dental health behaviors can be understood as part of the lifestyle (Schou *et al.* 1990, Kuusela 1997).

Another approach to the concept of lifestyle is to use as indicators of lifestyle behaviors that are not so directly linked with the health outcome at hand. This approach to lifestyle emphasizes more on the effect of health orientation than the effect of an individual health behavior. Therefore, if oral health is the outcome variable to be analyzed, dental health behaviors do not fulfill this criterion so well as, for example, physical activity or regular breakfast. A lifestyle variable constructed from a larger set of behaviors will shed more light on health orientation than the previously used individual behaviors. This approach was supported by Locker *et al.* (1997). As lifestyle has been defined, it has a close relationship with the culture, and appropriate lifestyle indicators may vary in different countries (Abel 1991). An international agreement on standardized methods for measuring lifestyle is lacking. The items that measure lifestyle should be chosen according to the research purpose (Abel 1991).

Rutten (1995) demonstrated clearly how behavioral risks were commonly analysed in three different ways. In the first model behavioral risk factors (smoking, diet, alcohol, physical activity) simply caused disease. In such of analysis, no attention was given to the complex interrelationships which are integrated into these social behaviors. The second model was more advanced. It aimed to analyze the relative explanatory strength (i.e. the amount of variation explained) of specific behavioral risk factors on disease outcomes. The problem was almost the same as in the first model. There was one factor which was the most powerful, but the emphasis is again on one factor. The third model focused on complex interactions that constitute patterns of behavioral risk.

Payne & Locker (1996) studied the interrelationships of a number of general and dental health behaviors in 1,050 adult Canadians. They created additive indices for both oral and general health behaviors. They defined optimal oral health behavior as consisting of the following activities: visiting a dentist at least once a year for an examination rather than a dental problem; at least daily tooth brushing; flossing daily; using an interdental device, such as a wooden toothpick, special brush or rubber tip, once or more per day; no snacking between meals; and consuming no more than one cariogenic food a day.

Optimal general health behaviors were defined as follows: not smoking; consuming fewer than ten alcoholic drinks per week if male, and fewer than five if female; always wearing a seatbelt in a car whether a driver or a passenger; and participating at least three times weekly in an exercise activity, such as brisk walking, aerobics, sports, or heavy housework.

Each optimal practice scored one point, and indices were created by counting the number of optimal behaviors for both general and oral health behaviors separately and a third additive index for the two behaviors. There was a significant, although weak, correlation between oral and general health behavior. The oral health behavior of females, older respondents, and those with higher incomes was superior to that of the others.

General health and within it, dental health reflect individual health habits and general health behavior in many ways. Changes in life and the dynamics of living can affect oral health habits and consequently dental health. Tinanoff (1995) combined biological, social, and psychological variables into a risk model and obtained more clinically relevant results than did researchers utilizing models with single factors. Dental diseases are connected to lifestyles, and multiple risk factors may affect dental health habits and dental health. The foundation of adult oral health is laid down during the formative pre-school years, during which a child's dental caries risk are established (Johnsen, 1995).

It is generally understood that the teeth of pre-school children are healthy, but the improvement in the dmft index has halted in the industrialized countries. Those few children who have caries have more of it than before. For children under five years of age, family members are expected to be in charge of their dietary habits, tooth brushing, and consequently their dental health and the personal dental behaviors of the older family members are highly visible to those under five years of age.

It has been proposed that the risk of adverse health (such as diabetes, cardiovascular disease, and

osteoporosis) in middle age may be 'programmed' by impaired development in utero (Barker, 2003). However, experiences in infancy, childhood and adulthood may also determine adult health, independently of fetal life (Gliksman et al., 1995; Davey Smith et al., 1998). The risk of poor oral health in adulthood has been linked to Socio-economic status in childhood (Poulton et al., 2002).

Researchers are occupied by the question of dimensionality of health behaviors (Rise *et al.* 1991). Unidimensionality of health behaviors implies that an individual with one good habit would act similarly with respect to all health-related behaviors (Patterson *et al.* 1994). However, there is notable consensus that dental health behaviors are multidimensional (Steele & McBroom 1972, Langlie 1979, Holund & Rise 1988) and that individuals have different motives for their behaviors (Williams & Wechsler 1972, Langlie 1979).

Rajala *et al.* (1980) found that the frequency of toothbrushing correlated negatively with sugar consumption among 13-19 year-old adolescents (n=3,209). Physical activity was positively related to toothbrushing, while alcohol consumption and smoking correlated negatively. Furthermore, health habits in general seemed to be polarized according to lifestyles which enervate or invigorate.

Nutbeam *et al.* (1989) found that good oral hygiene habits correlated with healthy food consumption, use of vitamins and regular physical activity among adolescents. Schou *et al.* (1990) studied tooth brushing frequency and its relation to lifestyle factors among 4,935 Scottish school children. The associations of different behaviors (regular breakfast, frequency of eating sweets, fruit consumption, smoking, frequency of getting drunk, bedtime, weekly video watching) with tooth brushing frequency were analyzed separately. Each of these lifestyle factors was associated with tooth brushing. The authors concluded that tooth brushing was not an isolated behavior but part of a child's lifestyle.

In Finland, dental caries was found to be more common among people who used sugar in their coffee or tea. Tooth brushing frequency was correlated negatively with dental caries. Those who brushed twice a day had less deep periodontal pockets than those who brushed less often. Those who used dental services regularly had less dental caries and better periodontal health than those who did not use such services regularly. (Social Insurance Institution 1991)

Mattila ML *et al.* (2000) examined the prevalence of dental caries in five-year-old children and its association with family-related factors in Finland. The predictive value of sociodemographic and family-related factors and of dental care habits was of particular focus in this study, which was a part of the Finnish Family Competence Study launched in 1985. The study sample consisted of 1443 mothers expecting their first child who completed their questionnaire during their first visit to the maternity health care clinic usually in the tenth week of pregnancy and the children were similarly followed regularly at the well-baby clinic until the child was five years of age. During pregnancy, questions were asked about the parents' lifestyles, health habits, and sociodemographic backgrounds. At the well-baby clinics, questions were asked about dental health habits, living conditions and the children's nutrition and eating habits.

In firstborn five-year-old children, dental health was found to be good in 72%, fair in 20% and poor in 8% of the cases. The final multivariate analysis illustrated that the dmft index > 0 was independently associated with the mother's irregular tooth brushing (OR 2.2; 95% CI 1.4-3.5), annual occurrence of several carious teeth in the father (OR 2.6; 95% CI 1.9-3.6), daily sugar consumption at the age of 18 months (OR 2.4; 95% CI 1.4-4.1), occurrence of child's headaches (OR 3.7; 95% CI 1.5-8.8), parents' cohabitation (OR 3.3; 95% CI 1.5-7.6), rural domicile (OR 2.4; 95% CI 1.2-4.5), and mother's young age (OR 5.0; 95% CI 1.3-19.8). The findings of the study illustrated that parents' dental hygiene habits, together with their educational backgrounds and/or child-rearing skills, were important in their children's dental health. The significance of father's poor dental health and the unfavorable effects of giving sweets must be recognized. Early prevention of caries was the key to a receptive, co-operative child regarding oral health in later years (Johnsen, 1995) and the parents should be made to realize that they are role models for their children. The authors concluded that the kind of preventive dentistry which concentrates on the oral health of the child was inadequate and that attention must be focused on the whole family, its dental health habits, and lifestyles.

Health-compromising behaviors are typical of adolescents who are not going to acquire extensive education, while health-enhancing behaviors are common among those striving for high education levels and improved socio-economic status (West, 1991; Neumark-Sztainer *et al.*, 1996; Koivusilta *et al.*, 1998). Neglecting dental health care may be connected with a wider complex of problems in adolescent lifestyles.

The influence of lifestyle factors on dental visiting habits was studied among 1,009 adolescents in Scotland (Attwood *et al.* 1993). Non-smokers were more likely than smokers to have visited a dentist within the last six

months and more likely to visit regularly, while no relationship was found between physical exercise and dental visiting behaviors. Smoking seemed to be a component of a broader concept of lifestyle.

Women had healthier lifestyle than men and people with higher socioeconomic status had healthier lifestyle than those with lower socioeconomic status (Wiley & Camacho 1980, Aro *et al.* 1986, Blaxter 1990, Prattala *et al.* 1994). Not all dental health behaviors were equally closely related to the general lifestyle. Tooth brushing frequency and the use of extra cleaning methods were related to the general lifestyle. This should be borne in mind by dentists trying to motivate and instruct about oral hygiene their adult patients. It is possible that a remarkable improvement in oral cleaning habits is difficult to achieve if the general lifestyle is unhealthy. The possibility of changing the behavior of an adult differs from that of a child, whose socialization process of the habits are incomplete. Tooth brushing frequency was related to lifestyle in both males and females, but the gender difference was not explained completely by the differences in lifestyle. Women have better health knowledge and are better prepared to act to improve their health (Woodward *et al.* 1994). Ronis *et al.* (1993) suggest that the higher brushing frequency of women may be due to the greater social pressure to be attractive. Health is not the only motivation for tooth brushing. The use of extra cleaning methods seems to be more closely related to a health orientation among both males and females, because only lifestyle was significantly associated with it. Extra cleaning methods are used for health reasons rather than aesthetic ones.

The use of sugar and the dental visiting habits were not determined by lifestyle. Boys and children from homes with low social status consumed more sugar than others (Honkala *et al.* 1982). The lack of a relationship between lifestyle and sugar consumption is understandable, because the good taste may override the known health risk of sugar (Freeman 1984).

Among adolescents, the dental visiting habit was related to smoking but not to physical activity (Attwood 1993). Smoking had an independent effect on the dental visiting habit when gender, social class, the parental dental visiting and smoking habits were taken into account. Smoking actually explained the social class difference. These results may be due to the fact that the parents' social class does not affect the adolescents' dental visiting pattern, but one's own social class in adulthood does, because one is responsible for the cost of the visit.

Study by Chen's (1983) found that the dental visiting habit seemed to be related to occupational status and lifestyle had a lesser impact. Osterberg *et al.* (1998) found that smoking and low physical activity were associated with the utilization of dental services in the middle-aged and elderly Swedish population. However, socioeconomic factors had a more significant association with the dental visiting habit than these lifestyle factors. Dental visits compared to other dental activities appeared to be more easily influenced by socioeconomic variables (Chen 1983). The influence of occupational status is not only economic.

Occupational status is related to attitudes and values as well. When lifestyle was used, these other factors, which are linked occupational status, could be controlled, and only the economic influences of occupational status remained. Occupational status was therefore related to the dental visiting habit but not to the oral cleaning habits. According to a study of adolescents (Attwood 1993) females visited the dentist more frequently than males. Dental visiting is not a preventive health-promoting habit, but may depend more on the subjective need for treatment (Steele *et al.* 1996), and women may seek help more easily than men (Verbrugge, 1984).

Norlen (1996) found lifestyle to consist of separate factors that can biologically influence oral health. Women with a high intake of energy had more decayed tooth surfaces than others and edentulous subjects had a higher intake of fat than dentate ones (Norlen *et al.* 1993). Edentulous women and women with removable dentures consumed more coffee than those with many (>20) remaining teeth. Among females, current smokers had higher DMFS-values than never-smokers and ex-smokers, but there was no difference with respect to the number of teeth (Norlen *et al.* 1993). Among dentate males, higher coffee and alcohol consumption and smoking were related to a lower number of teeth (Norlen *et al.* 1996).

Petersen and Nortov (1989) constructed their lifestyle variable emphasizing the comprehensive nature of lifestyle. They measured lifestyle activity by inquiring how often 67-year-old Danes (n=216) participated in social, cultural and other spare time activities (watching TV, listening to radio/music, reading, attending meetings, sporting activities, excursions by car/bicycle, walking, visiting restaurants, going to the cinema/theater/concerts/exhibitions, enjoying nature, attending educational programs for adults, visiting day center/club for the elderly).

Using these items, they constructed an additive index where scoring varied from 6 to 51. This scale was further categorized into four classes: very low, low, moderate and high lifestyle activity. People with a less

active lifestyle had more symptoms in their teeth and gums and were generally less healthy as well. Regular dental visits were more common among the subjects with high lifestyle activity.

The studies have shown that lifestyle can be understood in many different ways. An individual health behavior has been labeled as lifestyle on the one hand, while the most comprehensive lifestyle concept comprises more than only health behavior (Maas & Kuypers 1977, Aaro 1986). Therefore, if oral health is the outcome variable to be analyzed, dental health behaviors do not fulfill this criterion so well as, for example, physical activity or regular breakfast. A lifestyle variable constructed from a larger set of behaviors will shed more light on health orientation than the previously used individual behaviors. This approach was supported most recently by Locker *et al.* (1997).

Association of lifestyle with dental caries and periodontal pocket

Unhealthy lifestyle is associated with a higher prevalence of dental caries and periodontal pocketing. This is in agreement with the study by Locker *et al.* (1997) and the earlier finding that active lifestyle is associated with fewer symptoms in teeth and gums (Petersen & Nortov 1989).

It has been found previously that females have less dental caries and periodontal attachment loss than males, and people with higher socioeconomic status have less of these conditions than those with lower status (Sheiham 1970, Bellini & Gjermo 1973, Hansen 1977, King *et al.* 1983, Halling & Bjorn 1987, Oliver *et al.* 1991, Publications of the Social Insurance Institution 1991, Micheelis & Bauch 1996).

Lifestyle, number of teeth and edentulousness

The association of lifestyle with dental caries and periodontal health suggests that an unhealthy lifestyle may decrease the number of teeth as well. However, the reasons for tooth loss are difficult to capture in epidemiological surveys, because tooth loss is a complex outcome of decisions made by dentists and patients (Locker *et al.* 1996).

Thus, it seems that the significantly lower mean number of teeth among people with lower socioeconomic status is not so strongly related to more active disease among them than it is to treatment alternatives used to treat the teeth. Extractions have been found to be more common among people with lower than higher occupational status (Nyman 1990). Osterberg *et al.* (1995), found that smoking, low physical activity and low social activity predicted edentulousness in the Nordic countries. Furthermore, smoking was a stronger predictor of edentulousness among men than among women. However, Takala *et al.* (1994) found that although Finnish women have a higher prevalence of edentulousness than Finnish men, the incidence rate of edentulousness is lower among women.

Life course approach and oral health

When assessing the effects of factors operating at different stages of an individual's life on ones risk of adult disease, one should use information from across the whole life course (Kuh and Ben Shlomo, 1997). Such investigations assessing which stages of life are of most importance to an individual's oral health may give an overall context for assessing oral disease risks and planning prevention that cannot be achieved by other methodologies.

The Newcastle Thousand Families cohort, consisted of all 1142 children born in May and June, 1947, to mothers resident within the city of Newcastle upon Tyne, provides an opportunity to apply a life course approach to oral health. Two-thirds of these children were followed up until the age of 15 yrs (in 1962), with detailed information collected on their health, growth, and socio-economic circumstances (Lamont *et al.*, 1998).

Pearce MS *et al.* (2004) conducted a study to investigate the relative impacts of risk factors operating at different stages throughout life on the number of teeth retained at ages 49-51 yrs based on data from the Newcastle Thousand Families cohort. Very little variation in tooth retention in middle age was explained by factors operating at earlier stages in life. The previously noted relationship between childhood socio-economic status and oral health in adulthood appeared, with respect to tooth retention, to diminish with increasing age as adult socioeconomic position and lifestyle factors had an increasing effect. In both men and women, no factors acting at birth or during childhood showed a significant independent relationship with the number of retained teeth. An increased number of pack-years of cigarettes smoked was significantly associated with a lower number of retained teeth at age 50 yrs in both men and women, and remained so after adjustment for all other covariates ($p < 0.001$). Alcohol consumption and socio-economic status at age 50 yrs were also significant predictors of the number of retained teeth in women. The number of retained teeth increased with increasing category of self-reported alcohol consumption (p for trend, 0.01) and with increasingly advantaged socioeconomic status (p for

trend, 0.001). Socio-economic status during childhood was a significant predictor of the number of teeth retained by the women in this study ($p = 0.008$). However, after adjustment for adult socioeconomic status, the effect of childhood socio-economic status was no longer significant ($p = 0.25$). No other adult lifestyle variable was significantly related to the number of retained teeth in either men or women. Thus in this study, in both men and women, factors acting during adult life accounted for the majority of the explained proportion of variation in the number of teeth at age 50 yrs. Relatively little of the explained variation in oral health in middle age was accounted for by factors operating at earlier stages in life. The finding that adult lifestyle was the most important determinant of tooth retention was consistent with reports from other studies where data from the Thousand Families cohort were used to explore adult health and disease. The author quotes that, analysis of the data from the cohort had demonstrated that adult lifestyle and biological risk markers appeared to play the most important role in predicting cardiovascular disease (Lamont et al., 1998) and hyperinsulinemia, dyslipidemia, and obesity (Parker et al., 2003). To conclude authors said that promotion of a healthier adult lifestyle and continued improvements in oral hygiene throughout the whole lifecourse appeared to be the public health interventions most likely to increase tooth retention in middle age.

Sanders AE et al (2005) conducted a study to examine the associations between childhood familial conditions with the oral health status in adulthood, and to investigate the role of psychosocial attributes as potential mechanisms by which risk might be conveyed from childhood to adulthood. Study was conducted on 3678 dentate adults aged 18-91 years using short-form of Oral Health Impact Profile (OHIP-14). Childhood familial conditions included socioeconomic status assessed by paternal occupation group, family structure and quality of rearing. Middle childhood, the development stage extending from 6 to 12 years, was selected as reference stage and adults were asked to recall different familial characteristics in childhood at the age of 10 years. This index age was also used in Dutch globe study (1999) and the Kuopio Ischaemic Heart Disease Risk Factor Study (2002).

Psychosocial factors, in adulthood, of sense of control, perceived stress and satisfaction with life were assessed with standard scales and also, social support was evaluated. Results showed that parenting rearing style was significantly associated with OHIP-14 scores ($P < 0.001$) after controlling for gender, age and household income in adulthood. Adults who were reared supportively had more favorable scores on all current psychosocial attributes ($P < 0.001$) and reported that oral conditions disrupted their quality of life less often while adults with higher OHIP-14 scores had significantly higher levels of stress. Also, higher parental occupation was associated with a lower perception of stress in adulthood.

The study builds on substantial evidence that circumstances in childhood leave a lasting imprint on the individual. Authors found that retrospectively recalled childhood circumstances were related to psychosocial profile in adulthood and to varying degrees were also related to adult oral health status. Thus this has serious implications for timing and targeting of health promotion if the effects on oral health outcome of childhood exposures are irreversible.

Association of lifestyle with denture stomatitis

Lifestyle and oral hygiene were not associated with the occurrence of yeasts in saliva; biological factors seem to have a greater impact on the presence of yeasts in saliva than behavioral ones. The effect of smoking seems to be biological, because smoking has an effect on the occurrence of yeasts, which is independent of oral status or oral hygiene. The occurrence of yeasts seemed to be strongly associated with the secretion rate of unstimulated saliva and tobacco smoking.

The studies concerning the association between oral health and general health have recently emphasized the connection with cardiovascular diseases. Investigations by Johansson *et al.* (1994) showed that edentulous middle-aged individuals were more obese, had lower serum HDL-cholesterol concentrations, had less healthy dietary habits and were more often regular smokers than those with remaining teeth. Adolescents with high caries scores have more often had risk factors for cardiovascular diseases (Larsson *et al.* 1995).

Oral infections have been proposed to be risk factors for cardiovascular diseases (Mattila *et al.* 1993, Mattila *et al.* 1995, Joshipura *et al.* 1996). Loesche & Lopatin (1998) presented four different hypotheses that explain the interaction between dental and medical health. The absence of teeth results in a change in food choices and in eating habits. This can lead to either malnourishment or over-nourishment, which both may promote the development of cardiovascular diseases (the nutrition hypothesis).

The presence of poor oral hygiene and diseased teeth may lead to increased invasion of plaque bacteria into the bloodstream, and consequently, increased antibody production and a nonspecific increase in white blood

cells and fibrinogen levels. These may place the subject at risk of heart disease (chronic infection hypothesis).

S. sanguis is able to induce platelet aggregation in plasma (Herzberg & Meyer 1996). If these bacteria gain access to the bloodstream as a result of poor oral hygiene, the host may be at risk for myocardial infarction or cerebrovascular accident (platelet aggregation-associated protein and heat shock protein hypothesis). Individuals who do not take care of their body, but overeat, smoke and drink, are not likely to take care of their teeth (lifestyle hypothesis). It is possible that the studies that have established smoking as a risk factor for cardiovascular disease have indirectly measured tooth loss and periodontal disease, which may cause cardiovascular disease.

Conclusion

Several oral diseases are linked to noncommunicable chronic diseases primarily because of common risk factors. Worldwide strengthening of public health programmes through the implementation of effective measures for the prevention of oral disease and promotion of oral health is urgently needed. The challenges of improving oral health are particularly great in developing countries. The entire burden for improved health must not be placed on the individual alone. The responsibility must be shared between individuals and their families, between families and their communities; and between communities and their state, provincial, and national governments. Each level of organizational influence on behavior must assume some responsibility for setting the economic and environmental conditions that will support healthful lifestyles. In short, the achievement of optimum health demands adoption of healthy lifestyles.

References

- Aaro L (1986) Health behavior and socioeconomic status. A survey among the adult population in Norway.
- Abel T (1991) Measuring health lifestyles in a comparative analysis. Theoretical issues and empirical findings. *Soc Sci Med* 32:899-908.
- Attwood D, West P & Blinkhorn AS (1993) Factors associated with dental visiting habits of adolescents in the west of Scotland. *Community Dental Health* 10:365-373.
- Blaxter M (1990) *Health and lifestyle*. London: Routledge
- Bellini HT & Gjermo P (1973) Application of the Periodontal Treatment Need System (PTNS) in a group of Norwegian industrial employees. *Community Dent. Oral Epidemiol.* 1:22-29.
- Freeman RE (1984) Understanding and predicting sugar consumption in adolescents. Factors affecting choice intention. Msc Report, London Hospital Medical College.
- Hansen BF (1977) Caries experience in a Norwegian urban population. *Community Dent Oral Epidemiol* 5:132-135.
- Halling A & Bjorn AL (1987) Periodontal status in relation to education and dental attendance. A 12-year longitudinal and cross-sectional study of a random sample of dentate middle-aged women in Gothenburg. *Swed Dent J* 11:135-145.
- Herzberg MC & Meyer MW (1996) Effects of oral flora on platelets: possible consequences in cardiovascular diseases. *J Periodontol* 67:1138-1142.
- Holund U & Rise J (1988) Dimensions of dietary and other health-related behaviors in a group of Danish adolescents. *Community Dent Oral Epidemiol* 16:278-281.
- Honkala E, Nyyssonen V, Knuutila M & Markkanen H (1986) Effectiveness of children's habitual toothbrushing. *J Clin Periodontol* 13:81-85.
- Johansson I, Tidehag P, Lundberg V & Hallmans G (1994) Dental status, diet and cardiovascular risk factors in middle-aged people in northern Sweden. *Community Dent Oral Epidemiol* 22:431-436.
- Joshiyura KJ, Rimm EB, Douglass CW, Trichopoulos D, Ascherio A & Willet WC (1996) Poor oral health and coronary heart disease. *J Dent Res* 75:1631-1636.
- King JM, Pitter AFV & Edwards H (1983) Some social predictors of caries experience. *Br Dent J* 155:266-268.
- Kuusela S (1997) *Oral health behavior in adolescence*. University of Helsinki, Helsinki.

Locker D, Jokovic A & Payne B (1997) Life circumstances, lifestyles and oral health among older Canadians. *Community Dental Health* 14:214-220.

Langlie JK (1979) Interrelationships among preventive health behaviors: a test of competing hypothesis. *Public Health Rep* 3:216-225.

Lawrence W, Green BS, *Community Health*, 6th Edition, Times Mirror/Mosby College Publishing, USA (1990).

Loesche WJ & Lopatin DE (1998) Interactions between periodontal disease, medical diseases and immunity in the older individual. *Periodontology* 2000 16:80-105.

Maas HS & Kuypers JA (1977) *From thirty to seventy*. Jossey-Bass Publishers, San Francisco.

Mattila KJ, Valtonen VV, Nieminen M & Huttunen JK (1995) Dental infection and the risk of new coronary events: prospective study of patients with documented coronary artery disease. *Clin Infect Dis* 20:558-592.

Maas HS & Kuypers JA (1977) *From thirty to seventy*. Jossey-Bass Publishers, San Francisco.

Micheelis M & Bauch J (1996) Oral health of representative samples of Germans examined in 1989 and 1992. *Community Dent Oral Epidemiol* 24:62-67.

Mattila KJ, Valle MS, Nieminen MS, Valtonen VV & Hietaniemi KL (1993) Dental infections and coronary atherosclerosis. *Atherosclerosis* 103:205-211.

Mattila KJ, Valtonen VV, Nieminen M & Huttunen JK (1995) Dental infection and the risk of new coronary events: prospective study of patients with documented coronary artery disease. *Clin Infect Dis* 20:558-592.

Nyman K (1990) Dental status and dental care in Finland 1987. A nationwide evaluative survey of dental care and its development. *Publ Soc Insur Inst Finland M*:76. Helsinki.

Nutbeam D, Aaro L & Catford J (1989) Understanding childrens' health behaviour: The implications for health promotion for young people. *Soc Sci Med* 29:317-325.

Oliver DA, Brown LJ & Listgarten MA (1991) Variations in the prevalence and extent of periodontitis. *J Am Dent Soc* 122:43-48.

Petersen PE & Nortov B (1989) General and dental health in relation to life-style and social network activity among 67-year-old Danes. *Scand J Prim Health Care* 7:225-230.

Payne B & Locker D (1996) Relationship between dental and general health behaviors in a Canadian population. *J Public Health Dent* 56:198-204.

Patterson RE, Haines PS & Popkin BM (1994) Health lifestyle patterns of U.S. adults. *Prev Med* 23:453-460.

Park K. *Park's textbook of preventive and social medicine*. 19th Edition. M/s Banarsidas Bhanot Publishers, India (2007).

Prattala R, Karisto A & Berg M-A (1994) Consistency and variation in unhealthy behaviour among Finnish men, 1982-1990. *Soc Sci Med* 39:115-122.

Rajala M, Honkala E, Rimpelä M & Lammi S (1980) Toothbrushing in relation to other health habits in Finland. *Community Dent Oral Epidemiol* 8:391-395.

Rutten A (1995) The implementation of health promotion: A new structural perspective. *Soc Sci Med* 41:1627-1637.

Rise J, Wold B & Aaro LE (1991) Determinants of dental health behaviors in Nordic schoolchildren. *Community Dent Oral Epidemiol* 19:14-19.

Ronis DL, Lang WP & Passow MSW (1993) Tooth brushing, flossing, and preventive dental visits by Detroit-area residents in relation to demographic and socioeconomic factors. *J Public Health Dent* 53:138-145.

Steele JG & McBroom WH (1972) Conceptual and empirical dimensions of health behavior. *J Health Soc Behav* 12:383-392.

Schou L, Currie C & McQueen D (1990) Using a "lifestyle" perspective to understand toothbrushing behaviour in Scottish schoolchildren. *Community Dent Oral Epidemiol* 18:230-234.

Sheiham A (1970) Dental cleanliness and chronic periodontal disease. *Studies in populations in Britain Br Dent*

Takala L, Utriainen P & Alanen P (1994) Incidence of edentulousness, reasons for full clearance, and health status of teeth before extractions in rural Finland. *Community Dent Oral Epidemiol* 22:254-257.

Wiley JA & Camacho TC (1980) Life-style and future health: evidence from Alameda County Study *Prev Med* 9:1-21.

Williams AF & Wechsler H (1972) Interrelationships of preventive actions in health and other areas. *Health Serv Rep* 10:969-976.

Woodward M, Stat C, Bolton-Smith C & Tunstall-Pedoe H (1994) Deficient health knowledge, diet, and other lifestyles in smokers: Is a multifactorial approach required? *Prev Med* 23:354-361.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage:

<http://www.iiste.org>

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. **Prospective authors of IISTE journals can find the submission instruction on the following page:**

<http://www.iiste.org/Journals/>

The IISTE editorial team promises to review and publish all the qualified submissions in a fast manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

