

Oral Diseases And Other Systemic Conditions

Impact of oral diseases on general health and quality of life

Oral health means much more than beautiful teeth. It means freedom from chronic oral-facial pain, oral and throat cancers, oral soft tissue lesions, birth defects such as cleft lip and palate, and other diseases and disorders that affect the craniofacial complex. These are tissues whose functions are often taken for granted but are essential to the quality of our daily living. They allow us to speak, smile, sigh, and kiss; smell, taste, touch, chew, and swallow; cry out in pain; convey feelings and emotions through facial expressions; and do well at school and at work. They also provide protection against microbial infections and environmental insults. These functions can be applicable to the foods we choose to eat, our social interactions, our employment opportunities, and our self-esteem. [1]

Given the importance of the mouth and teeth in verbal and nonverbal communication, diseases that disrupt their functionality are likely to damage self-image and alter the ability to sustain and build social relationships and life satisfaction. [1] Poor oral health causes unnecessary pain and discomfort that can affect children's learning, concentration and performance at school, as well as their ability to thrive. [70, 71]

Adults can also suffer from poor oral health and fail to be productive at work. Many systemic diseases and conditions manifest themselves initially in the mouth. Therefore, early diagnosis by a dental professional can lead to early referral to the appropriate health professional.

Impact of oral diseases on systemic diseases

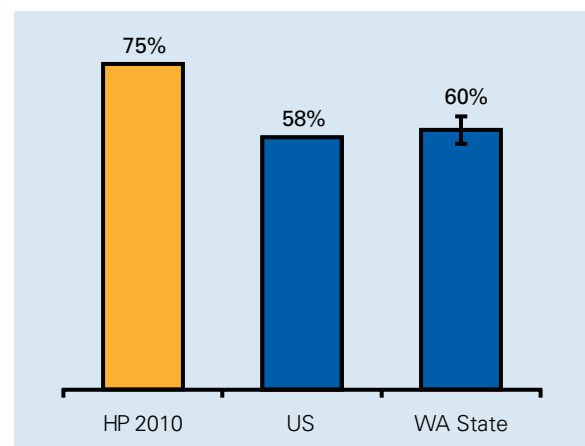
The mouth—the lungs, intestines, and genitourinary tract—are potential entry sites through which a multitude of bacteria may gain access to the body. [72] If a patient's general condition is weakened for any reason, normally harmless oral bacteria may become detrimental and initiate a local opportunistic infection or affect other parts of the body. [73, 74]

Several systemic diseases can result from infectious oral microbes, especially in patients with immunological and nutritional deficiencies, where oral microbes are granted systemic access. Therefore, the control of existing oral infections is clearly of great importance and a necessary precaution to prevent systemic complications. [75] More research is being conducted in this area.

Diabetes

Diabetes is a serious disease with considerable economic costs for individuals and health systems. Its incidence is increasing because of rising rates of obesity and the aging of the population. [76] The two-way relationship between diabetes and oral health has been widely studied. Given their compromised ability to respond to infections,

Figure 47: Adults with diabetes who had an oral exam last year, BRFSS 2004.



people with diabetes are more susceptible to periodontal disease [75, 77, 78] and have an earlier onset of severe periodontal disease than do non-diabetics. [79-81] Diabetics with periodontal disease have more difficulty in controlling their blood sugar and therefore suffer from worsened diabetes. And diabetics react to periodontal infection with aggravated destructive responses [82-84] that include reduced immune response and reduced ability for tissues to heal.

HP2010 requires 75 percent of diabetics to have had an annual dental examination; the national average is 58 percent.

In 2004, 6.4 percent of Washington adults (ages 18 years and older) reported having diabetes, and about one percent of women reported gestational diabetes. About 60 percent of adults with diabetes had a dental visit in the previous year. Also, tooth loss was more likely to occur in adults with diabetes.

Table 23: Last dental visit by diabetes status for Washington adults, 2004 WA BRFSS.

| Diabetes | Last dental visit | | | | |
|------------------|------------------------|-----------------------|-----------------------|------------------------|---------------------|
| | Past year | Past two years | Past five years | More than five years | Never |
| Yes | 59.7% (56.5%-62.9%) | 11.8% (9.7%-14.0%) | 10.4% (8.6%-12.2%) | 17.4% (14.9%-19.9%) | 0.7% (0.3%-1.1%) |
| Yes, gestational | 69.2% (61.1%-77.2%) | 12.2% (6.8%-17.5%) | § | § | § |

Note: (§) represent data where the Relative Standard Error (RSE) is >30%; therefore the data is too unreliable to report.

Table 24: Teeth lost by diabetes status for Washington Adults, 2004 WA BRFSS.

| Diabetes | Teeth lost | | | |
|------------------|------------------------|------------------------|------------------------|------------------------|
| | None | Five or fewer | Six or more | All |
| Yes | 37.8% (34.4%-41.2%) | 29.3% (26.3%-32.4%) | 19.2% (16.7%-21.7%) | 13.7% (11.5%-15.8%) |
| Yes, gestational | 65.6% (57.1%-74.1%) | 25.3% (17.6%-32.9%) | § | § |

Note: (§) represent data where the Relative Standard Error (RSE) is >30%; therefore the data is too unreliable to report.

Cardiovascular diseases

Cardiovascular disease (CVD) is the second leading cause of death in the United States, and it has some of the highest economic costs. The American Heart Association reports that in 2004, 871,500 Americans died of CVD—these mortality data are for whites and African Americans only. The estimated prevalence of CVD among adults age 20+ is 79.4 million. [85]

Some studies have reported a moderate relationship between periodontal disease and cardiovascular disease. Because periodontal and cardiovascular diseases are highly prevalent in the population, periodontal disease is a public health problem worthy of attention, even though the strength of the association may only be moderate. [86]

About 30 percent (13,796) of all Washington deaths in 2005 were due to cardiovascular disease (stroke or heart disease). In 2005, the most common form of cardiovascular disease, coronary artery disease, had an age-adjusted mortality rate of 125 per 100,000, which was lower than the national age-adjusted rate of 151 per 100,000 (*US data is from 2004*). In 2005, about 7.3 percent of adult Washingtonians reported having been told that they had cardiovascular disease, which the BRFSS defines as including heart attack, angina, coronary artery disease, or stroke.

Respiratory diseases

Several studies have shown an association between poor oral health and respiratory disease. Dental plaque seems to work as a reservoir of potential respiratory pathogens in high-risk patients, such as alcoholics, diabetics, and institutionalized or hospitalized people. These individuals may be prone to oropharyngeal colonization by potential respiratory pathogens due to their compromised swallowing reflexes. [75] Associations have been found with lung infections, pneumonia, and chronic obstructive pulmonary disease. With the continuing emergence of antibiotic resistant bacteria, pneumonia is likely to assume increasing importance in the near future. [75] Hence, even a modest effect of poor oral health on pneumonia would have great public health implications.

Preterm birth and low birth weight infants

Preterm birth and low birth weight babies are a major public health problem worldwide, with substantial associated morbidity, mortality, and societal costs. [1, 75, 87-89] In 2005, the rate of low birth weight for singletons (used so that factors other than plurality can be explored) was 4.8 percent, representing 3,902 births in Washington State, and the overall rate of low birth weight (including multiple births) was 6.2 percent (5,199 births). Comparably, 2004 national data shows a singleton rate of 7.0 percent and an overall rate of 8.1 percent [90] In Washington State, preterm deliveries have been increasing since 1993, for a total preterm delivery rate of 10.4 percent in 2005. The rate of singleton preterm births is almost twice the rate of singleton low birth weight rates. From 2001-03, about 70 percent of singleton preterm infants were also normal birth weight. Therefore, a variety of other factors are affecting preterm birth rates. [91]

Infections can be major risk factors in preterm birth. Some studies suggest a strong potential association between periodontal disease and preterm birth. During pregnancy, there are alterations in psychology and behavior, with a tendency toward lack of personal care, including oral hygiene. [92] Pregnant women also experience metabolic and hormonal changes, which could lead to pregnancy gingivitis and pyogenic granuloma. Increased attention to oral hygiene can help minimize the effects of these metabolic changes. [1, 75, 93] Toxins or other products generated by oral bacteria in the mother may reach the general circulation, cross the placenta, and harm the fetus. In addition, the response of the maternal immune system to the infection elicits the continued release of natural chemical defense mechanisms that can interfere with fetal growth and delivery. [88]

Bacteremia and endocarditis

The negative impact of oral infection on systemic health generally stems from the entry of oral microorganisms or their products into the bloodstream, which is known as bacteremia. It appears that accumulated periodontal bacteria or their products can directly invade the periodontal tissues, and from there, they gain access to the systemic circulation and adhere to damaged heart valves or heart surfaces. The best means to prevent bacteremia is by minimizing gingival inflammation and accumulation of periodontal bacteria through good oral hygiene. Dental and other surgical procedures predispose susceptible patients to endocarditis. [75] Antibiotics may be necessary before major oral surgical procedures to prevent endocarditis.

Impact of systemic diseases on oral health

Signs of several systemic diseases and conditions can be manifested in the mouth, which makes the oral cavity an important diagnostic tool for health professionals. [1]

Indeed, problems with speaking, chewing, taste, smell, and swallowing are common in some systemic diseases. For example, oral complications of AIDS include pain, dry mouth, mucosal infections, and Kaposi's sarcoma. Cancer therapy can result in painful ulcers, mucositis, and rampant dental caries. Periodontal disease is a complication of diabetes and osteoporosis. Several systemic factors have demonstrated effects on oral health, such as malnutrition, tobacco, stress, medications, diabetes, HIV/AIDS, and immunosuppression.

Dental professionals can be the first to identify these oral manifestations and make early referrals to the appropriate health professionals. This has been a common scenario for dental patients with HIV/AIDS, eating disorders [94], methamphetamine use, tobacco users, and potentially other diseases.

HIV/AIDS

Oral lesions occur in 40-50 percent of people who are HIV-positive and in up to 80 percent of those with a diagnosis of AIDS. [95] The lesions are among the first to manifest and serve not only as an HIV infection indicator but also as a predictor of the progression of HIV disease to AIDS. They can be used as entry or end-points in therapy and vaccine trials, determinants of opportunistic infection and anti-HIV therapy, and in staging and classification systems. [95] As new drug regimens increase the life expectancy of HIV patients, chronic disorders such as periodontal diseases are likely to become more important problems in the management of infected patients. [96]

Mental health diseases (stress, depression, eating disorders)

Studies have revealed associations between stressful environmental stimuli and periodontal status. [14] At sufficient levels, stress can increase circulating cortisol and suppress immunological responses. Depressed patients often have poor oral hygiene due to a lack of interest in self-care. Dry mouth can occur as a result of depression and the drugs used to treat it. [97] Eating disorders such as anorexia nervosa, bulimia, binge eating, and pica are characterized by serious disturbances in eating and psychological effects. [98] Only one in ten individuals with eating disorders receive treatment. Eating disorders may cause dental destruction (perimolysis), parotid swelling, and biochemical abnormalities in saliva. Research as yet provides few insights about the connection of oral lesions with nutritional deficiency and eating disorders. [99]

In Washington in 2004, about 30 percent of Washington youth in Grades 8, 10 and 12 reported struggling with depression in the previous year. In 2003, 18 percent of Washington parents with children ages 5-10 years and about 9 percent of parents with children ages 3-5 years reported that their child had difficulties with emotions, concentration, behaviors, or getting along with people. [91]

Medications

The mouth and its functions can be adversely affected by medications and other therapies used to treat systemic diseases and conditions. Prescription and nonprescription drugs often have the side effect of dry mouth, but other common consequences include stomatitis, reduced salivary flow, altered taste, oral ulcers, and difficulty in eating, chewing, and swallowing, all of which can affect nutrition, treatment compliance, and overall quality of life. [100] The elderly are at higher risk for xerostomia (dry mouth) due

to the larger amount of medications they use for managing their chronic conditions. With the aging of the world's population, this problem is likely to increase.

Osteoporosis

Systemic osteoporosis develops due to bone loss resulting in bone brittleness, a condition that can be seen in the facial bones. Periodontitis leads to loss of attachment and bone loss. Hence a patient with osteoporosis with low bone density of alveolar bones may be more susceptible to rapid progression of periodontitis. [101, 102]

In 2000, 40 percent of Washington residents who reported on the BRFSS that they had arthritis; 35 percent of them also reported having osteoporosis. [103, 104]

Diet and nutrition

Poor oral health can affect appetite and the ability to eat, result in malnutrition, and hence compromise general health and well-being. Indeed, inadequate food or nutrient intake may result from caries, periodontal disease, oral and dental pain, tooth loss, dry mouth, ill-fitting dentures, cracked or sore lips or tongue, and sensitivity to temperatures. [105, 106] A diet that is rich in fruits, vegetables, and whole grain foods and low in free sugars and fat is likely to benefit many aspects of oral health. [107] In 2004, about 20 percent of Washington's eighth, tenth and twelfth graders reported drinking at least two sodas per day. Additionally, only 26 percent of eighth graders, 23 percent of tenth graders, and 22 percent of twelfth graders ate the recommended five servings of fruits and vegetables per day. A reported 5-6 percent of youth in Grades 8, 10 and 12 reported vomiting or taking laxatives in the past 30 days to lose weight. [51]

Obesity

Obesity is a chronic disease with high mortality and co-morbidity. It is related to several aspects of oral health, such as caries, periodontitis, and xerostomia. Oral health professionals are increasingly concerned about how oral hygiene and preventive measures (fluorides) are being managed, given the poor quality and high amount and frequency of peoples' eating habits. [108]

In 2004, about 10 percent of Washington's eighth, tenth and twelfth graders self-reported being overweight. [51] In 2000, 40 percent of Washington adults ages 18 years and older reported that they were trying to lose weight. [104]

Alcohol use

In terms of etiology, the combined effects of tobacco use, heavy alcohol consumption, and poor diet account for more than 90 percent of cases of head and neck cancer. Alcohol synergizes with tobacco as a risk factor for all of the upper aero digestive tract. The increase in oral cancer in the Western world has been related to rising alcohol use. [109] Alcohol use has also been associated with increased risk of cleft palate. [110]

In 2004, about 10 percent of Washington's eighth graders, 19 percent of its tenth graders, and 26 percent of its twelfth graders reported binge drinking in the past two weeks (defined as consuming five or more alcohol beverages in a row). [51] During 2002-2004, about 15 percent of new mothers reported binge drinking three months before they became pregnant, but less than one percent reported binge drinking in the last three months of pregnancy. [111]

Recreational drug use

Methamphetamine (meth) is an inexpensive, easy-to-make, and highly addictive drug. Its use is increasing

in the U.S. and other countries. Meth causes rampant (severe) dental caries, probably due to the drug's acidic nature, dry mouth (which reduces the amount of protective saliva around the teeth), craving for high-calorie carbonated beverages, and a tendency to grind or clench the teeth. The drug's effect is of long duration (12 hours), during which users are not likely to clean their teeth. [112]

In 2004, about two to eight percent of Washington State youth in Grades 6, 8, 10 and 12 reported ever using methamphetamine, cocaine, ecstasy, or steroids in their lifetime. Further, tobacco and drug use are closely associated. For example, of tenth graders surveyed, about 38 percent of smokers reported using marijuana in the past 30 days compared to four percent of non-smokers. [51]

Traumatic injuries

The impact of sports, work, violence, traffic, household, and play accidents with dental trauma has been documented. These events can lead to severe physical and psychological trauma in children and adults. Teeth and facial structures can be affected, and treatment is generally extensive and expensive. Use of mouth guards and helmets for sports activities, safe playgrounds for children, seat belts while driving or riding in a car, canes or support devices for elderly, and a reporting system for abuse and neglect (known as Prevent Abuse and Neglect through Dental Awareness—PANDA) are some of the recommended preventive measures. Washington State has discontinued its PANDA Program. [113-115]

In 2003, Washington experienced a rate of unintentional nonfatal injury hospitalizations of 182 per 100,000 children ages 0-19 years (3,087). The three most common causes for unintentional injury hospitalizations for Washington children were motor vehicle transport, falls/jumps/pushes, and being struck by or against (including being accidentally struck by an object or person). [91]

Economic costs of oral diseases to individuals and society

The economic impact of oral diseases can be substantial given their relationship with so many important functions and systemic conditions.

Global costs

Traditional curative dental care (restorations or fillings) is a significant economic burden for many industrialized countries, where five to ten percent of public health expenditures are invested in oral health. A study conducted in 2002 reported that to treat the permanent dentition of the U.S. child population using the traditional method of amalgam restoration would cost between \$1,600-\$3,500 per 1,000 children ages 6-18 years old, and the total amount would exceed the public budget available for oral health in most countries. [116] These findings suggest that a rational plan to controlling caries would instead be a public health prevention and health promotion program to reduce the cause of caries and dental trauma. Strategies adopting preventive principles are more appropriate, affordable, and sustainable.

National costs

In the United States in 2003, expenditures for dental care among the civilian non-institutionalized (community) population were \$67 billion, or 7.5 percent of total health care expenditures for the nation. The percentage of the population with a dental expense that year was 42.7 percent, which closely aligns with the population's experience in 1996, when 41.8 percent had a dental expense. Over the same period, the average dental expense per person increased 40.6 percent, from \$384 to \$540, an increase much greater than indicated by the Consumer Price Index. [117]

Dental expenditures differ from overall health expenditures in the distribution of sources of payment. In 2003, 42.4 percent of all medical expenditures were covered by private insurance, as were a similar proportion (43.1 percent) of dental expenditures. But government programs, such as Medicare and Medicaid, covered a much smaller amount of the cost of dental care. In addition, persons with a dental expenditure in 2003 paid 48.2 percent of the costs, out-of-pocket. This is about 2.5 times the rate paid out-of-pocket for overall health expenditures. [117]

For individuals with craniofacial disabilities, expected costs are even higher. Overall costs of chronic pain conditions are estimated to be \$79 billion. [118] Other expenses include: tens of billions of dollars in direct medical care and indirect costs to treat chronic craniofacial pain conditions such as temporomandibular disorders, trigeminal neuralgia, shingles, or burning mouth syndrome; \$100,000 minimum individual lifetime costs of treating craniofacial birth defects such as cleft lip and palate [1]; costs of oral and pharyngeal cancers; costs of autoimmune diseases; and costs associated with the unintentional and intentional injuries that affect the head and face. Finally, such outlays have social and psychological consequences.

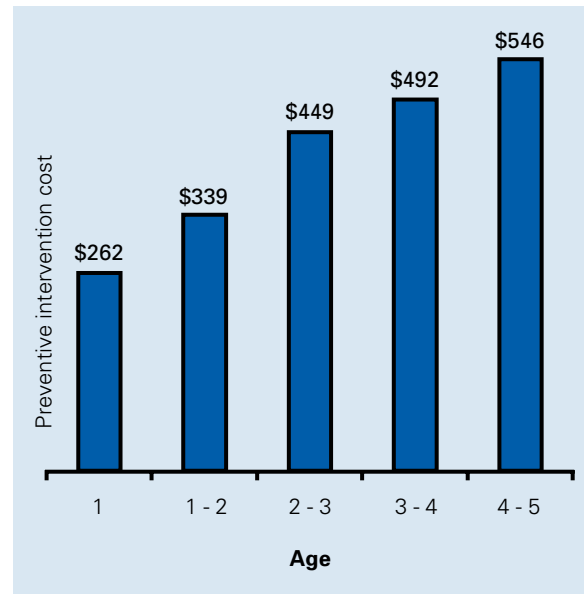
A substantial number of young children with untreated caries are seen in hospital emergency departments, and for many it is their first dental visit. In 1996-97, the mean cost for dental care provided to hospitalized children was \$1,508 compared with \$104 for those who were not treated in a hospital operating room.

Prevention pays off. Preschool-age, Medicaid children who had an early preventive dental visit were more likely to use subsequent preventive services and experience lower dental costs. [120] This is important since preschool children have shown some of the greater increases in caries prevalence in the last few years. Among Medicaid enrolled children, the average cost per child based on the age at the time of the first preventive dental visit increases from as low as \$262 at age 1 to \$546 at age 4-5 years. See figure 49. [119].

Societal costs

Poor oral health can limit people's employability, and it can lower productivity for people who have jobs. In 1996, the United States experienced 3.7 days of restricted activity per 1,000 employed persons ages 18 years and older as a result of an acute dental condition. This compares to a rate of 624 restricted activity days per 100,000 for all acute conditions, but the total cost to society is nonetheless considerable. Restricted activity days were most prevalent among adults ages 18-24 years, women, blacks, and individuals with annual incomes of less than \$10,000.

Figure 48: Cost for first preventive dental visit per child by age, 1992-97 North Carolina Medicaid data [119].



Oral and pharyngeal cancers have the highest mortality of all oral diseases. A 1988 study estimated that 16.2 years of life were lost per person dying of cancer of the oral cavity and pharynx [121], which exceeds the average of 15.4 years lost for all cancer sites

The cost of extensive dental caries on children's performance at school is less well established, but a U.S. study shows that in 1996, children lost 51 million school hours were lost each year because of oral health problems. Dental caries and the pain associated with it is a daily occurrence for school nurses in school systems with many children from minority groups and living in poverty. For youths 5-17 years old, 3.1 days of school are lost per year per student.

In 1996, a national survey showed that the percentage of all acute conditions that are medically attended for all ages was 68 percent, while for acute dental conditions, 60 percent were attended. Poor children have nearly 12 times more restricted-activity days because of dental-related illness than children from higher-income families. [1] Children whose teeth are in excellent or very good condition are less likely than other children to miss more than two weeks of school due to illness or injury. Of children who missed 11 days or more of school in the past year, 56.6 percent were reported to have teeth in excellent or very good condition, compared to 65.4 percent of children who missed ten days of school or fewer.

Opportunity costs

Many of the costs described above relate to dental caries, which is the most common chronic disease in children and largely preventable. Once established, dental caries generally requires treatment. A cavity grows larger and becomes more expensive to repair the longer it remains untreated. Prevention is a much more cost-effective and painless solution for caries. The CDC recommends two evidence-based public health activities to prevent caries: community water fluoridation and school based or school linked sealant programs.

Community water fluoridation refers to the adjustment of the natural fluoride in the water to a level that is effective to prevent tooth decay. Water fluoridation effectively prevents dental caries in communities with varying disease prevalence, does not require the presence of a dental provider, and is easily available to all citizens using public water systems. Children in communities with water fluoridation experience 29 percent fewer cavities. Children receiving dental sealants in school-based programs have 60 percent fewer new caries in pit and fissure surfaces in back teeth for up to two to five years after a single application. [1]

Not taking full advantage of these two mass preventive measures can lead to significant and unnecessary costs. A 2001 study showed that for every \$1 invested in community water fluoridation, \$38 is saved in averted costs. A 2003 study shows that Colorado was able to realize sizeable annual savings—\$149 million or an average of \$60 per person—from its community water fluoridation program. About 75 percent of Coloradans use fluoridated water through their public water system. If all Colorado public water systems were fluoridated, an estimated \$47 million more could be saved. This estimate was based on the cost of water fluoridation per inhabitant which was 50 cents to \$3, depending on the size of the community in 2002 and on the cost of services in dental offices, \$306 per capita. [122] In Washington State, 58 percent of residents using public water systems receive fluoridated water.

School-based or linked sealants can also lead to financial savings. In 2005, 59 percent of Washington's second and third graders had caries experience (number of treated plus untreated caries), and 20 percent had untreated decay. At the same time, only 45 percent of Washington second and third graders had sealants. Studies have shown that sealant costs can vary from \$6 if applied in schools to \$27 in dental offices, and amalgam restoration costs about \$74 at a dental office. [37]