

Aging, Systemic Disease and Oral Health: Implications for Women Worldwide (Part I)



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Intended Audience: Dentists, Dental Hygienists, Dental Assistants, Dental Students, Dental Hygiene Students, Dental Assisting Students

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Conflict of Interest Disclosure Statement

- Maria Goldie had done consulting work for P&G. She has no relevant financial relationships to disclose.
- Ms. Hughes had done consulting work for P&G. She has no relevant financial relationships to disclose. Pam passed away in 2017.

Short Description

This free continuing education course provides dental team members with information on three common health conditions among aging women.

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Overview

This course will review global prevalence and risk factors of three common health conditions among aging women: cardiovascular disease, diabetes, and osteoporosis. It explores prevention and treatment approaches, connections to oral health, and specific treatment plans for each condition.

This is Part 1 of a 2-part series on women, aging and oral health. Part 2 is available in the dentalcare.com CE library.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Identify three women’s health concerns observed worldwide.
- Identify common risk factors linked to systemic diseases and oral implications from medication use.
- Outline essential steps for the dental professional to use in adequately delivering comprehensive care.
- Examine specific treatment protocols and product recommendations based on medical and/or dental assessments.

Changing Patient Demographics

Technological advances, improved screening

tools, and better disease management are among several factors that have led to the expression “sixty is the new forty.” Retirement today often means a transition to a new career as people are enjoying greater longevity. An average American female and male today in the U.S. is expected to live to be 79.3 and 73.5 years of age, respectively.^{1,7} In the most countries, women live four to eight years longer than men. This is due to biological sex differences and gender behaviors such as smoking and drinking excessive amounts of alcohol.¹ According to the U.S. Census Bureau, 20.7% of the population will be 65 years or older by 2050.² These changing demographic trends are similar across most of the globe.

From 2000 to 2019, global life expectancy increased from 67 years to 73 years, due to the fall in child and maternal mortality and the decline in incidence and mortality from many infectious diseases.³ Also, expansions in access to health services, including improvements in prevention and treatment for non-communicable diseases, played a role. However, the COVID-19 pandemic halted progress against many global health indicators, which slowed or stagnated.³

According to the Administration for Community Living, in 2019, there were 30 million women and 24.1 million men aged 65 and older in the US, which means that there were 125 women for every 100 men. The sex/gender gap widens even more in the 85+ age group, where there were 178 women for every 100 men.⁴ Despite the universal appeal of extending our life expectancy, living longer may also bring health complications that can negatively impact overall well-being in those later years. Women are more susceptible to certain chronic diseases as they age,⁴ and recent studies suggest periodontal health may play a role in the progression of many systemic conditions.⁵ This includes Alzheimer’s disease, inflammatory bowel diseases, and oral cancer, emphasizing the importance of the oral cavity in systemic health.⁵ This increased risk also presents at a time when oral hygiene may be challenging, since dexterity and ability can be impaired due to memory loss, poor vision, arthritis and other factors.

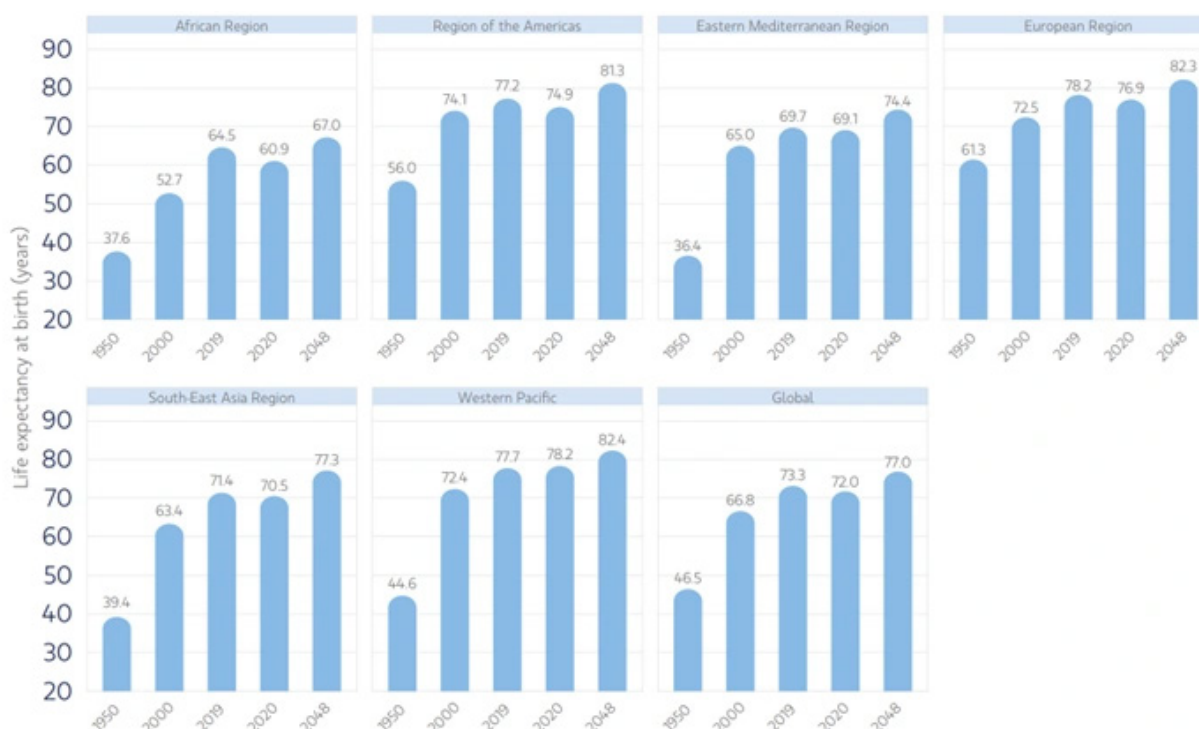


Figure 1. Life Expectancy at Birth, WHO regions and global, 1950-2048¹

Oral health care professionals have the opportunity to improve the health of patients by understanding their individual needs based on factors such as health status, age, and sex/gender. Since older female patients will represent a growing portion of our patient population, it is important that we are familiar with their specific health concerns. This article will concentrate on three common conditions women may experience as they age: cardiovascular disease, diabetes, and osteoporosis. It will discuss risk factors and common approaches to treatment and prevention. It will also explore links to oral health and outline treatment plans, including home care products to promote optimal oral health.

Cardiovascular Disease: No Longer a “Man’s” Disease

The media has typically portrayed cardiovascular disease (CVD) as a “man’s” disease and has clouded the importance and significance of CVD in women until now. CVD - including coronary heart disease, high blood pressure, and stroke - is now the leading cause of death

among American women. It is followed closely by cancer. Heart Disease is the leading cause of death for women in the U.S. and can affect women at any age, with over 60 million women experiencing some form of heart disease.

In 2018, heart disease was responsible for more than 1 out of every 5 deaths for women in the U.S.⁶ According to the 2021 Heart Disease & Stroke Statistical Update Fact Sheet for Females and Cardiovascular Diseases by the American Heart Association, in 2018, cardiovascular disease (CVD) was the cause of death in 420,164 females of all ages, representing 48.4% of deaths from CVD. The same report also states that in 2018, CVD was the disease with the highest percent of total deaths for all subgroups of females; 30.3% of all non-Hispanic White female deaths, 32.6% of non-Hispanic Black female deaths, 28.3% of Hispanic female deaths, and 31.3% of non-Hispanic Asian female deaths.⁷

Based on data from 1995 to 2012, 23% of females age 45 and older who had an initial recognized myocardial infarction (MI or heart attack) died within a year compared with 18%

of males. However, within 5 years after a first MI, 36% of males and 47% of females died. Females have MIs at older ages than males do and they're more likely to die from them within a few weeks. Heart attacks in women under the age of 50 are twice as fatal as in men, and women are more than twice as likely to die within a few weeks from the heart attack versus men.⁸ It is important to note that this is not due to any inherent biological differences between men and women. Rather, it is due to a combination of factors such as delayed diagnosis, lack of awareness of symptoms, and less aggressive treatment.⁸ Approximately 46% of women who survive heart attacks become disabled by heart failure in six years,⁸ while 64% will die suddenly.⁹ Ischemic heart disease will account for 3.4 million and approximately 3 million women will die yearly from stroke and a remaining 2.2 million will die from hypertensive heart disease, rheumatic heart disease, and inflammatory heart disease.⁹ In fact, heart disease kills more women each year than all cancers, chronic lung disease, pneumonia, diabetes, traffic accidents and AIDS combined.⁹

A global study reported that women are less likely to have heart disease and die of it, than men.¹⁰ Current trends indicate CVD and stroke, the first and second leading causes of death globally; will be responsible for increasing deaths and disabilities worldwide, and the number of fatalities is expected to increase to 20 million yearly. By 2030, the rate is estimated to be 24 million.¹¹

Fortunately, CVD is beginning to decrease in many developed countries due to factors such as public prevention programs and medical advances. However, the lower socioeconomic groups in developed countries have a greater prevalence of risk factors, higher incidence of disease, and higher rates of mortality exist. People living in low and middle-income countries often do not have the benefit of primary health care programs for early detection and treatment of people with risk factors for CVD, and have less access to effective and equitable health care services.

According to a new study, half of Canadian women who experience a heart attack have



Heart disease and stroke claimed the lives of **32,271 women** in Canada in 2019. That's one woman's life every 16 minutes.

Figure 2. 2023 Spotlight on Women's Heart and Brain Health¹²

their symptoms go unrecognized.¹² Women who suffer from a heart attack are less likely than men to obtain the treatments and medications needed in a timely manner, and are more likely than men to die in the year following a heart attack.¹² Women who experience STEMI or NSTEMI, two of the three main types of heart attacks, are more likely than men to die or develop heart failure in the subsequent five years. As well, women who endure a stroke are at higher risk of dying than men.¹²

Cardiovascular disease (CVD) is the leading cause of mortality in Europe and globally and creates a substantial economic burden for health systems.¹³ Existing cardiovascular conditions greatly increased the negative effects of Covid-19 infections, and research has shown that pre-existing cardiovascular conditions are extremely relevant predictors of Covid-19 severity and mortality.¹³ According to a study funded by the British Heart Foundation and carried out at the University of Leeds, women have a 50% higher chance than men of receiving the wrong initial diagnosis following a

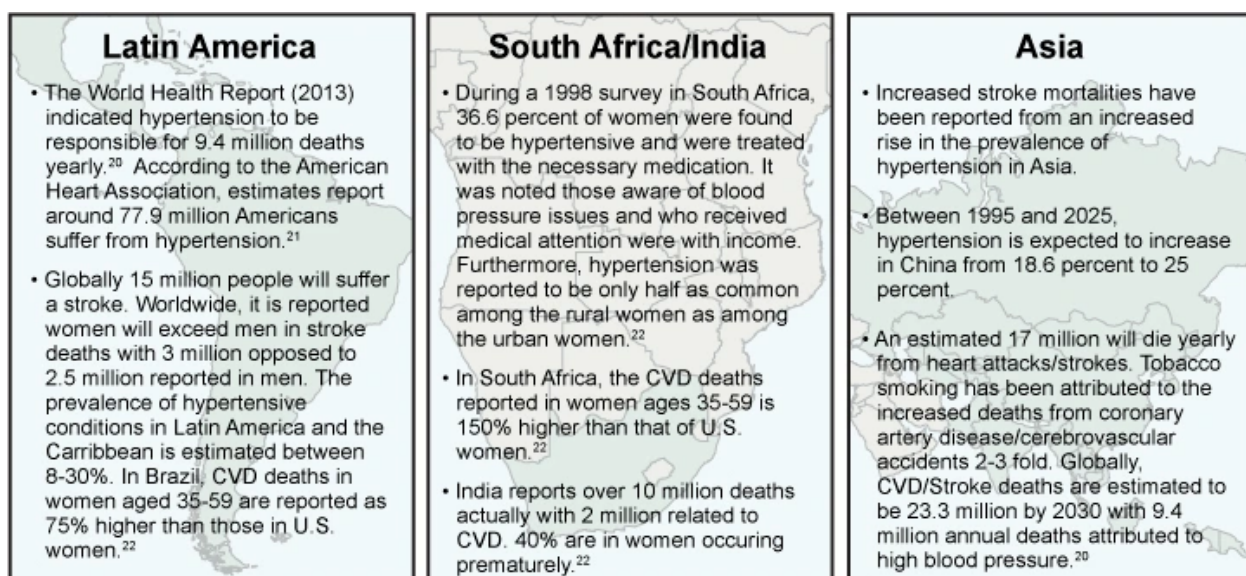


Figure 3. Hypertension – Spotlight on Latin America, South Africa and Asia.

heart attack.¹⁴ The study found that almost one third of patients had an initial diagnosis which was different than their final diagnosis. Women who were misdiagnosed had about a 70% increased risk of death after 30 days compared with those who had received a consistent diagnosis, and also in men.¹⁴

From a historical perspective, CVD in men has overshadowed some sex and gender differences related to its diagnosis, presentation, and treatment. Biologically, women have smaller hearts than men, making diagnosis and treatment more challenging, and hormonal changes may affect a woman's risk for coronary heart disease.¹⁵ Symptoms of a heart attack can be very different between individuals, but especially for men and women. The most common signs of a heart attack

are the same for both, such as shortness of breath, sweating, pain in the chest, neck, or arms. Women can present with additional subtle symptoms unrelated to those classic symptoms, such as unusual fatigue, nausea, anxiety, uncomfortable pain between the shoulder blades, and sleep disturbance. Men will typically describe chest pain as "crushing" rather than women referring to an "aching or squeezing."¹⁶

Oftentimes these signs are associated with stress and panic disorders and, consequently, lead to a misdiagnosis and/or mistreatment of a potentially serious and deadly condition. Some treatments may be less aggressive for women due to their age, since heart disease is often diagnosed in their later years when estrogen production has diminished.¹⁶

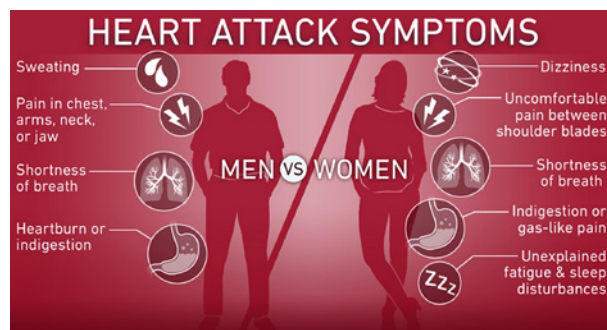


Figure 4. Heart Attack Symptoms
Image Source: Temple Health¹⁶

Risk Factors, Prevention, and Treatment (Cardiovascular Disease)

Heart attack and stroke share many similar risk factors such as elevated blood pressure, smoking, elevated cholesterol, diabetes, obesity, and physical inactivity (Figure 5). A family history of heart disease co-existing with diabetes can contribute to even greater risk.¹⁶ According to the WHO, tobacco use worldwide will contribute to the single greatest cause of death and disability with a projected 7 million deaths yearly by 2030.¹⁷ Smoking the

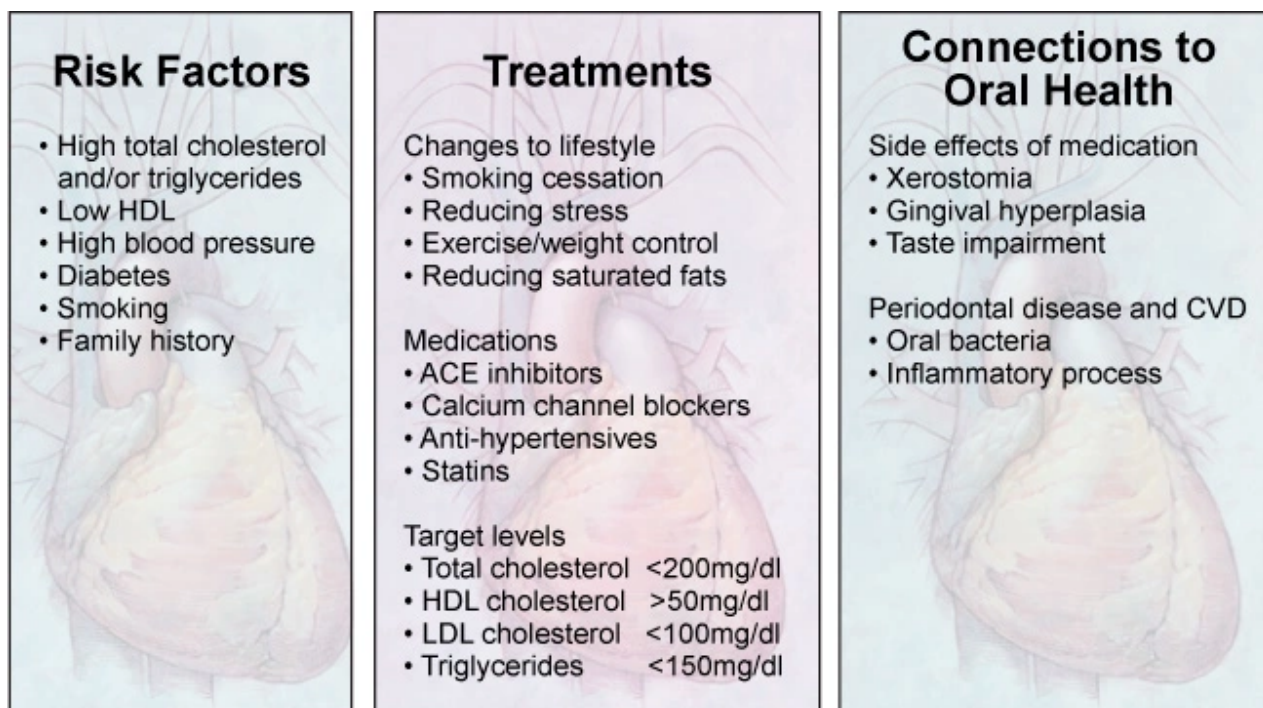


Figure 5. Cardiovascular Disease – Risk Factors, Treatments and Connections to Oral Health.

equivalent of one cigarette per day carries a risk of developing coronary heart disease and stroke much greater than expected, that is, around half that for people who smoke 20 per day.¹⁸ Smoking e-cigarettes daily doubles risk of heart attacks, and when combined with daily cigarette use, heart attack risk rises five-fold.¹⁹ Obesity is another risk factor for several chronic conditions. Older women are heavier now than they were a decade ago. Approximately 62% of American women 20 years of age and older are reported overweight and 33% of the women are identified as extremely overweight.

Fortunately, there are preventive treatment and lifestyle recommendations that can significantly reduce risk. Research indicates when smoking, obesity, stress, and physical inactivity are altered with lifestyle changes, positive health benefits are realized.²⁰

In 2019, the ACC/AHA issued a “Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.”²¹ The most important way to prevent cardiovascular disease is to promote a healthy lifestyle throughout life.

The guidelines are helpful in assessing for other risk-enhancing factors can help guide decisions about preventive interventions in select individuals, such as coronary artery calcium scanning, as well as treatments pharmacological therapy. A healthy diet healthy that focuses on consumption of vegetables, fruits, nuts, whole grains, lean vegetable or animal protein, and fish and minimizes the intake of trans fats, red meat and processed red meats, refined carbohydrates, and sweetened beverages is encouraged.²² Maintaining a healthy weight and exercising are part of the regimen, and tobacco use in any form should be stopped completely.

When lifestyle changes are inadequate, medications are often used to reduce risk, such as:

- Calcium channel blockers(Calan®, Procardia®, Cardizem®) to dilate coronary arteries that in turn increase blood flow to the heart
- Angiotensin-converting enzyme (ACE) inhibitors (Vasotec®, Prinivil®, and Zestril®) that aid in lowering blood pressure by inhibiting the formation of angiotensin II
- Statins (Zocor®, Lipitor®) that block the enzyme (HMG-CoA) necessary for cholesterol production

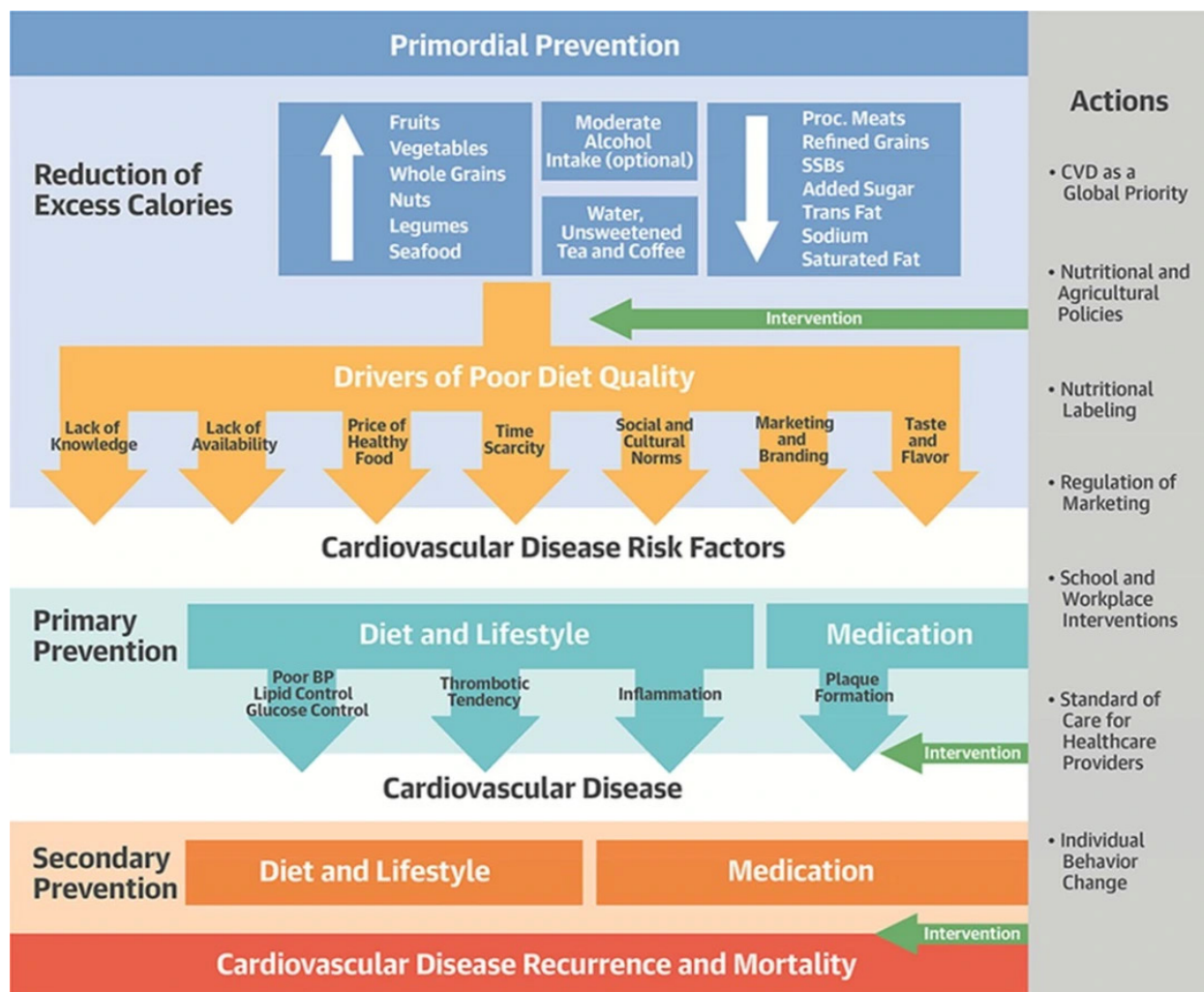


Figure 6. Flow Diagram of the Development of CVD and Possible Prevention by a Healthy Diet²²



Figure 7. Spotlight on a Finnish Study.

Medications such as anti-hypertensives are frequently used to lower blood pressure.²⁴ In addition to these preventive and pharmaceutical approaches, new scientific breakthroughs are on the horizon. The Atlas of Heart Disease and Stroke is a data publication from the World Health Organization (WHO) and the U.S. Centers for Disease Control and Prevention (CDC) that presents the latest global data related to heart disease and stroke in an accessible format.²⁵ For example, research is being conducted on stem cell applications that actually repair the damaged heart muscle and improve cardiac function. According to the National Institute of Health, stem cells can create new blood vessels to supply the necessary oxygen to the heart.^{26,27} Researchers in a 2020 study found that human cardiopoietic cells focus on damaged proteins to reverse complex changes caused by a heart attack.²⁷ Cardiopoietic cells are derived from adult stem cell sources of bone marrow. These medical advances may lead to significant reductions in cardiovascular disease for future generations.

New Research

Reproductive history represents many possible sex-specific risk-enhancing factors for CVD. A thorough reproductive history offers an opportunity for early prevention of risk factors and primary prevention. This includes the timing of menarche, menopause and any pregnancy complications, all of which could reveal short and long-term cardiometabolic and cardiovascular risk curves.²⁸ Factors increasing CVD risk in women are: early and late menarche; polycystic ovary syndrome; menstrual irregularity; infertility; adverse pregnancy outcomes, such as hypertensive disorders of pregnancy; and absence of breastfeeding.

Hypertensive disorders of pregnancy are not rare conditions and are the second leading cause of maternal death after maternal hemorrhage. They are a significant cause of short and long-term maternal and newborn morbidity worldwide, and 15% of U.S. childbearing women experience these during at least one pregnancy.²⁹ Prior research indicates hypertension develops faster among women who experienced hypertensive disorders of

pregnancy, up to 10 years earlier, compared with women with normal blood pressure during pregnancies.

A statement by the American Heart Association (AHA) states that high blood pressure during pregnancy remains a major cause of maternal and fetal pregnancy-related complications and death, and it increases women's short and long-term risks for cardiovascular disease.³⁰ The statement highlights that hypertension treatment in pregnancy is safe and effective, and lessens maternal heart risks. The paper was based on data from clinical trials and observational research which support the benefits and safety of blood pressure treatment during pregnancy. The statement advises multidisciplinary, team-based personalized care where clinicians partner with the patient to determine preferred treatment and consider the risks for hypertension-related adverse outcomes.

In addition to the current risk factors for CVD, as mentioned above, AHA has added another risk factor of concern. In addition to high blood pressure, high LDL cholesterol, diabetes, smoking and secondhand smoke exposure, obesity, unbalanced diet and physical inactivity, the AHA has added chronic kidney disease to the list of risks.³¹ Cardiovascular-Kidney-Metabolic Syndrome (CKM) is "a systemic disorder characterized by pathophysiologic interactions among metabolic risk factors, chronic kidney disease, and the cardiovascular system, leading to multi-organ dysfunction and a high rate of adverse cardiovascular outcomes".³¹ According to the AHA, cardiovascular-kidney-metabolic health reflects the interaction among metabolic risk factors, chronic kidney disease, and the cardiovascular system and has serious impacts on morbidity and mortality. The advisory imparts guidance on the definition, staging, prediction paradigms, and holistic approaches to care for patients with cardiovascular-kidney-metabolic syndrome and details a multicomponent goal for effectively and equitably enhancing cardiovascular-kidney-metabolic health in the population.³²

The AHA recommends its Life's Essential 8 as a framework for people to use to prevent disease.

The areas it focuses on include health behaviors: eating a balanced diet, being more active, quitting tobacco and getting healthy sleep and individual health factors such as managing a healthy weight, cholesterol, blood sugar and blood pressure.³²

Oral Connections

The relationship between cardiovascular disease and periodontal disease has been the topic of many reports in contemporary dental literature. Experts generally agree that some level of association exists. However, the exact nature of this relationship has yet to be definitively established.

Studies have shown patients with periodontal disease are more likely to have cardiovascular disease than those without periodontal disease³³ and numerous reports from leading dental and medical journals substantiate a link.³⁴⁻³⁷ Periodontal disease is an important risk factor for total cerebrovascular accidents (CVA) and, in particular, nonhemorrhagic or ischemic stroke.³³ A conclusion of a 2014 study showed a correlation between putative bacteria contributing to atheromatous plaques and species associated with periodontal disease.³⁵ Several studies found periodontal disease to be independently associated with increased risk of CHD.³⁷ A 2007 trial published in the *New England Journal of Medicine*, showed patients with severe periodontitis had improved endothelial function (blood flow) following 6 months of intensive periodontal treatment.³⁴ Endothelial function of arteries is an important factor in CVD. Knowing, this, how can we intervene to keep patients healthy, especially those at increased risk and co-morbidities? One study showed that advanced periodontal therapy lowers the rate of CVD, especially myocardial infarction and heart failure. Dental management has a beneficial effect on the overall and cardiovascular health of patients with type 2 diabetes.³⁸ Periodontal disease is a potential risk factor that may potentiate the development, maturation, and instability of atheroma in the arteries. In this study, two mechanisms were suggested to explain the potential association, either periodontal pathogens directly invade bloodstream or indirectly by increasing systemic level of inflammatory mediators.³⁹ While there is a significant body of evidence supporting an

association between CVD and periodontal disease, there are also conflicting findings and causality has yet to be proven. At the present time, there is insufficient evidence for a possible causal relation between periodontal disease and atherosclerotic disease, with somewhat stronger evidence for stroke. If future studies show consistent associations, periodontal disease may be revealed as an independent and potentially modifiable causal risk factor for atherosclerotic disease.³⁹

A common element between CVD and periodontal disease is inflammation, which contributes to narrowing of the arteries in CVD and tissue destruction in periodontitis.⁴⁰ Researchers believe the outcomes from the inflammatory process in periodontal disease are related to the components of specific bacteria destroying gingival tissues and trigger host responses to rupture atherosclerotic plaques. Most heart attacks are believed to be triggered by ruptured plaques rather than arterial blockage.

While the link between periodontal disease and cardiovascular continues to be investigated, the oral manifestations commonly associated with medications used to treat CVD are well-known.⁴¹ Gingival hyperplasia, gingival enlargement, oral hyperpigmentation, oral hypersensitivity reaction, medication-related osteonecrosis, xerostomia, and/or taste impairment are common manifestations encountered from such medications. Oral healthcare professionals are challenged to stay abreast on the potential links between CVD and periodontal disease, as well as recognize potential associations during clinical assessments, active treatment, and maintenance phases of patient care.

Diabetes

Diabetes is a disease occurring when the pancreas produces an inadequate amount of insulin or when insulin is improperly used by the cells, thus, leaving the body incapable of breaking down carbohydrates and starches into energy. Insulin, an important hormone, is used to regulate blood sugar. An increase in the amount of blood sugar is known as hyperglycemia, which is a common reaction

from uncontrolled diabetes over a period of time. Many of the body's systems such as the heart, eyes, kidneys, oral cavity, nerves, and blood vessels can become damaged due to uncontrolled diabetic conditions.

People with Type 1 diabetes produce little or no insulin and represent about 5% of those diagnosed with the disease. It is essential that people with Type 1 diabetes receive insulin daily. Without insulin, you cannot convert food into usable energy. Without insulin, a person with Type 1 diabetes cannot survive.⁴² About 90% of those with diabetes globally have Type 2 diabetes, which is largely due to excessive body weight and inactive or limited physical activity. Those with Type 2 produce insufficient amounts of insulin or the body uses what is produced improperly. Oftentimes, the disease is diagnosed years after symptoms have been identified and serious complications have already developed. According to the WHO, in 2014, 8.5% of adults aged 18 years and older had diabetes. In 2019, diabetes was the direct cause of 1.5 million deaths and 48% of all deaths due to diabetes occurred before the age of 70 years.⁴³ Nearly 10 percent of pregnancies in the U.S. are affected by gestational diabetes mellitus (GDM) every year. It has been well documented that women found to have GDM are at high risk for development of type 2 diabetes mellitus in subsequent years.⁴⁴

The Centers for Disease Control and Prevention have reported diabetes as the seventh leading cause of death among American women and the fourth leading cause of death among Hispanic and African-American women.⁴⁵ Diabetes increases the risk of heart disease by about four times in women, but only about two times in men, and women have worse outcomes after a heart attack. Women are also at higher risk of other diabetes-related complications such as blindness, kidney disease, Alzheimer's disease, and depression.⁴⁶ If blood glucose levels can be controlled, the risk of a CVD event, stroke, heart attack or death from CVD can be reduced.⁴¹ Many people do not even know they have diabetes. In fact, of the 29.1 million American adults who have the disease, it is estimated that 1 out of 4 are unaware of their diagnosis.⁴⁷

The global diabetes prevalence in 2019 was estimated to be 9.3% (463 million people), rising to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045.⁴⁸ The reasons for this increase are complex and the International Diabetes Federation (IDF) Diabetes Atlas data cannot estimate their various contributions but they include: increasing incidence of Type 1 diabetes in children, especially younger children; increasing incidence of Type 2 diabetes in young people and increasing incidence of Type 2 diabetes in adults as a result of sedentary living, high-energy dietary intakes and other as yet unknown factors; the inter-generational effects of hyperglycemia in pregnancy and the general ageing of the global population. Conversely, earlier diagnosis of Type 2 and better management of all types of diabetes leading to greater life-expectancy are also contributing to this rise in prevalence.⁴⁸

Significant economic burdens are placed on families, individuals, countries, and healthcare systems due to diabetes and its numerous complications. Countries in the Western world report those with Type 2 diabetes frequently experience kidney disease, which has exorbitant costs associated with dialysis.⁴⁸

Risk Factors, Prevention, and Treatment (Diabetes)

Ethnicity is one significant contributing factor for diabetes as Hispanic, American Indian, African-American, and Pacific/Asian Islander women are at a two-to-four times greater risk than white females for diabetes.⁴⁹ Being over age 45, having a family history of diabetes (parent or sibling), being overweight, having elevated cholesterol and having high blood pressure are other contributing factors for diabetes.⁴⁹ Fortunately, adopting a healthier diet and increasing daily physical activity can significantly decrease the risk of Type 2 diabetes. Eating a high-fiber, low-fat diet and working on measures to control weight are important steps to take while focusing on an effective plan against diabetes. Relatively inexpensive blood testing can assist in an early and proper diagnosis.

The new diabetes guidelines for 2023 are based on the latest scientific research and clinical

Diabetes Disparities

By Race and Ethnicity

Certain racial and ethnic groups are at a higher risk of developing diabetes than other groups.

Percentage of US Adults 18 or Older With Diagnosed Diabetes, by Race and Ethnicity, 2018–2019

Race and Ethnicity	Percentage
American Indian or Alaska Native	14.5
Asian, non-Hispanic	9.5
Black, non-Hispanic	12.1
Hispanic, overall	11.8
White, non-Hispanic	7.4

Data sources: 2018–2019 National Health Interview Survey, except the American Indian and Alaska Native data, which are from the Indian Health Service National Data Warehouse (2019 data only).

Figure 8. Diabetes Percentages by Race and Ethnicity.⁴⁹

trials and aim to provide better care for people with diabetes and prediabetes. The guidelines include new and updated recommendations for weight management, cardiovascular and kidney disease prevention, amputation risks, sleep habits, social factors, and access to technology. The guidelines also cover the diagnosis and treatment of different types of diabetes, and the strategies for the prevention or delay of Type 2 diabetes and associated comorbidities. (See resources)⁵⁰

If diagnosed, diabetes can be controlled with minimal effect on quality of life. Insulin injections or an insulin pump is the common method of treating the Type 1 diabetic. (Glipizide) Glucotrol® or (Glyburide) Micronase® are hypoglycemic agents used to slow digestion of carbohydrates while (Metformin) Glucophage® is used to decrease blood glucose. These medications are commonly prescribed for treating the Type 2 diabetes. With CVD reported as a primary complication of diabetes, it is not unusual for a statin medication to

be prescribed for the Type 2 diabetes. Blood pressure control and foot care are other vital interventions used in treating diabetes. Tobacco cessation is also an important consideration to avoid complications in diabetic-related cases. Important cost-saving interventions can include screenings for retinopathy, a condition known to cause blindness; blood lipid panels that assist in regulating cholesterol; and additional screenings to assist in early signs of diabetes-related kidney disease.

The WHO's work focusing on population-wide strategies is aimed to promote healthy diets and regular physical activity, thereby attempting to reduce the global concern of overweight and obesity issues. In raising awareness regarding the global epidemic surrounding chronic diseases, healthier environments for the poor and disadvantaged populations can be created. A goal to reverse and even slow trends identified among common disease risk factors will prove beneficial in the prevention of premature deaths and potentially limit the

enormous financial and medical burdens created by diabetes and other chronic conditions.

Oral Connections (Diabetes)

Diabetes is one of the most obvious systemic diseases that predisposes a patient to oral infections and in turn worsens the existing disease. Diabetes increases the risk of periodontal disease, and the risk is further increased for diabetics with poor glycemic control.⁵¹ According to the US Centers for Disease Control and Prevention, almost one-third of diabetics have severe periodontal disease with 5mm or greater attachment loss. Diabetes causes blood vessels to thicken, resulting in reduced circulation and a slower flow of nutrients to areas in the body where they are needed. This can create longer periods of healing and increase the potential for infection.

The inverse relationship - the effect of periodontal disease on diabetes - has been the subject of many recent investigations. Studies suggest periodontal disease may worsen glycemic control and contribute to complications (e.g., heart and kidney disease) associated with diabetes.^{51,52} Evaluations of the benefit of periodontal treatments (e.g., scaling & root planning, tetracycline) on glycemic control have yielded mixed results. Some investigations have shown significant benefits on periodontal health and glycemic control^{53,54} while others have only shown significant improvement in periodontal status.^{55,56} Separate research has demonstrated a reduction in blood inflammatory mediators associated with insulin resistance following periodontal therapy.⁵⁷ The development of a triangular model linking periodontal disease, diabetes and obesity has been reported.⁵² The common factor linking all three diseases is inflammation. According to the report by Dr. Robert Genco, fat tissue can trigger production of proinflammatory cytokines, which can intensify infections and promote insulin resistance.

Understanding these connections should lead to more comprehensive disease management for patients, both diagnosed and undiagnosed. In many instances, the presence of an undiagnosed or uncontrolled diabetic might be more accessible to your care than realized. Commonly

recognized oral symptoms may include severely inflamed tissues, ranging from red to magenta in color, acute gingival and/or periodontal abscesses (oftentimes recurrent and/or multiple), and rapidly advancing periodontitis along with candidiasis represented by fungal infections and commonly experienced painful xerostomic conditions.⁵⁷ Some dental offices choose to test patients for diabetes in the office. See the Resource Section for information on in-office testing.

Osteoporosis: A Global Concern for Women

Osteoporosis is not typically seen or felt by the patient, referred to as “the silent disease,” since it oftentimes progresses slowly without symptoms. Bone density loss or osteoporosis is characterized by porous bone causing bones to become fragile, thin, and high risk for fracture. From the loss of bone, fractures occur more easily, and the accompanying loss of height and severe back pain can leave the patient suffering from permanent disabilities and even death if serious spinal or vertebral fractures occur.

Osteoporosis is a disease marked by significant bone loss and reduced bone strength leading to increased risk of fractures. It affects people of all races/ethnicities and both sexes. In the United States, an estimated 10 million people age 50 years and older have osteoporosis. Most of these people are women, but about 2 million are men. Just over 43 million more people — including 16 million men — have low bone mass, putting them at increased risk for osteoporosis.⁵⁸ It is estimated that one in two females over age 50 will suffer with a broken bone due to osteoporosis. Two million broken bones yearly have been attributed to osteoporosis and nearly 80% of older American women who have suffered broken bones are not tested or even treated for osteoporosis. A woman can lose up to 20% of bone density within five to seven years following menopause. In the US alone an estimated 52% of postmenopausal white women are osteopenic and 20% are osteoporotic.⁵⁸

Osteoporosis can indirectly lead to death, since fractures and related complications can cause an older person's health to quickly deteriorate.

Risk factors include: advancing age; a prior fracture, osteopenia (low bone density); family history of fractures; medications that may weaken bones, such as steroids; rheumatoid arthritis; diabetes; current smoking; and excessive use of alcohol.⁵⁹ Black women have a lower incidence of osteoporosis, however, they experience worse outcomes after fractures caused by osteoporosis. Reasons for this may include: higher incidence of lupus and sickle cell anemia; less likely to be screened; lactose intolerance is a large percentage of black women, leading to less consumption of dairy products with calcium and vitamin D; less likely to receive medication for prevention and treatment; and less likely to engage in physical therapy after a fracture.⁵⁹ The risk of developing breast, uterine, and ovarian cancers varies depending on several factors such as age, family history, and lifestyle choices. However, the combined risk of developing these cancers is not equivalent to the risk of osteoporotic fractures.

Table 2. The Bone Health & Osteoporosis Foundation Guidelines indicate BMD Testing for:

- Women age 65 years and older
- Men age 70 years and older
- Anyone who has broken a bone after age 50 years
- Women age 50-64 years with risk factors*
- Men age 50-69 years with risk factors*

*Examples of risk factors for osteoporosis and fractures include family history of osteoporosis and/or fracture, frequent falling, vitamin D deficiency, smoking, excessive alcohol intake, malabsorption, and some medications, such as prednisone.

Morbidity rates are reported to occur more from hip fractures, and mortality rates occurring after hip fractures are up to 24% in the first year from the fracture;⁵⁸ for at least 5 years afterwards a greater risk of death may exist. Loss of independence and function can be profound among survivors along with the inability to walk independently. For those ambulatory prior to the hip fracture, now one in five require some form of long-term care. Up

to six months following the fracture incidence, 85% require assistance in walking across the room and 33% are solely dependent on nursing home care for one year. Among women over 45 years of age, osteoporosis accounts for more days being spent in hospitals than any other disease including diabetes, myocardial infarction, and breast cancer.⁵⁸ As indicated by statistics across Asia, Europe, Latin America and North America (Figure 9), osteoporosis and its associated morbidity is a growing concern worldwide.

United States

According to the International Osteoporosis Foundation, osteoporosis and low bone mass are currently estimated to be a major public health threat for almost 54 million U.S. women and men aged 50 and older (2010 data). Among the 54 million, 10.2 million adults are estimated to have osteoporosis, of which more than 80% were women. Economic burden was estimated at 17 billion USD in 2005. In a study based on almost 380,000 fractures in female Medicare beneficiaries, 10% had another fracture within 1 year, 18% within 2 years, and 31% within 5 years.⁶¹ Broken bones and serious falls in age 50 and over is the first sign of low bone density and often osteoporosis related.⁶⁰ According to a study by Harvard Medical School, the number of hip fractures worldwide is projected to nearly double by 2050 compared to 2018. The study reviewed more than 4 million cases and highlights an urgent need for better strategies in hip fracture prevention and care. Hip fracture remains a global public health concern contributing to increased dependency, morbidity, and mortality and placing a burden on patients, their families, and health care systems.⁶²

The International Osteoporosis Foundation (IOF) reported that the age-standardized incidence rates in females in Europe ranged from 246 in Romania in 2005–2009 to 677 in Denmark in 2004, per 100,000 population. Compared with Europe, countries in Asia reported lower age-standardized incidence rates in females, ranging from 133 in Philippines in 2001–2005 to 355 in Taiwan in 1996–2000, per 100,000 population. Stable or declining trends have been reported in Europe,

Oceania, and North America, but increasing trends have been observed in Asia. Overall, 4,115,046 hip fractures were identified from 20 databases. Over 70% of fractures occurred in females and more than 40% occurred in people aged ≥ 85 years.⁶²

All of the data reported and reviewed reported incidence rates of hip fractures. The highest age- and sex-standardized incidence rate per 100,000 population was observed in Denmark (315.9), followed by Singapore (314.2) and

Taiwan (253.4) (Table 2 and Fig. S1), and the lowest incidence rate was observed in Brazil (95.1), followed by Thailand (95.2) and the UK (134.0). 54b The age-standardized incidence rates were higher in females than in males in all populations. The incidence of hip fractures increased markedly with increasing age.⁶²

All databases contributed to the projected number of hip fractures in 2030, 2040, and 2050. Excluding Japan and the US Medicare populations, the total number of hip fractures

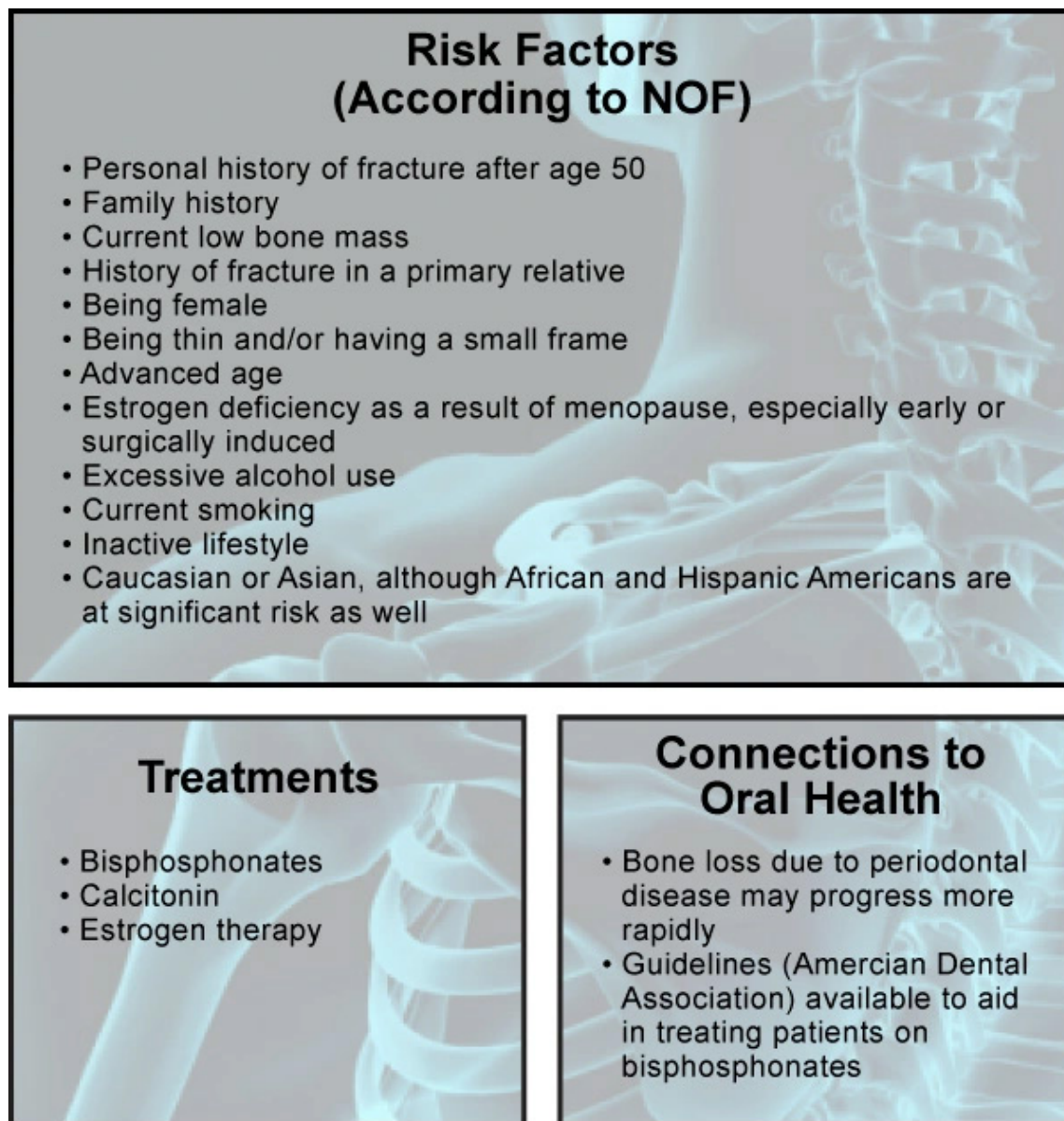


Figure 10. Osteoporosis – Risk Factors, Treatments and Connections to Oral Health.

in all databases projected in 2050 is nearly double the number in 2018 (1.9-fold increase).⁵⁶ Surprisingly, the increase in males (2.4-fold increase) was relatively larger than that in females (1.7-fold increase) (Table 4), and only in Denmark had fewer projected hip fractures in 2050 than in 2018.⁶²

Risk Factors, Prevention, and Treatment (Osteoporosis)

Being female poses a greater risk for developing osteoporosis than male; however, the risk increases in each sex with age. Low bone mass, family history, amenorrhea, estrogen deficiency, cigarette smoking, certain medications, and Caucasian or Asian ethnicity are all risk factors (Figure 10).

Weight loss and low body weight can be associated with an increased risk of fractures due to a greater loss of bone mass.⁶³ Glucocorticoids are a type of corticosteroid hormone that are very effective at reducing inflammation and suppressing the immune system, and are effective immunosuppressants used in a wide variety of diseases.⁶⁴ Glucocorticoid use results in secondary osteoporosis in about 30–50% of chronic glucocorticoid users, and the drugs can cause a rapid decline in bone strength within the first 3–6 months mostly due to increased bone resorption by osteoclasts.⁶⁴ Smoking, a modifiable risk factor, has been identified in leading to lower bone density, as well as it contributes to an early death, tumors, and numerous chronic diseases.⁶⁵ Alcohol consumption continues to increase globally, even though there are considerable negative health effects.⁶⁶ According to animal studies, chronic alcohol consumption has been shown to affect multiple organs, body systems and molecular pathways, including the skeletal system, by disturbing vitamin D metabolism.⁶⁶ Other studies showed that chronic alcohol consumption increases osteoclastogenesis and osteoclast activity in animals and humans. There is also evidence that binge or episodic excessive alcohol consumption leads to similar effects.⁶⁶ A sedentary lifestyle and physical inactivity can contribute to reduced bone quality and increased risk of fractures.⁶⁷ Excessive time spent in sedentary behaviors is

associated with reduced physical functioning and leg blood flow, which could predispose individuals to falls, reduced bone quality, and fracture. Without proper physical activity, bones become weak and thus can fracture easily.⁶⁷ In this study of over 77,000 women, regular physical activity and less sedentary time was associated with reduced risk of fracture in older women.

While there is no cure for osteoporosis, prevention and treatment is available. It is estimated that 85–90% of the adult bone mass is gained during the first two decades of life. Before age 20 is when most skeletal mass forms; therefore, preventive measures are important to implement at even young ages. Eating a diet rich in calcium, vitamins D and K, avoiding smoking or excessive use of alcohol, and exercising regularly (including weight-bearing exercises) are important preventive steps. Childhood and adolescence are critical periods of bone mineral content accumulation that may have long-term consequences for osteoporosis in adulthood, as the maximum rate of bone mass accumulation is during early adolescence. Adequate dietary calcium intake and weight-bearing physical activity are important for maximizing bone mineral content growth.⁶⁸ Daily calcium enriched foods, milk, and supplementations with calcium have shown enhanced rates of bone mineral acquisition in children and adolescent studies (See Figure 11).⁶⁹ While some older studies show some benefit of calcium supplementation, a 2015 systematic review showed that dietary calcium intake is not associated with risk of fracture, and there is no clinical trial evidence that increasing calcium intake from dietary sources prevents fractures. Evidence that calcium supplements prevent fractures is weak and inconsistent.⁷⁰ The ageing process has been connected with physiological and psychological changes that affect the efficiency of older adults, and their health issues become more chronic and complex. Among other nutritional issues, an increased risk of malnutrition, which is associated with poor quality of life, reduced functional ability, and premature mortality occur in older adults.⁷¹ Good nutrition is an essential component for any successful rehabilitative program; however, it is critically

important in the frail, elderly, and osteoporotic risk patients where poor nutritional levels can impair healing and increase further susceptibility to future fractures.⁷¹

- Calcium intake should include about 3 servings of dairy or calcium-fortified dairy substitutes such as soymilk beverages or calcium fortified juices and cereals.
- Adequate vitamin D intake requires multiple daily servings of milk or vitamin D fortified foods or consideration of a supplement, especially in low exposure situations.
- If uncertain as to the calcium or vitamin D content of a food, check the food label to identify calcium and vitamin D content.
- Limit soda intake to at most one serving daily if it cannot be completely excluded.
- Recurrent or unexpected fractures should be evaluated for possible bone loss disorders including biochemical evaluation and possible bone mineral content measurement using DXA with age-appropriate standards.
- Children with chronic illnesses should be assessed usually via DXA for possible bone demineralization using age appropriate standards especially if receiving a medication known to be associated with bone loss.

Figure 11. Prevention of Osteoporosis^{61,63,69}

Physical activity and fitness exercise programs have been shown to reduce the risk of osteoporosis,⁷² and epidemiological evidence has suggested that physical activity can assist in reductions of hip fractures in both women and men in so much as strengthening back muscles and improving strength and function.⁷³ Changes in regular physical activity status were associated with the risk of hip fracture, consistent in regular physical activity was related to the maximum benefit for risk reduction in the general population.⁷³ With therapeutic exercise assisting in maintaining or increasing bone mineral density in postmenopausal women⁷⁴ studies have shown that Tai Chi may be an optional and safe exercise for improving bone mineral density (BMD) loss in postmenopausal women, and practicing Tai Chi for more than 6 months may yield greater benefits.⁷⁵ In the pivotal 2004 Nurses Health Study, it was reported that women who walked at least four hours weekly experienced a 40% reduction in the risk of hip fractures.⁷⁶ It is important to value daily exercise with any age group, especially during the childhood and adolescent years where bone mass, strength, and balance develop into essential elements necessary for maintaining bone density in the aging years.

Early screening with a DEXA scan measuring bone density in critical areas of the body such

as the hip and spine is recommended. It is a painless, non-invasive test that takes about 20 minutes. Follow-up DEXA scans should be performed in women who develop bone mass loss. Changes in height or complaints of back pain can require consulting with a physician and healthcare professionals about x-ray and bone density measurements to determine if a fracture is present. Monitoring bone health is essential and a baseline DEXA scan can be performed for women who experience premature menopause.

Once diagnosed, treatments for osteoporosis may include oral bisphosphonates (Actonel®, Actonel® with Calcium, Fosamax® or Fosamax Plus D, Boniva®, Reclast). Intravenous bisphosphonates (Zometa®, Aredia®) are used for patients with metastatic cancer and Paget's disease and in some cases are used by physicians for osteoporosis. Calcitonin or Fortical®, an injectable or nasal spray, Reclast, an intravenous infusion once yearly, Foreto, a daily subcutaneous injection, Prolia, an intra-muscular injection administered every 6 months, Selective Estrogen Receptor Modulators (Evista®) and Hormone Therapies (HT) have also been used. Controversial theories exist around the use of HT's resulting in physicians prescribing treatment based on individual needs, whereas communication and patient advocacy are essential.

The Oral Connection (Osteoporosis)

Osteoporosis is a widespread disease affecting millions of people. If diagnosed early, it can be treated to prevent fractures. Understanding that osteoporosis acts as a 'silent disease' validates the importance for dental professionals to closely monitor high risk patients exhibiting osteoporotic risk factors. Dental professionals should pay particular attention to attachment levels, rapid bone loss, and/or tooth mobility in their female patients who are post-menopausal and high risk for osteoporosis.

Findings from a cross-sectional study of 1256 postmenopausal women ranging in ages between 53 and 83 have indicated the prevalence of specific bacteria identified with a periodontal infection and oral bone loss.

The strongest association between the bacterial infection and oral bone loss was discovered in overweight women who demonstrated the periodontal species, *T. forsythensis*. Since the greatest risk was identified among overweight women, future research should evaluate the impact of weight and body mass index (BMI) on the links between oral bone loss and bacterial infections.⁷⁷ Not every patient with osteoporosis will exhibit oral signs; nevertheless, when clinical and radiographic examinations, risk factors, and medical history findings identify concerns, dental professionals should refer to a physician for further medical assessments.

There has been much discussion as well as confusion regarding treatment of dental patients taking bisphosphonates. A report issued in August 2007 by a multi-disciplinary task force of the American Society for Bone and Mineral Research is a useful resource.⁷⁸ In addition, both the National Osteoporosis Foundation and the American Dental Association (ADA) have issued treatment guidelines for patients on intravenous bisphosphonates and oral bisphosphonates.^{79,80}

The ADA expert panel recommends conducting a comprehensive oral evaluation prior to the beginning of bisphosphonate therapy (oral or intravenous) if possible, or as soon as possible after the initiation of therapy. Patients should also be educated on maintaining good oral hygiene. In general, the panel felt routine dental treatment should not be modified based only on the patient's use of oral bisphosphonates. However, dentists treating patients receiving intravenous bisphosphonates are advised to avoid invasive dental procedures while patients are receiving treatment, if possible. Professional judgment must obviously be used to determine the need for invasive treatment based on the patient's individual situation.

The US Surgeons General Carmona (2002-2006) said it best, "Osteoporosis isn't just your grandmother's disease. We all need to take better care of our bones. The good news is that you are never too young or too old to improve your bone health. With healthy nutrition, physical activity every day, and

Table 3. Bisphosphonate Preparations by Name.

Generic Name	Trade Name	Clinical Indication
Oral bisphosphonates 1. Alendronate 2. Risedronate 3. Etidronate 4. Ibandronate 5. Clodronate 6. Tiludronate	<i>Fosamax, Actonel, Didronel, Bondronat, Bonviva, Bonefos, Loron, Clasteon, Skelid</i>	Treatment of osteoporosis and corticosteroid-induced osteoporosis, Paget's disease.
Intravenous bisphosphonates 1. Pamidronate 2. Zoledronate 3. Clodronate 4. Ibandronate	<i>Aredia, Zometa, Aclasta Bonefos, Loron, Clasteon Bondronat, Bonviva</i>	Hypercalcaemia of malignancy, osteolytic lesions, Paget's disease, skeletal metastases, osteoporosis (at lower frequency and dose).

Source: Kavitha Ganesan; Amandeep Goyal; Douglas Roane. Bisphosphonate. National Library of Medicine. Last Update: July 3, 2023. Accessed October 30, 2023.

regular medical check-ups and screenings, Americans of all ages can have stronger bones and live longer, healthier lives.”

The Dental Professional's Role

Dental professionals have a unique opportunity not only to influence patients' oral health status but also their quality of life. Understanding the relationship between oral health and systemic health allows us to assess, diagnose, and treat in a comprehensive manner rather than focusing solely on the oral cavity.

- **Assessments** – It is imperative to ask patients about any pre-existing medical conditions, medications, and other treatments that could impact oral health. Ascertaining patient compliance to medications and therapy is also helpful information to collect.
- **Screening** – Screening is one of the most critical steps to identify early stages of disease. Examples of screenings that can be done in the dental office include oral cancer evaluations, blood pressure monitoring, and/or bone density testing.
- **Education** – Several organizations distribute patient handouts, videos, and other materials for patients to read or access via the Internet. The ADA and the American Dental Hygienists' Association have online patient information (www.ada.org and www.adha.org) and www.dentalcare.com offers more than 150 continuing education courses; patient educational materials, along with oral health instructional videos and materials customized specifically for children.
- **Referrals** – Dental professionals should refer patients to the physician or the appropriate healthcare provider if a clinical examination or screening test suggests presence of a systemic disease.
- **Treatment planning** – Recall frequency, treatments, and home care products can be tailored to the patient's health status and perceived compliance.

Oral Hygiene Products for Home Care

Home care products to control plaque biofilm and maintain good oral health are a critical part of treatment planning. This is particularly important for older patients who have a higher prevalence of medical health issues. Dental professionals should consider a regimen that involves products to improve periodontal health, reduce the risk of dental caries, reduce sensitivity, and alleviate xerostomic conditions.

Mechanical Removal of Plaque Biofilm

Controlling plaque biofilm interdentally is vital to good oral health. We know that plaque biofilm accumulation is a significant factor in the development of periodontal and peri-implant disease. The 2017 periodontal disease classification system developed cooperatively by the American Academy of Periodontology (AAP) and European Federation of Periodontology.⁸¹ The updated classification system uses four stages and three grades to describe disease status. The stages are based on the severity of the disease as established by the loss of the interdental clinical attachment, radiographic loss of bone, and/or loss of teeth, difficulty of management, and extent or dissemination of disease measured.

- **Power toothbrushes**– Many power toothbrush technologies can provide more effective plaque removal than manual brushes. Certain power toothbrush models have compliance-enhancing features such as timers and multiple brushing modes. Power brush technologies available today include rotating, counter-rotational, sonic, ultrasonic, and oscillating-rotating. Results from an independent systematic review by the **Cochrane Collaboration** showed power toothbrushes with oscillating-rotating action removed plaque and reduced gingivitis more effectively than manual toothbrushes. No other power designs were as consistently superior to manual toothbrushes.^{82,83} In addition, there are new products available that are fully automated with individualized mouth pieces. One cleans the upper and lower arch in 10 seconds simultaneously.⁸⁴ Another product, Proclaim, claims to provide consistent, effective at-home oral care in

just 7 seconds a day.⁸⁵ Each user has their own Proclaim mouthpiece, created from an intraoral scan, with up to 60 jets placed interproximally, both lingual and facial surfaces. According to the study, subjects who were assigned to the Fresh + Manual Toothbrushing group showed significantly greater reductions in gingival inflammation, gingival bleeding, plaque accumulation, BOP, and pocket depth measurements than those in the MTB and floss + MTB groups.⁸⁵ Other “brushes” of this type have come and gone, with some still making a debut on Amazon or other websites.⁸⁶

- **Interdental cleaning** must be individualized in order to ensure compliance with our suggestions. Methods include: floss; a rubber tip; an interdental brush; an oral irrigator; or wooden sticks. Compliance with regular flossing has been far less than ideal. The routine use of dental floss has been shown to be in a range of daily use among adults ranging from 10% to as high as 30%.⁸⁷ A 2015 study concluded that inter-dental cleaning with interdental brushes is the most effective method for inter-dental plaque removal.⁸⁸ The majority of available studies in this meta-review did not demonstrate that flossing is generally effective in plaque removal. A Cochrane Database of Systematic Reviews recently summarized the research on interdental biofilm control devices for self-care that impact periodontal disease and caries. The authors warned there were weaknesses in most studies and found that generalizing to all populations challenging.⁸⁹ The general conclusion was that the use of dental floss or interdental brushes, in addition to toothbrushing, may reduce gingivitis or plaque, or both, more than toothbrushing alone.

Chemotherapeutic Inhibition of Plaque Biofilm

- **Chemotherapeutic dentifrices** containing stannous fluoride are used to inhibit plaque regrowth between brushings and to reduce gingival inflammation and bleeding.⁹⁰ Stannous fluoride also offers protection from sensitivity⁹¹, a common condition reported to be even more prevalent among older patients

and those with periodontal disease⁹², in addition to its caries and gingival health benefits.⁹³ The latest stannous fluoride dentifrice technologies include; Crest Pro-Health Gum Detoxify™ and Colgate Total SF™.

- **Chemotherapeutic rinses** are another important home care product often recommended in either prescription or over-the-counter versions.⁹⁴ Dental professionals generally view chlorhexidine — now available in alcohol and alcohol-free forms — as the gold standard due to its efficacy and substantivity. However, its use is often limited to short-term use due to extrinsic stain and compliance challenges with taste. Other safe and effective options for long-term maintenance are over-the-counter chemotherapeutic rinses Cetylpyridinium chloride (CPC) is a broad spectrum antimicrobial available in an alcohol-free formulation. The alcohol-free form may provide a more pleasurable rinsing experience for patients with soft tissue sensitive to alcohol. Essential oils rinses containing alcohol are also available over-the-counter. Research demonstrates significant reductions in plaque and gingivitis for CPC and essential oils rinses when formulated appropriately.^{95,96} A recent study on an essential oil mouthrinse showed that, at 6 months, subjects had nearly 5 times more plaque-free sites versus mechanical method subjects, and over 2 times more healthy gingival sites vs mechanical methods as well.⁹⁶

Dry Mouth Aids and Fluorides Aids for Xerostomia

It is estimated that 30% of the population 65+ is likely to suffer with xerostomia and salivary gland hypofunction. Systemic conditions as well as local factors have been reported to impact xerostomic patients, placing them at a higher risk for plaque and caries due to a lower oral pH.⁹⁷ Other complications of decreased salivary flow include persistent sore throat, difficulty speaking, hoarseness, and oral candidiasis. Various forms of salivary stimulants, including sugar-free chewing gum and candy, may help stimulate saliva if glands function

properly. Specialized rinses, dentifrices, and liquid moisturizers are marketed to relieve symptoms and protect against xerostomic conditions.

Fluoride Treatments

Root caries is a growing concern among aging patients. In-office or take-home fluoride treatments often containing acidulated phosphate fluoride, neutral sodium fluoride, or stannous fluoride can be useful for these patients. Forms include gels, varnishes, pastes, rinses, or foaming solutions. Dental professionals may choose to treat high risk patients with a combination of in-office and at-home treatments.

Staying Informed

The plethora of literature on the oral-systemic connection challenges dental professionals to differentiate fact from fiction. Further complicating the issue, patients can obtain information as rapidly as dental professionals with the speed of the digital information highway. Table 4 lists several resources to help dental and medical professionals stay current with valid, credible research related to oral and systemic health. There are unprecedented opportunities for dental professionals to provide individualized care when addressing patient's oral care needs. All patients, female and aging alike have unique

health needs indicative of specialized care. With numerous research findings revealed each day, our role as a dental professional is exciting and challenging as we continue to understand oral discoveries and systemic relationships. We as professionals will continue to evolve to best assist our patients in achieving optimal oral health and overall well-being.

Table 4. Web Sites Related to Oral and Systemic Health.

- www.heart.org, Cardiovascular disease
- www.diabetes.org, Diabetes
- www.americanbonehealth.org, Osteoporosis
- www.nof.org, Osteoporosis
- www.asbmr.org
- www.womenshealth.gov
- www.globalhealth.gov/worldhealthstatistics.shtml
- www.who.int/whosis/en
- www.acl.gov
- www.cochrane.org
- www.dentalcare.com
- [*Diabetes testing in the dental office*](#)
- [*Blood Glucose Monitoring in the Dental Office*](#)
- [*American Diabetes Association Releases 2023 Standards of Care in Diabetes to Guide Prevention, Diagnosis, and Treatment for People Living with Diabetes | ADA*](#)

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: www.dentalcare.com/en-us/ce-courses/ce302/test

- 1. According to a recent study, periodontal disease does NOT play a role in the progression of this systemic condition?**
 - A. Alzheimer's disease
 - B. Inflammatory bowel diseases
 - C. Leukemia
 - D. Oral cancer
- 2. Cardiovascular disease is now the leading cause of death among American women, followed closely by ____.**
 - A. Lupus
 - B. Alzheimer's Disease
 - C. COVID-19
 - D. Cancer
- 3. According to a study funded by the British Heart Foundation and carried out at the University of Leeds, women have a ____ higher chance than men of receiving the wrong initial diagnosis following a heart attack.**
 - A. 100%
 - B. 70%
 - C. 50%
 - D. 25%
- 4. According to the WHO, ____ worldwide will contribute to the single greatest cause of death and disability with a projected 7 million deaths yearly by 2030.**
 - A. COVID-19
 - B. Tobacco use
 - C. Heart disease
 - D. Stroke
- 5. Which of the following is NOT a typical symptom of cardiovascular disease observed in women?**
 - A. High blood pressure
 - B. Shortness of breath
 - C. Unusual fatigue
 - D. Crushing chest pain
- 6. Calcium channel blockers (Calan®, Procardia®, Cardizem®) are used to dilate coronary arteries that in turn decrease blood flow to the heart.**
 - A. True
 - B. False
- 7. Research has shown that stem applications can repair damaged heart tissue and generate new blood vessels.**
 - A. True
 - B. False

- 8. Hypertensive disorders of pregnancy are not rare conditions and are the second leading cause of maternal death after:**
- A. Maternal hemorrhage
 - B. Polycystic ovary syndrome
 - C. Adverse pregnancy outcomes
 - D. Glioblastoma
- 9. Hypertension treatment in pregnancy is not safe, and may increase maternal heart risks.**
- A. True
 - B. False
- 10. Periodontal disease is an important risk factor for total cerebrovascular accidents (CVA) and, in particular:**
- A. TIA
 - B. Hemorrhagic stroke
 - C. Non-hemorrhagic stroke
 - D. Intracerebral hemorrhage
- 11. Endothelial function of arteries is an important factor in CVD. Periodontal therapy does not affect endothelial function patients with severe periodontitis.**
- A. True
 - B. False
- 12. It is believed the inflammatory process in periodontal disease and the specific bacteria destroying gingival tissues is what triggers host responses to rupture atherosclerotic plaques thus worsening the level of CVD in a heart patient.**
- A. True
 - B. False
- 13. The important hormone used to regulate blood sugar is _____.**
- A. Thyroxin
 - B. Micronase
 - C. Vasotec
 - D. Insulin
- 14. Which of the following is NOT true regarding women and diabetes, according to the Center for Disease Control?**
- A. Women with diabetes have better outcomes after a heart attack than men
 - B. The seventh leading cause of death among American women
 - C. The fourth leading cause of death among Hispanic and African American women
 - D. It increases the risk of heart disease by about four times in women
- 15. Commonly recognized oral conditions associated with diabetes can include which of the following?**
- A. Pink, stippled tissues
 - B. Acute gingival and/or periodontal abscesses
 - C. Viral infections
 - D. Excessive saliva

- 16. Which of the following is NOT a risk factor for osteoporosis?**
- A. Estrogen deficiency
 - B. Caucasian or Asian ethnicity
 - C. Certain medications
 - D. Weight bearing exercises.
- 17. Dentists treating patients receiving intravenous bisphosphonates are advised to avoid invasive dental procedures while patients are receiving treatment.**
- A. True
 - B. False
- 18. Which of the following is NOT included in the 2017 updated periodontal disease classification system?**
- A. Five stages and four grades to describe disease status
 - B. Severity of the disease
 - C. Loss of the interdental clinical attachment
 - D. Radiographic loss of bone, and/or loss of teeth.
- 19. Results from an independent systematic review by the Cochrane Collaboration showed power toothbrushes with oscillating-rotating action removed plaque and reduced gingivitis more effectively than manual toothbrushes.**
- A. True
 - B. False
- 20. Which is the leading cause of death among women?**
- A. Breast Cancer
 - B. Lung cancer
 - C. Diabetes
 - D. Cardiovascular disease including high blood pressure, stroke and coronary heart disease.

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Additional Resources

- No Additional Resources Available.

About the Authors



Maria Goldie, RDH, MS, FADHA

Maria graduated from the University of Pennsylvania, School of Dental Hygiene & is the recipient of the 1999 University of Pennsylvania Dental Hygiene Alumni Achievement Award. She is also a 2003 winner of the Pfizer/ADHA Award for Excellence in Dental Hygiene and the 2011 Alfred C. Fones Award. She was awarded the first ever “2016 Distinction in Service Award” from the International Federation of Dental Hygienists in June, 2016 Presidential Citation in 2018 from ADHA. She earned her BA in Health Services Administration from Saint Mary’s

College and a MS in Health Science from San Francisco State University. Maria is a graduate of the 2004-2006 fellowship of the California Health Care Foundation’s (CHCF) Health Care Leadership Program, administered by the Center for Health Professions at the University of California, San Francisco, a two-year program. She is the owner of Seminars for Women’s Health and Sex Based Medicine, whose goal is to educate professionals about the differences in health and disease between men and women, communication styles, and the link between oral and general health.

As a noted researcher, author, and speaker, Maria has presented seminars nationally and internationally on topics such as Women’s Health and Wellness, Cancers and Oral Care for the Cancer Patient, Oral Cancer, Enamel Therapy, and Immunology and Periodontal Disease. Maria was a member of the National Advisory Committee for the Robert Wood Johnson Foundation’s Smoking Cessation Leadership Center. She conducted research with the late Dr. Margaret Walsh on smokeless tobacco at the University of California, San Francisco.

Maria is co-editor of the textbook: Dental Hygiene – Applications to Clinical Practice. Maria is co-founder of the International Dental Hygiene Educator’s Forum (IDHEF), the seventh meeting to be held in New Orleans in 2024. Maria served as the 1997-98 President of the American Dental Hygienists’ Association (ADHA), served on an advisory panel to develop “The Future of Dental Hygiene Report”, and was the President of the International Federation of Dental Hygienists (IFDH) 2010-2013.

Updated: December 2023

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Pam Hughes, RDH, MS

The P&G team wishes to express its sadness over the loss of our colleague and friend, Ms. Pam Hughes, on December 14, 2017. She was a dedicated, passionate dental hygiene educator and clinician who touched so many lives through her teaching and patient care. We will miss her.

Pam was a recognized speaker throughout the United States on advances in therapeutic oral care products, women’s aging complexities, oral risk assessment and improving patient care with evidence-based decision making. She was a past President of the California Dental Hygiene Educators’ Association and the California Dental Hygienists’ Association.

Pam was clinically active in a general practice with over 37 years of experience and held a faculty position in the BSDH and MSDH graduate program at the Ostrow School of Dentistry of University of Southern California in the Division of Periodontology, Diagnostic Sciences and Dental Hygiene. Pam was the recipient of the 2016 Most Outstanding Part-time Faculty award and the 2017 Excellence in Teaching Award.