2013

Cardiologists referring patients for periodontal evaluation

Valerie Maxey
Eastern Washington University

Cardiologists Referring Patients for Periodontal Evaluation

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Masters of Science

in

Dental Hygiene

in the

College of Graduate Studies

Eastern Washington University

by

Valerie Maxey, BSDH

June 13, 2013

Major Professor:

Ann O'Kelley Wetmore, RDH, BSDH, MSDH

THESIS OF VALERIE MAXEY APPROVED BY

_____ DATE_____
Ann O'Kelley Wetmore, RDH, MSDH, GRADUATE STUDY COMMITTEE

_____ DATE_____
Lisa Bilich, RDH, MEd, GRADUATE STUDY COMMITTEE

_____ DATE_____
Tanya LaPier, PT, PhD, CCS, GRADUATE STUDY COMMITTEE

MASTER'S THESIS

In presenting this thesis in partial fulfillment of the requirements for a master's degree at Eastern Washington University, I agree that the JFK Library shall make copies freely available for inspection. I further agree that copying of this project in whole or in part is allowable only for scholarly purposes. It is understood, however, that any copying or publication of this thesis for commercial purposes, or for financial gain, shall not be allowed without my written permission.

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Human Subjects Approvals

Eastern Washington University
at Cheney and Spokane

MEMORANDUM

To: Valerie Maxey, Department of Dental Hygiene, 160 HSB

From: Sarah A.C. Keller, Chair, Institutional Review Board

Date: February 26, 2013

Subject: Expedited Review of *Cardiologist Referring to Periodontists* (HS-4161)

The Institutional Review Board for Human Subjects' Expedited Review Committee has reviewed your proposal to assess the knowledge level and interest of cardiologists in addressing the relationship of periodontal inflammation and heart disease with their patients.

The Expedited Review Committee has approved your application subject to the conditions noted below; a signed, approved copy of your application is enclosed.

Before you begin:

1. In your application, section IV B, you say audio files will be erased after transcription, in section IV D you say all audio files will be kept for three years according to US HHS. Please clarify.
2. We will need your recruiting script for when you first contact the cardiologists. This can just be a bulleted list that covers the points you are going to make so that you will be consistent in what you tell each of them.
3. After discussion Ruth Galm and I decided that you may use oral consent, following the script you have provided, as we do not feel that the risk level to the subjects is more than minimal. For your own protection, however, we recommend that you use a written consent form so that you have documentation that the subject consented to participate and was aware of the nature and protocol of the study. Please advise as to which you are going to do.
4. If you do use a written consent form, you will need to make the following changes to the one you have provided:
    a. Please provide contact information for both yourself and Dr. Wetmore so that subjects may contact you if they have questions.
    b. Under Purpose and Benefits, please include a sentence that says you are doing the study in partial fulfillment of the requirements for your Master's degree.
    c. Under Procedures, the second from last sentence about asking questions isn't clear. Do you mean this in general or are you speaking about the details of the procedures.

d. Under Risk, Stress or Discomfort, second sentence, you are the Principal Investigator.
e. Under Other Information, please capitalize Principal Investigator.
f. This study is confidential not anonymous as you can associate a subject's data with that person.
g. In the subject's statement, please remove the rubric (as appropriate) from that sentence.

5. You indicate in your Interview Guide that the first thing to do is turn on the recorder. You mustn't turn on the recorder until the subject has had an opportunity to ask and have satisfactory answers to any questions s/he might have, and have either signed the consent form giving permission to record or have orally given permission to record. The recorder can only be turned on when the actual interview begins.
6. Whether you use an oral or written consent, it might be useful to send a copy of the interview questions to the cardiologist prior to being interviewed. It may help them decide whether or not they want to participate and will give them more time to consider their answers. This is not required, only a suggestion.
7. Would you please send us a memo addressing the above questions and a copy of the revised consent form if you are going to use one.

Human subjects research approval granted by the IRB is good for one year from the date of approval, to February 26, 2014. If research is to continue, with no substantial changes, beyond that date, a renewal of IRB approval must be obtained prior to continuation of the project (contact OGRD for procedure). If, subsequent to initial approval, a research protocol requires minor changes, the OGRD should be notified of those changes. Any major departures from the original proposal must be approved by the appropriate review process before the protocol may be altered. A Change of Protocol application must be submitted to the IRB for any substantial change in the protocol. The Director, Grant and Research Development, or the Chair of the IRB will determine whether or not the research must then be resubmitted for approval.

If you have additional questions please contact me at 509-359-7039; fax 509-359-2474: email: skeller@ewu.edu. It would be helpful if you would refer to HS-4161 if there were further correspondence as we file everything under this number. Thank you.

cc: R.Galm
R.Stolberg
A.Wetmore
Graduate Office

Memorandum

To: Sarah A.C. Keller, Chair, Institutional Review Board

From: HS-4161 Valerie Maxey, Department of Dental Hygiene, 160 HSB

Date: February 27, 2013

Subject: Conditions for IRB approval of proposal

Thank you for your approval of my proposal. I will address the conditions for approval here.

1. Section IV has been changed to read:
   Actual name of respondent/participant will be removed during the coding process at the time of transcription. Transcription will occur immediately after the interview. The audio files will be saved on external USB drive after transcription. The USB drive with all interview recordings will be kept at the PI's place of residence for three years after the conclusion of the research. This USB drive will be stored in locked fireproof safe.
2. Recruiting script for contact with cardiologists.
   - "My name is Valerie Maxey; I am a dental hygienist completing my Master's degree in Dental Hygiene. I am conducting research for my thesis on Cardiology and Dentistry and interprofessional collaboration.
   - This is a qualitative study and I would greatly appreciate an opportunity to interview you for my research.
   - The interview could be in person, telephone or Skype.
   - The time involved would be less than 1 hour and can be conducted at your convenience and at a location that works with your schedule.
   - Your responses and information will be kept confidential and only used by me to assess your beliefs and experiences in regards to this topic.
   - I can send you my interview questions prior to our interview so that you may know the type and content of the questions.
   - Are you agreeable to participate in my study?
3. I have chosen to obtain oral consent. Can this be done via audio recording? Your memo states that I mustn't turn on the recording device until the subject has had an opportunity to ask and have satisfactory answers to any questions. However, if I do all this with the recorder turned on, then I have proof of consent on the audio recording, which I will be keeping for three years.

Thank you again for your approval and for your suggestions on my research.

From: Keller, Sarah

Sent: Wednesday, February 27, 2013 5:10 PM

To: Wetmore, Ann

Subject: Re: IRB conditional approval for HS-4161(Maxey)

Ann—she can record their consent agreement just before the interview begins but she should do everything else, e.g., answering all their questions, etc., before she turns the recorder on and she should inform them when she is turning it on so she has their permission to record. She may begin her research. Sarah Keller

On 27/02/2013 17:00, "Wetmore, Ann" <awetmore@ewu.edu> wrote:
Hi all,
Please find attached Valerie's response to IRB questions.

as always, **ann**

Ann O'Kelley Wetmore MSDH, RDH
Assistant Professor
Director BSDH Degree Completion Program
Eastern Washington University
Department of Dental Hygiene

From: Keller, Sarah
Sent: Tuesday, February 26, 2013 4:17 PM
To: Maxey, Valerie; Wetmore, Ann; Stolberg, Rebecca; Dalla, Ronald
Subject: IRB conditional approval for HS-4161(Maxey)

Please see attached IRB conditional approval for HS-4161(Maxey). Sarah Keller

Abstract

The association of periodontal disease and atherosclerotic vascular disease is proven in current scientific literature, however there is no empirical evidence that suggests cardiologists recognize this association or collaborate with dentists to address this association for patients. This study utilized qualitative research method to investigate the current beliefs and practices of five cardiologists. Using a standardized open-ended interview technique, the cardiologists were asked 12 interview questions designed to answer three research questions. Grounded theory method of analysis was followed in order to generate theories to answer the research questions. Results imply that while cardiologists accept the oral-systemic link as associative and relevant to cardiovascular disease, they are not convinced treating periodontal disease or collaborating with dentists will affect health outcomes for their patients. Theories to support this finding are: (a) lack of time; can only focus on well known risk factors, (b) if something is obvious about the oral health, it will be discussed with the patient, (c) adhere to practice standards and guidelines, and (d) collaboration will only happen if the dentist initiates it. The findings suggest the dental team needs to be prepared to address the oral-systemic link with patients because they are not likely to hear it at the cardiology office. Additionally, because cardiologists are not formally trained to detect all types of oral infection, and do not routinely refer to dentists for evaluation; they are missing an opportunity to reduce inflammation that may improve health outcomes.

Acknowledgments

Gratitude for direction and support given by my thesis committee chair, Ann O'Kelley Wetmore, MSDH, is first and foremost. Her dedication to my success has been valued since I began this journey. Through her guidance, suggestions, teaching, leading, and synthesizing, I have an original research study that I hope will make an impact in health care and make her proud. I also acknowledge my second and third committee members, Lisa Bilich, MS, and Dr. Tanya La Pier, whose time and expertise filled in the holes where needed. Cardiologists are one of the busiest groups of physicians there are, with heart disease being the number one killer; therefore, I cannot over emphasize my thankfulness to the five participants of this study who allowed me some of their valuable time. Thank you to the entire Eastern Washington University Dental Hygiene Department for their commitment to my success as a researcher and lifelong learner.

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List of Abbreviations

AAOS……..American Academy of Orthopedic Surgeons

ACGME…..Accreditation Council for Graduate Medical Education

ADA……American Dental Association

ACTA……..Academic Center for Dentistry Amsterdam

AHA……American Heart Association

ASVD……..Atherosclerotic Vascular Disease

CAD……Coronary Artery Disease

CHF……Congestive Heart Failure

CHD……Coronary Heart Disease

CODA…….C-Reactive Protein

CWRU……Case Western Reserve University

CVD……Cardiovascular Disease

DDS……Doctor of Dental Surgery

DMD……..Doctor of Dental Medicine

EHR……...Electronic Health Records

EWU……..Eastern Washington University

ICD……Implantable Cardioverter Defibrillator

IE……...Infective Endocarditis

IL-6……...Interleukin 6

IPE……Interprofessional Education

IRB……...Institutional Review Board

OSL……...Oral-Systemic Link

PAD……..Peripheral Artery Disease

PD……..Periodontal Disease

PI……...…Primary Investigator

NUG……..Necrotizing Ulcerative Gingivitis

NUP……..Necrotizing Ulcerative Periodontitis

U of W.....University of Washington

WHO…....World Health Organization

Introduction

Introduction to the Research Question

Research suggests a relationship between periodontal inflammation and cardiovascular disease (Buchmann, Hasilik, Van Dyke, & Lange, 2002; Ebersole, Machen, Steffen & Willmann, 1997; Genco, Beck & Offenbacher, 2002; Wu et al., 2000). However, there is no empirical evidence that suggests cardiologists understand or value this connection often termed the Oral-Systemic Link (Genco & Williams, 2010). Assessment of the information cardiologists possess regarding the oral-systemic link between periodontal infection and cardiovascular disease is important to determine why they may or may not refer to an oral health care provider when developing comprehensive care plans for their patients who exhibit risk factors for or have cardiovascular disease. Additionally, study data revealed barriers to interprofessional collaboration between the medical and dental fields. Patients benefit when health care providers work together and depend on each other to use their expertise (WHO, 2010). This benefit is realized in improved health outcomes for patients and a strengthened health care system that better serves the community (WHO, 2010). If potential barriers to this collaboration are understood, perhaps oral health care providers can work toward alleviating this phenomenon.

Background of Study

The purpose of this study was to assess the knowledge level and interest of cardiologists in addressing the relationship of periodontal disease and heart disease with their patients. This study aimed to determine what cardiologists know about the oral-

systemic link as it relates to cardiovascular disease. Additionally, the investigator intended to determine if cardiologists inquire of a patient if they have periodontal disease; furthermore do they examine the mouth of their patient? In addition, this study strived to provide evidence about the level of desire for cardiologists to collaborate with dentists or dental hygienists in providing care for their patients. It is anticipated study results will provide data to enlighten both the fields of cardiology and dentistry on the need for bi-directional referral of patients with comorbidities of periodontal and cardiovascular disease. Collaborative care across the professions of medicine and dentistry may result in additional positive outcomes of therapy and overall improvement of health.

Statement of the Problem

The Oral-Systemic Link (OSL) is well established in the research (Billings, 1916; Barnett, 2006; Ebersole, Machen, Steffen & Willmann, 1997; Genco, Beck & Offenbacher, 2002; Mattila, et al.; Wu et al., 2000). Investigating the beliefs and opinions held by cardiologists regarding periodontal inflammation and cardiovascular disease risk may be important to understanding possible barriers to interprofessional collaboration. Oral health care providers are trained to address oral infection. Cardiologists are trained to address cardiovascular disease. Both diseases are inflammation driven (Shanies & Hein, 2006). Both professions focus on therapies that reduce inflammatory response. Yet, there is no evidence to suggest collaboration for better patient health outcomes. When barriers are identified and understood, perhaps oral health care providers can work toward eliminating them.

Significance of the Study

To date there have been no studies of the qualitative nature to investigate the phenomenon resulting in the lack of collaboration between the fields of cardiology and dentistry. This study endeavored to understand and explain to both professions how collaboration may improve health care outcomes for their mutual patients. This information will be important to students of dentistry, dental hygiene, medicine, and cardiology. In addition, current practitioners and educators may find the results helpful in improving collaboration. Becoming aware of the origins of possible misconceptions helps the professions move past any misunderstandings that hinder our goal of optimum patient health. The overall goal being improved health outcomes for patients suffering from cardiovascular disease and periodontal disease. Additionally, this information may help prove the need for changes in medical and dental education concerning interprofessional collaboration.

Overview of the Methodology

This study was conducted using a qualitative research methodology. This method is the best option to investigate the many dimensions of the research problem. The researcher strived for objectivity and did not allow personal biases to influence the information gathered. The investigator interviewed cardiologists to ascertain their perceptions of the oral-systemic link. Interview questions were designed to garner the most information on how this oral-systemic link determines therapy recommendations of cardiologists for patients with cardiovascular disease. Data analysis included looking for patterns and synthesizing responses of cardiologists using grounded theory (Glaser & Strauss, 1967).

Delimitations of the Study

Due to the large number of potential subjects for this study, only cardiologists were recruited and enrolled as participants. A cardiologist is most often the provider to administer tests and evaluate persons with suspected cardiovascular disease. Cardiologists are responsible for educating patients on the disease process, risk factors and recommend treatment. Therefore, other healthcare professionals including cardiac surgeons were not included in the study.

For pragmatic purposes, the primary investigator used a convenience sample of cardiologists. In qualitative research, a sample can be one or more, however, in this study the primary investigator conducted interviews until data saturation was reached. Only cardiologists who were willing to participate in this study and who live in a geographic area where the primary investigator could easily conduct a face-to-face interview were enrolled.

Definition of Key Terms and Operational Definitions

1. Periodontal Disease (PD): A bacterial infection that results in inflammation of gingival tissues. As the disease progresses into deeper surrounding connective tissues, pathogens destroy attachment fibers and supporting bone that secure the teeth in the mouth. Left untreated, these diseases can lead to tooth loss. The main cause of periodontal disease is bacterial plaque, a sticky, colorless biofilm that constantly forms on teeth (Newman, Takei, Klokkevold & Carranza, 2012; Nield-Gehrig & Willman, 2008).
2. Periodontal risk factors: These factors influence one's susceptibility to periodontitis:

- *Modifiable Risk Factors*: Smoking, Diabetes, Specific bacterial pathogens, Poor oral hygiene, Osteoporosis, Human immunodeficiency virus and Acquired immunodeficiency syndrome, Stress, Bleeding on probing, Medications, Local factors.
- *Nonmodifiable Risks*: History of periodontitis, Age, Male Gender, Genetics disorder.

(Darby & Walsh, 2010)

3. Cardiovascular disease risk factors: Arteriosclerosis, high cholesterol levels, hypertension, physical inactivity, smoking, obesity, stress, age, genetics, ethnicity, and diabetes (World Heart Federation, 2011).
4. Diagnosis: The diagnosis of periodontal disease requires a clinical evaluation by an educated oral health care provider. After a careful medical and dental history, an examination of oral tissues for signs of inflammation is crucial as well using a periodontal probe and mouth mirror to determine the level of the attachment mechanism. In addition, radiographs are interpreted to determine the amount of bone loss. Based on these findings the clinician classifies periodontal disease according the classification system published by the American Academy of Periodontology (Armitage, 2003).
5. Cardiovascular diseases (CVD): Conditions or diseases of the heart and blood vessels. Coronary heart disease (CHD)/Coronary artery disease (CAD) refers to diseases of blood vessels such as arteriosclerosis (hardening of the arteries) and atherosclerosis (narrowing of the arteries due to plaque buildup) (Mayo Clinic, 2011).

6. Inflammation: Inflammation is a protective attempt by the body to remove stimuli, initiate healing, and repair. The classic signs of inflammation are redness, swelling, heat, pain, and loss of function. These reactions are mediated by chemical factors derived from plasma or cells (Gurenlian, 2006).
7. Chronic Inflammation: Prolonged inflammation is when the healing process is in "over drive". The longer the inflammatory process lasts, the more destruction it can cause to systemic tissues (Gurenlian, 2006).
8. C-Reactive protein (CRP): A plasma protein released by the liver during the inflammatory response. The levels rise in response to chronic inflammation. CRP is a systemic marker of inflammation and has been associated with risk for cardiovascular disease (Libby, 2004; Loos, Craandijk, Hoek, Wertheim-van Dillen & van der Valden, 2000).
9. Interleukin-6 (IL-6): An inflammatory mediator produced by T-cells and macrophages in response to infection. Plasma levels of IL-6 are higher in individuals with periodontal disease. Increased level of IL-6 is associated with risk of cardiovascular disease (Gurenlian, 2006; Loos, 2000).
10. Oral-Systemic Link (OSL): The connection (link) between oral disease or infection and systemic disease (Billings, 1916; Genco & Williams, 2010). For example the bidirectional relationship between diabetes and periodontal disease.

Summary

The association between CVD and PD is so strong that researchers from many fields of study including, cardiology, periodontology, endocrinology (diabetes), pulmonology and geriatrics are publishing new information rapidly (Genco & Williams,

2010). The Oral-Systemic Link and systemic inflammation have gained much interest as evidenced by mainstream news reports, magazines and health shows. Interprofessional collaboration is also gaining momentum as a needed reform for healthcare systems (Reeves, 2009; Shanies & Hein, 2006, Zwarenstein & Reeves, 2006). The goal is to increase collaboration between professions to create more positive health outcomes for patients. The results of this study may prove enlightening to both the fields of cardiology and dentistry. There is potential for improved health outcomes when professions can learn from each other, and come to depend on each other (WHO, 2010).

In order to understand the origin of the oral-systemic link, the following review of literature begins at the turn of the last century and continues to modern day. The review describes research over the decades and how the idea of a possible association between oral and systemic health is changing long held beliefs.

Review of the Literature

Overview of Research

The Oral-Systemic Link has received much attention from researchers in recent years and has shown to be an important risk to the health of the population. Studies show periodontal inflammation increases inflammation throughout the body (Barnett, 2006; Buchmann, et al., 2002; D'Aiuto et al., 2004; Ebersole et al., 1997; Noack, 2001; Wu, 2000). Inflammation is associated with increased inflammatory proteins called cytokines. In addition to cytokines, C-reactive proteins (CRP) are found to further increase inflammation and cause tissue destruction over time (D'Aiuto, et al., 2004). Tissue destruction leads to disease. By reducing inflammation caused by periodontal disease, the inflammatory burden of the body may be diminished (D'Aiuto et al., 2004).

The need for professional collaboration for patients is clear. Ideally, the medical and dental community would collaborate based on the realization that both professions endeavor to reduce inflammation (Shanies & Hein 2006). With this realization, the medical profession might trust the dental profession to care for and help heal oral infections in their patients with diseases such as cardiovascular disease (Gurenlian, 2006).

In the same way a physician refers a patient with diabetes to an endocrinologist, or a patient with a torn ligament to an orthopedist, patients should be referred to a dentist for oral disease. To ignore the oral cavity as a potential site of inflammation is to dismiss the possibility of eliminating or reducing disease in their patients. The body is a *whole* and as such, the mouth is part of that *whole*. For medical doctors who practice

evidence-based medicine, the research cannot be ignored.

The following parts of this chapter outline the historical perspective of cardiology and dentistry related to the oral-systemic Link.

Related or Theoretical Frameworks and Supporting Research

This section discusses the related theories and supporting evidence regarding specifics on the history of the oral-systemic link. It broadly describes and categorizes periodontal diseases and cardiovascular diseases, risk factors and morbidity. Next, it discusses evidence to suggest a shift from the silos of health care, where practitioners focus on their own discipline when providing care, to collaboration between health care providers and oral health care providers to establish best practices for care. In addition, how cardiologists and dentists are educated is outlined as well as evidence that cardiology and dentistry have historically worked together to best serve patients who are susceptible to bacterial endocarditis.

Empirical Evidence of Oral-Systemic Connection. In the past 25 years, significant evidence has been published about the Oral-Systemic Link concerning diabetes, pre-term birth, cardiovascular disease, and stroke (Barnett, 2006). This literature review focuses on the connection between periodontal disease and cardiovascular disease.

Periodontal Disease. Periodontal disease is characterized by bacterial infection causing inflammation in the gingival and periodontal tissues. The diagnosis of periodontal disease is determined by relying on the following factors: (a) presence of inflammation- bleeding gingival tissues, swelling, and redness, (b) probing depths,

(c) extent of clinical attachment loss and bone loss (based on radiographs and tooth mobility), (d) patient's medical and dental history, and (e) presence or absence of symptoms such as pain, ulceration and the amount of observable plaque and calculus (Armitage, 2003).

Periodontal diseases are classified in the following manner. Gingival Diseases that are reversible, affect only gingival tissues, and do not display loss of periodontal attachment of the tooth to the bone. Periodontitis is not reversible and affects deeper tissues of the periodontium resulting in loss of periodontal attachment. Periodontitis is further delineated as Chronic Periodontitis, Aggressive Periodontitis, Periodontitis as a Manifestation of Systemic Diseases, and Developmental of Acquired Deformities and Conditions (see Figure 1). These categories have sub-categories to describe the disease process further (see Figure 1). Necrotizing Periodontal Diseases include Necrotizing Ulcerative Gingivitis (NUG), Necrotizing Ulcerative Periodontitis (NUP), Abscesses of the Periodontium that may appear as a gingival abscess, Periodontal abscess, or Pericoronal abscess or a combination (see Figure 1). Lastly, Periodontitis Associated with Endodontic Lesions that may exhibit as an Endodontic-Periodontal lesion, Periodontal-Endodontic lesion, or a Combined lesion (see Figure 1). The final sub-category is Developmental of Acquired Deformities and Conditions. (see Figure 1) (Armitage, 1999; Newman, Takei, Klokkevold, & Carranza, 2012) .

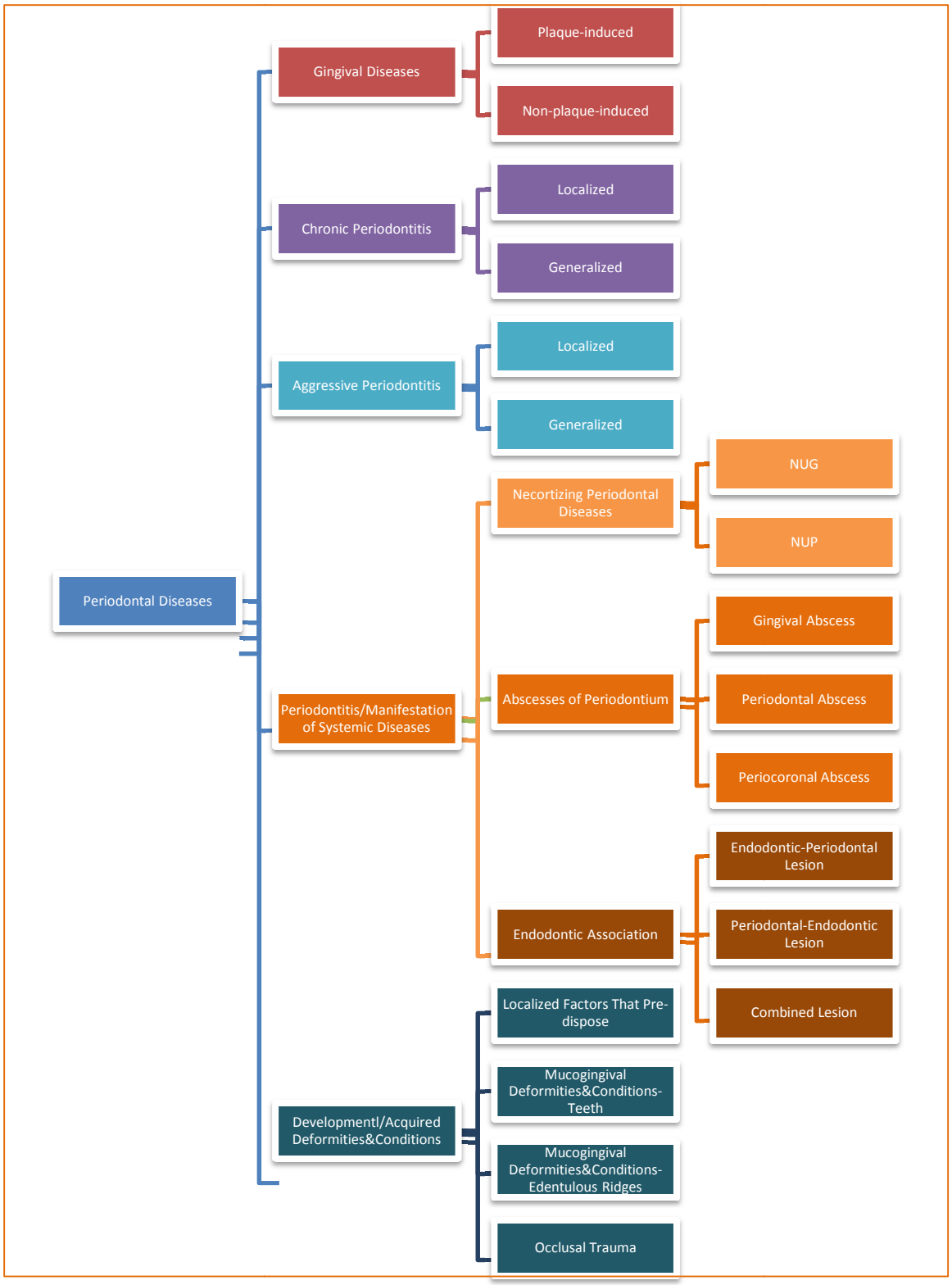

Figure 1. Classification of Periodontal Diseases. Adapted from "Development of a classification system for periodontal diseases and conditions" by G.C. Armitage, 1999, *Annals of Periodontology, 4*(1), 1-6.

Diseases of the heart. *Heart disease* is a broad term used to describe diseases affecting the heart. Diseases that affect the heart are first grouped into Cardiovascular Diseases (CVD) that are diseases of the blood vessels and Other Types of Heart Disease (see Figure 2). Within the CVD group there are two types, Coronary Artery Disease (CAD) and Hypertension commonly referred to as high blood pressure. Figure 2 displays the categories of heart disease.

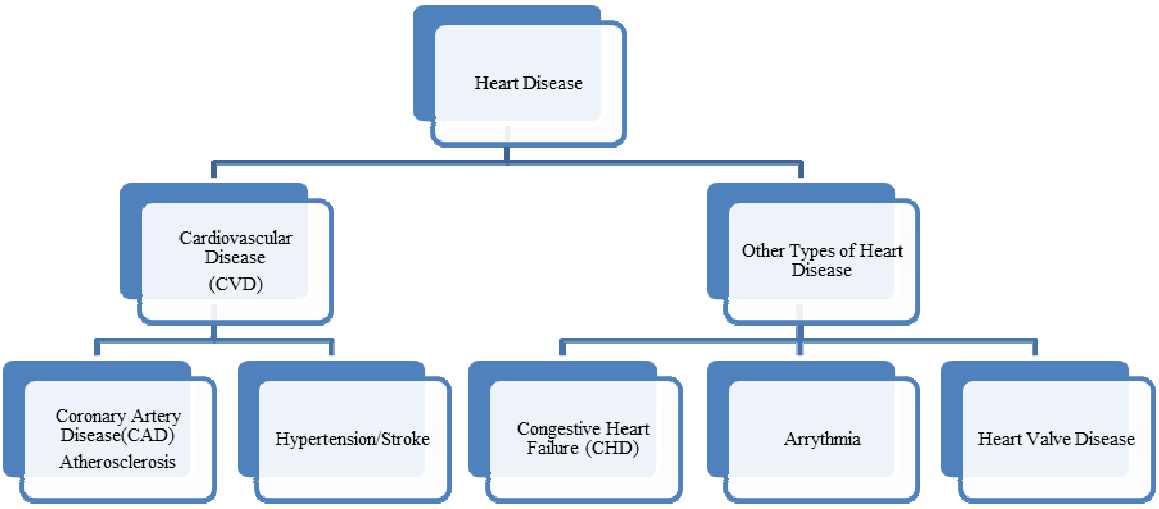

Figure 2. Diseases of the Heart. Adapted from "Heart Disease: Definition" by Mayo Clinic Staff, Mayoclinic.com, 2011.

Coronary Artery Disease (CAD), the most common type of CVD, occurs when plaque, made up of cholesterol, builds up in the arterial wall. This buildup leads to narrowing of the artery, known as Atherosclerosis. The narrowing causes reduced blood flow to the heart, a symptom of this is Angina. Angina is a pain in the chest described as a squeezing, heaviness, pressure, or tightness in the chest. A complete blockage can lead to

a Myocardial Infarction (Centers for Disease Control and Prevention, 2009; Mayo Clinic, 2011).

Hypertension (High Blood Pressure) occurs when pressure against the walls of the arteries rises and stays high over time. High Blood pressure increases the risk for heart attack or stroke (Mayo Clinic, 2011; National Institutes of Health, 2012). A stroke happens when the flow of oxygen-rich blood through the arteries is blocked. A stroke can cause lasting brain damage, lasting disability, or even death (NIH, 2012; NIH, 2011). There are two types of strokes: Ischemic stroke occurs when an artery becomes blocked, cutting off oxygen to the brain. Hemorrhagic stroke occurs when an artery leaks or ruptures in the brain and the pressure from the leaked blood causes damage to the brain cells. Hemorrhagic strokes can be caused by hypertension and aneurysms. Aneurysms are bulges in the artery that can burst (NIH, 2012; NIH, 2011).

The other types of heart disease include Congestive Heart Failure (CHF), Arrhythmias, and Heart Valve Disease. These heart diseases do not involve the vascular system and each has specific diagnostic criteria. Congestive Heart Failure (CHF) - CHF is a condition where the heart cannot pump enough blood to keep up with the demands of the body. The heart has not actually stopped working; however, it cannot pump blood to the rest of the body with enough force (NIH, 2011). Arrhythmia refers to irregular heartbeat and includes tachycardia and bradycardia. Tachycardia occurs when the heartbeat is more than 100 beats per minute. Bradycardia occurs when the heartbeat is below 60 beats per minute (American Heart Association, 2011).

Heart Valve Disease is diagnosed when one or more of the heart valves do not work properly. Regurgitation occurs when the valve does not close tightly and blood

leaks back into the chamber. Stenosis occurs if the valves thicken, stiffen, or fuse together and the valve cannot fully open. Atresia occurs if the heart valve does not have an opening for the blood to pass through (NIH, 2011).

Mortality of Heart Disease. According to the Heart disease and Stroke Statistics 2011 update, CVD accounted for more deaths than any other major cause of death in every year since 1900, except 1918 (Veronique et.al., 2011, p.21). In 2010, the cost of cardiovascular disease was estimated to be $444 billion. The economic hardship for this nation will increase as population ages (CDC, 2011).

Many types of heart disease can be prevented, according to The Mayo Clinic (2012), by adopting a healthy lifestyle that includes:

- Quit smoking. Smoking increases the risk for coronary heart disease, hardened arteries, aneurysm, and blood clots.
- Manage Blood Pressure. The American Heart Association (AHA) defines normal blood pressure as *less than* 120/80. Table 1 displays the categories of blood pressure.
- Control Cholesterol. Total Cholesterol should be less than200 mg/dL.
- Prevent or manage diabetes. Diabetes greatly increases the risk of heart disease and stroke. There is a bi-directional relationship between diabetes and periodontal disease well established in the literature(Genco & Williams, 2010) . This relationship suggests further study is needed to determine if prevention of periodontal disease has potential for decreasing risk of cardiovascular disease.
- Exercise at least 30 minutes a day on most days of the week.
- Eat a diet that is low in salt, saturated fat, and added sugars.

- Maintain a healthy weight. Obesity is now recognized as an independent risk factor for CVD.
- Reduce and manage stress. Chronic stress can cause an increase in blood pressure and may damage artery walls.
- Practice good hygiene. The Mayo Clinic lists poor hygiene as a risk factor for CVD. Poor hand washing can lead to bacterial or viral infections that may lead to heart infections. Poor dental health may also contribute to heart disease (Mayo Clinic, 2011)

Table 1

Blood Pressure Categories

Blood Pressure Category	**Systolic**		**Diastolic**
Normal	Less than **120**	And	Less than **80**
Prehypertension	**120-139**	Or	**80-90**
High Blood Pressure (Hypertension) Stage 1	**140-159**	Or	**90-99**
High Blood Pressure (Hypertension) Stage 2	**160** or higher	Or	**100** or higher
Hypertensive Crises **(Emergency care needed)**	Higher than **180**	Or	Higher than **110**

Note. Adapted from AHA "Understanding Blood Pressure Readings" (www.heart.org, 2012)

With periodontal disease and cardiovascular disease defined and their significance to overall health understood, it is important to examine the history of the oral-systemic link and the progression of understanding it over the decades. Further review of the

literature shows how improvements in scientific methods have taken the oral-systemic link from merely anecdotal, to acceptance as an independent risk factor for CVD.

Oral-Systemic Link. The oral-systemic link is a modern day term referring to the connection of oral disease and systemic disease (Billings, 1916; Barnett, 2006; Ebersole, Machen, Steffen & Willmann, 1997; Genco, Beck & Offenbacher, 2002; Mattila, et al.; Wu et al., 2000). The idea that infections in the oral cavity may affect health in other regions of the body has been explored for decades, even centuries. W.D. Miller, a dentist and physician in Germany, published a book titled *The Micro-Organisms of the Human Mouth: The Local and General Diseases Which Are Caused by Them* in 1890.

> It has been established beyond all question that myriads of micro-organisms are constantly present in the human mouth and that these under favorable circumstances, are capable of manifesting an action of the utmost significance upon the local as well as the general health of the patient.
>
> (Miller, 1890, p. v).

It was Miller who first used the term "Focus of Infection" in *Dental Cosmos* the next year (Pallasch & Wahl, 2000). Miller believed at least thirteen systemic diseases could be traced to bacterial colonization in the mouth. Although he did not advocate removal of infected teeth, he did suggest root canal treatment for these teeth (Genco & Williams, 2010). This was followed by an article published in 1900 by English physician William Hunter titled "Oral Sepsis as Cause for Disease" in *The British Medical Journal.* Hunter criticized conservative dentistry as contributing to many systemic diseases and considered them "ghastly tragedies." Hunter addressed medical students at McGill University in Montreal in 1910 where he explained that dental work, such as gold filling

crowns, bridges, and partial dentures were built on diseased teeth and considered the perfect trap for sepsis. He claimed to have many times traced the origin of *trouble* to within a couple months of the placement of dental work (Pallasch & Wahl, 2000, Barnett, 2006).

Dr. Frank Billings, Dean of Medicine at the University of Chicago, was responsible for changing the term from "Oral Sepsis" to "Focal Infection" in 1911. Billings presented a series of lectures on the subject in September of 1915 to medical students at Stanford University (Genco & Williams, 2010). Billings stated in his introduction, "Systemic or general disease due to a local infection is a conception as old as medical knowledge" (Billings, 1916, p.1). Billings described a focal infection as "sepsis arising from a focus of infection that initiates a secondary infection in a nearby or distant tissue or organs" (Billings, 1916, p.3).This theory was not well accepted and was not well supported by scientific research. Nonetheless, it did cause a wave of tooth extractions in effort to avoid possible *foci* of infections (Genco & Williams, 2010).

In 1938, Cecil and Angevine called for a re-evaluation of the theory when they published a study in *Annuls of Internal Medicine*. This follow up study of 156 patients suffering from rheumatoid arthritis showed that of the 52 subjects who had infected tonsils or teeth removed, 47 did not get better, and in fact, three became more ill (Billings, 1916, Pallasch & Wahl, 2000). Following this was a critical review of the theory by Reiman & Havens in 1940 in the *Journal of the American Medical Association*. The authors determined there was no proof to support the theory of focal infection; people with their teeth and tonsils removed continue to suffer from the same diseases. This brought the era of Focal Infection to an end and for nearly 50 years (1940-1989)

there was very little interest in oral infections and their relationship to systemic health (Genco & Williams, 2010).

In 1989, Kimmo J. Mattila and his research team in Finland, lead a resurgence of interest in the theory. They investigated the dental health of patients with acute myocardial infarction who were admitted to Helsinki University Central Hospital. Based on the clinical impression that chronic dental infections are often seen in patients with myocardial infarction, they studied two separate case-controlled series of patients. The first series comprised male patients (*N*=40), aged 50 or less, and admitted consecutively with MI. The second series comprised of patients (*N*=60), males aged 60 or less, and females aged 65 or less. Mattila et al. found the relationship between poor dental health and acute myocardial infarction to be significant even after adjusting for age, social class, hypertension, serum lipid and lipoprotein concentrations, smoking, presence of diabetes, and serum C peptide concentration (Mattila, 1989). This work by Matilla and colleagues was "the beginning of a new era of understanding the impact or oral health and disease on overall health and disease" (Genco & Williams, 2010, p. 48). This next era saw many scientific publications on the association between periodontitis and conditions such as stroke and preterm/low birth weight as well as coronary heart disease (Genco & Williams, 2010; Barnett, 2006). During the time between Billings and Matilla (1915-1989), there was great improvement in scientific research methods. Additionally, there was an increased awareness of the etiology and pathogenesis of oral and systemic diseases (Genco & Williams, 2010, Barnett, 2006).

Strengthening the findings of Mattila are results of a longitudinal study by DeStefano et al. in 1993 showing a 25% increased risk of coronary heart disease in

subjects (*N*=9760) with periodontitis. These results suggested an association between periodontal disease and coronary heart disease; however, additional prospective studies were recommended to confirm the association, clarify the nature, and determine the potential for a causal relationship (De Stefano, 1993).

The last few decades has seen the research focus on periodontitis, a chronic infectious and inflammatory disease, and its connection to systemic conditions such as diabetes, respiratory diseases, and osteoporosis, in addition to the already well-studied impact periodontal disease has on CHD, stroke, and preterm, low-birth-weight babies (Offenbacher, 1996, Genco & Williams, 2010). Researchers began concentrating their efforts on clarifying the link between periodontitis and systemic diseases (D'Aiuto, 2004; Kweider, 1993; Ebersole, 1997; Paraskevas, 2008). Various researchers hypothesized that the inflammatory nature of periodontal disease contributed to the overall inflammatory burden of the body (Glurich, 2002, Libby, 2002; Mattila, 2002; Noack, 2001; Wu, 2000). With increased systemic inflammation there are increased levels of inflammatory markers (D'Aiuto, 2004; Kweider, 1993, Ebersole, 1997; Paraskevas, 2008; Tonetti, 2007). A cross-sectional study by Loos, et al. (2000) looked at data from 150 subjects from the Academic Center for Dentistry Amsterdam (ACTA). The study population consisted of 107 consecutive, untreated periodontitis patients (localized periodontitis (*n*=53); generalized periodontitis (*n*=54) who were newly referred to the department of periodontology. The control group (*n*=43) was subjects of the same age range without periodontitis. Results of the study showed that patients with periodontitis (*N*=107) had higher median CRP levels than controls (p =0.030). Specifically, 52% of the generalized periodontitis patients (*n*=54) and 36% of the localized periodontitis

patients (*n*=53) were sero-positive for the inflammatory marker interlukin-6 (IL-6), only 26% of the controls (*n*=43) were positive for the marker. Loos concluded these patients might be at risk for inflammatory activity in atherosclerotic lesions (Loos, 2000).

Similar to the research by Loos, a study by Noack, et al.(2001) at the University at Buffalo, Buffalo, NY, also found subjects (*N*=109) with periodontal disease more likely to have significantly higher levels of CRP (*p*= 0.036) compared to the CRP (*p*=0.011) of the control group (*n*=65). These subjects ranged in age from 35-79 with no history of myocardial infarction and randomly selected from the MI Life Study of Erie and Niagara County from the Department of Oral Biology and Social and Preventative Medicine, University of Buffalo (Noack et al., 2001). Additionally Noack et al., found the presence of periodontal pathogens Porphyromonas Gingivalis, Prevotella Intermedia, Camphylobacter Recta, Bacteroides Forsythus in subgingival samples was positively associated with elevated CRP levels (*p*=0.029) (2001). The extent of the CRP level increase depended on severity of periodontal disease after adjusting for age, smoking, body mass index, triglycerides, and cholesterol. These results suggested the positive correlation between CRP and periodontal disease could contribute to an increased risk for CVD in these patients (2001).

The study by Noack, et al., (2001) strengthened the findings of Ridker, et al. a year prior. This research looked at 12 markers of inflammation in apparently healthy post-menopausal women and found CRP to be the strongest univariate predictor of cardiovascular events (Ridker, et al. 2000). The prospective, nested case-control study involved women (*N*=28, 263) who were participants in the Women's Health Study, an on-going trial. Case subjects were women for whom a base-line blood sample had been

obtained who subsequently had a cardiovascular event during the follow-up period of three years (*n*=122). A cardiovascular event was defined as death from coronary heart disease, nonfatal myocardial infarction, or stroke, or a coronary-revascularization procedure. For each case subject, two control subjects were chosen who were of the same age and smoking status, who had remained free of cardiovascular disease during the follow-up period (*n*=244).

While Ridker's (2000) study involved only females; a study performed by Hung at the Harvard School of Public Health studied only male subjects (Hung, 2003). In the prospective study of (*N*=45,136) male health professionals, 342 cases of Peripheral Artery Disease (PAD) were identified in a 12 year follow up period. The study looked at the associations between oral health and PAD. There was a strong association between tooth loss and PAD among men with a history of periodontal diseases (p=0.09). These findings suggested the association between periodontal disease, incidental tooth loss, and PAD is probably influenced by the oral infection-inflammation pathway. Alternatively, having a risk factor such as a genetic predisposition to inflammation (pro-inflammatory trait) leading to increased risk of periodontal disease and atherosclerosis might also explain the association (2003).

A rigorous meta-analysis of publications up to 2003, Renvert (2003) at Kristianstad University in Sweden, focused on published studies covering the possible association between periodontal disease and diabetes mellitus, coronary heart disease, osteoporosis, pulmonary disease and depression. This was a timely review as the subject was gaining popularity in mainstream media. Renvert pointed out there have been numerous reports claiming such association between periodontal disease and these

systemic diseases exists, and many claiming otherwise. This review showed support for the relationship between periodontal disease and diabetes mellitus. It revealed limited evidence that destructive periodontal disease is associated with increased risk of CHD. The relationship between periodontal disease and osteoporosis remained uncertain at the time of the review. Finally, the number of studies in the area of respiratory diseases and periodontal disease is few. However, aspiration of oral microorganisms may contribute to aspiration pneumonia. Additionally, oral microbes have been found in pulmonary infections (Renvert, 2003).

With the connection between periodontal disease, inflammation, and systemic diseases gaining acceptance and popularity, a team in London aimed to assess whether periodontal therapy was associated with a reduction in serological markers of inflammation (D'Aiuto et. al. 2004). This study was a prospective, longitudinal, single-blind pilot trial with a 6-month follow-up. Participants (N=94) were selected from subjects referred to The Department of Periodontology of the Eastman Dental Hospital, University College London. The participants had severe periodontitis, including pocket depths of 6 mm (measurement from gingival margin to attachment to bone) and marginal alveolar bone loss greater than 30% involving at least 50% of the teeth. Serum samples were collected before treatment and then at two and six months after treatment. Participants were provided oral hygiene instruction, subgingival scaling, and root planing therapy. Six months after treatment, both CRP and IL-6 showed significant reduction respectively, IL-6 ($p < 0.001$) and CRP ($p < 0.0001$). These findings support the hypothesis that periodontal infection and accompanying inflammatory burden, amplifies the systemic inflammatory response. In turn, this may contribute to systemic

inflammatory diseases such as atherosclerosis (D'Aiuto, 2004).

In a more recent study by Tonetti et al. at the University of Connecticut Health Center, Farmington (2007), periodontal patients showed an improvement in endothelial function following intensive treatment of periodontitis. Since inflammation is related to the pathogenesis of atherosclerosis, and periodontitis is believed to be associated with endothelial dysfunction, this study aimed to determine if intensive periodontal treatment improved endothelial function. Patients with severe generalized periodontal disease (N=114) were assigned to a control group (n=56) and to the intensive treatment group (n=58) randomly. At 6 months post intensive periodontal treatment (mechanical scaling and root planing), without systemic drug therapy, the treatment group did show reduced indices of periodontal severity and significantly better endothelial function compared to the control group. The degree of improvement in function was related to improvement in measures of periodontal disease (p=0.003). The authors stated that the exact mechanism by which periodontal disease affects endothelial function remains unclear. Additionally, further studies are required to determine if these results would be seen in patients with less severe periodontal disease (2007).

In the *Editor's Consensus Report* in 2009, the editors of *The American Journal of Cardiology* and *The Journal of Periodontology* set out to create a document to provide cardiologists and periodontists a better understanding of the link between atherosclerotic CVD and periodontitis (Friedewald, 2009). The authors write:

> The human organism is a single unit composed of a seemingly infinite number of biologic processes so intertwined that abnormalities of almost any of its parts or diseases have profound effects on multiple other body areas, exemplified in this

document by the complex theme of *inflammation.* (Friedewald, 2009, p. 1021)

This consensus document discusses the multiple reports that claimed the association between periodontitis and atherosclerotic CVD, as well as those studies claiming no causative relationship between the two diseases. At the time of the report (2009), no direct causal relationship between periodontitis and atherosclerotic CVD had been established. Studies have suggested two biologically plausible mechanisms:

1. Moderate to severe periodontitis increases the level of systemic inflammation, and therefore is associated with increased systemic inflammation measured by increased levels of CRP and other biomarkers (Tonetti, 2007, Paraskevas, 2008).
2. In untreated periodontitis, gram-negative bacteria that may be found in periodontal pockets also have been found in atheroma (Haraszthy, 2000).

Although the direct causal relationship is not scientifically proven, the editors in this report deemed it reasonable to acknowledge that since moderate to severe periodontal disease increases systemic inflammatory burden, periodontitis may independently increase the risk for CVD. The authors in this report made clear recommendations for periodontists and physicians to address periodontal disease and CVD in their respective patients (Friedewald, 2009).

More recently, the AHA released a Scientific Statement (2012). This statement was concurred by The American Dental Association Council on Scientific Affairs and endorsed by the World Heart Federation. This statement was based on a review of 537 peer-reviewed publications between 1950 and July 2011. The focus was to assess whether available data support an independent association between atherosclerotic

vascular disease and periodontal disease and whether periodontal disease treatment affects atherosclerotic vascular disease risks or outcomes (Lockhart, Bolger, Papapanou, 2012). In this analysis, evidence supports the association between periodontal disease and atherosclerotic vascular disease. This is true even after adjustments for known confounders. A direct causal relationship of periodontal disease and atherosclerotic vascular disease is not supported. In addition, evidence does not support a benefit of periodontal treatment in decreasing long-term systemic inflammation (2012). The authors point out that periodontal disease and atherosclerotic vascular disease share many risk factors, including, tobacco use, diabetes mellitus, and age. Statements that imply a causative association between these two diseases, or that periodontal treatment may be useful are not warranted (Lockhart, 2012). Table 2 summarizes the history of the Oral-Systemic Link.

With evidence supporting an association between PD and CVD, it does not appear the medical and dental fields can ignore the flood of information in magazine, newspapers, and television health shows. The public is interested in this association. With CVD being the number one cause of death, most people are affected in some way by CVD. The next section explores the current education of dentists and cardiologists and how they learn to collaborate in their healthcare education.

Table 2

History of the Oral-Systemic Link

1890	Miller coins the term "Focal Infection" Publishes *The Micro-Organisms of the Human Mouth: The Local and General Diseases Which Are Caused by Them.*
1900	Hunter claims modern dentistry contributes to systemic diseases with dental work on diseased teeth. Writes "Oral Sepsis as Cause of Disease" for the *British Medical Journal.*
1915-1930's	Billings lectures medical students regarding his work at the University of Chicago. Tooth and tonsil removals increase greatly in effort to avoid or cure systemic health conditions such as rheumatoid arthritis.
1938-1940	Review by Cecil & Angevine call for a re-evaluation of the theory, and coupled with a results review by Reiman & Havens, the "Focal Infection" era ends. By this point research techniques had become more scientific rather than anecdotal.
1989	Matilla leads resurgence of interests as his team finds relationship between dental infections and myocardial infarction.
1993	DeStefano shows 25 % increased risk of coronary heart disease with his longitudinal study of 9,760 subjects.
1990's	Researchers hypothesized the inflammatory nature of periodontal disease may contribute to overall inflammatory burden of the body.
2000 & 2001	Studies by Loos and then Noack shows periodontitis leads to increases in CRP which may lead to inflammatory activity in arteriosclerotic lesions.
2003	Review by Renvert shows support for the relationship between PD and Diabetes, and limited support for the relationship between PD and CVD.
2004	D'Aiuto shows that periodontal treatment can reduce inflammatory markers (IL-6 and CRP).
2007	Research by Tonetti shows improved endothelial function following intensive periodontal therapy. However, the mechanism by which periodontal disease affects endothelial function remains unclear.
2009	Editor's consensus report (*American Journal of Cardiology and The Journal of Periodontology*) states that direct causal relationship is not proven scientifically but agreed that periodontal disease could be an independent risk factor for CVD. Recommendations were made for periodontists and physicians to address periodontal disease and CVD in their respective patients.
2012	A review by the AHA states there is not enough scientific evidence to support a causative relationship between PD and CVD or that PD treatment may prevent or modify CVD outcomes. Unfortunately, many professionals took this report as proof that the connection had been disproven. When, in fact, the review supported an association between PD and CVD independent of known confounders.

Education of Dentists and Cardiologists. With the association of oral health and systemic health becoming more accepted in both medical and dental fields, it is important to understand who is responsible to educate and care for patients who suffer from periodontal disease and systemic disease such as coronary artery disease. Teaching interprofessional collaboration in medical and dental schools has never been more important. There are new models of healthcare providers being proposed based on this interprofessional collaboration. Certainly, collaboration between the fields has taken place on some levels. Evidence of this would be the Editor's consensus report of the American Journal of Cardiology and Journal of Periodontology referenced previously (Friedewald, 2009).

Dentists and physicians are educated based on curricular standards that are monitored by their respective accrediting bodies, the ADA Commission on Dental Accreditation (CODA) and The Accreditation Council for Graduate Medical Education (ACGME) respectively (Accreditation Council for Graduate Medical Education, 2012; ADA CODA, 2010). An overview of the curriculum that guides dental and medical students in their understanding of the oral-systemic link as well as interprofessional education experiences follows.

Dentists. To become a dentist, a student who receives a Bachelor of Science degree applies to dental school. Once enrolled in dental school, students complete four years of curricula accredited by ADA CODA. Students receive either a Doctorate of Dental Surgery (DDS), or a Doctorate of Dental Medicine (DMD), which are equivalent degrees ("Dentist: What Education" 2012). A dentist may wish to pursue a post-graduate degree and become a specialist in one of nine specialties recognized by the ADA (Dental

Public Health, Orthodontics and Dentofacial Orthopedics, Endodontics, Prosthodontics, Oral and Maxillofacial Pathology, Oral and Maxillofacial Surgery, Oral and Maxillofacial Radiology, Periodontics, and Pediatric dentistry). These specialties require an additional 2-4 years of study and sometimes involve a two-year residency ("Dentist: What Education," 2012).

Dental school curriculum includes courses in Biomedical Science, Behavioral Science, Practice management, Ethics and Professionalism, Information Management and Critical Thinking, and Clinical Sciences (CODA, 2010). Standard 2-12 of the CODA Accreditation Standards for Dental Accreditation states: "Biomedical science instruction in dental education must ensure an in-depth understanding of basic biological principles, consisting of a core of information on the fundamental structures, functions, and interrelationships of the body systems" (CODA, 2010, p. 13). Moreover, Standard 2-13 states: "The biomedical knowledge base must emphasize the oro-facial complex as an important anatomical area existing in a complex biological interrelationship with the entire body" (CODA, 2010, p. 13).

These standards are rigorously evaluated by CODA. The standards insure students have proven their knowledge in systemic health, including cardiovascular health. Similar standards regarding the understanding of systemic diseases are included in the curriculum of medical students.

Cardiologists. To become a cardiologist, a medical school graduate must attend an Internal Medicine residency. The physician spends three years in an Internal Medicine residency and then three or more years specializing in cardiology ("Cardiologist: Career Profile," 2011). The ACGME is the accrediting body responsible for all post-MD

medical training programs in the United States (Accreditation Council for Graduate Medical Education, 2012). Of the many requirements for Internal Medicine program, the ACGME directs that the resident must demonstrate competency in *Systems-based Practice*. This is further defined as:

"Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care" (ACGME, 2012, p. 21).

"Residents are expected to work in interprofessional teams to enhance patient safety and improve patient care quality…" (ACGME, 2012, p. 21).

This requirement of Internal Medicine residency programs illustrates that, at some point in their training, these physicians are introduced to the importance of interprofessional collaboration in the best interest of the patient. It is important to this qualitative study to understand what cardiologists have been exposed to in their training as it may help bring to light their desire or lack of desire to collaborate with the dental community. The following is a review of the concept of interprofessional education and how it could influence the education of our medical and dental students.

Interprofessional education. Interprofessional Education (IPE) is "an interactive learning activity that involves participants from two or more professions" (Reeves, 2009, p.142). The participants learn with, from, and about each other in a way that can positively affect patient care. The World Health Organization (WHO) first described IPE and its importance to primary health in 1978. Mutiprofessional Education, as it was called originally, was encouraged by WHO to complement current curriculum with an emphasis on learning how to interact with one another (World health Organization,

1988). An article authored by Glennys Parsell and John Bligh in the *Fellowship of Postgraduate Medicine* (1998), stated that "those who work together in practice for the benefit of patients should be provided with opportunities to learn together at all levels of their training" (Parsell & Bligh, 1998, p.89). The concept of IPE is generally well received; however most health professionals are still educated in isolation from other professions (Sargeant, 2009).

The Interprofessional Education Collaborative Expert Panel published *Core Competencies for Interprofessional Collaborative Practice: Report of an Expert Panel* in 2011. Representatives from the Association of American Medical Colleges, American Association of Colleges of Nursing, American Association of Colleges of Osteopathic Medicine, American Association of Colleges of Pharmacy, American Dental Education Association, and Association of Schools of Public Health panel developed four core competency domains for IPE:

Domain 1: Values/Ethics for Interprofessional Practice

Domain 2: Roles/Responsibilities

Domain 3: Interprofessional Communication

Domain 4: Teams and Teamwork

(Interprofessional Education Collaborative Expert Panel, 2011)

The vision of this group of experts is to create a future that includes IPE as mandatory in all of healthcare education. The panel adopted these competencies to ensure that students understand the value of interprofessional collaboration and ultimately translate IPE experiences into their practice. Currently, our healthcare education systems do not

prepare students for team work (Interprofessional Education Collaborative Expert Panel, 2011).

Mouradian, et al. (2005) at the University of Washington (U of W), described the need for oral health education for medical students. In an effort to create an oral health curriculum for medical students at their university, the authors (a) reviewed current evidence of medical education and physician training in oral health, (b) developed oral health learning objectives and competencies appropriate for medical students, and (c) identified current oral health content in the undergraduate curriculum and opportunities for including additional materials (2005). Mouradian et al. (2005) found very few articles addressing the training medical students receive on oral health. Additionally, they discovered when content on oral health is included in the curriculum, it is inadequate. The authors pointed out students at U of W were only receiving about two hours of oral health-related education during their four-year medical school training (2005). This study provides a possible reason for why medical doctors often do not correlate oral disease with systemic disease. The next section provides background on the importance of collaboration in providing quality holistic care.

Interprofessional Collaboration. Efforts by Mouradian et al. (2005) to develop and integrate IPE into a full medical education curriculum demonstrate the understanding of educators that IPE is imperative to the future healthcare system. Implementation of IPE experiences has the potential to teach health care providers how to collaborate. In another example of IPE, students in the School of Dentistry and School of Nursing at Case Western University in Ohio will soon be participating in a new interprofessional team approach to healthcare. This three year test project is funded by a grant from the

Health Resources and Service Administration and will begin in January 2013. Students will work in pairs in *dental-nursing teams* and provide oral exams and health screenings for cholesterol, glucose, blood pressure, red and white blood cell counts, and, if desired, HIV (Case Western Reserve University, 2012).

Another example of interprofessional education is the Regional Initiatives in Dental Education (RIDE) program at the U of W School of Dentistry. Dental students in this program take some of their classes with medical students. In partnership with Eastern Washington University as well as Washington State University, the students have several community-based clinical experiences that include working with and learning with medical students and professionals (Ballweg et al., 2011).

An integrative approach to healthcare is practiced at The University of Arizona with a clinic in Tucson and a new Integrative Health Center in Phoenix. Integrative medicine is defined as "a healing-oriented medicine that takes into account the whole person, including aspects of lifestyle" (University of Arizona, 2012). Patients have a personal physician with specialized training in integrative medicine, a health coach, a nutritionist, and can choose to see an integrative chiropractic physician, an acupuncturist or a mind-body specialist (University of Arizona, 2012). This program is another model for whole body health; most importantly the practitioners collaborate to provide holistic care.

The WHO Study Group on Interprofessional Education and Collaborative Practice (WHO, 2010), describes the benefits of collaborative practice for best health outcomes in their publication entitled *Framework for Action on Interprofessional Education & Collaborative Practice* (2010). This is best displayed in Table 3.

Zwarenstein & Reeves (2002) hypothesize that "Good interprofessional collaboration will allow one profession to effectively report to another about the aspects of patients' condition that need intervention but that may, under less collaborative circumstances, be ignored or not heard " (Zwarenstein & Reeves, 2002, p. 52).

Table 3

Benefits of Collaborative Practice

Collaborative practice can improve:	Collaborative practice can decrease:
✓ access to and coordination of health services ✓ appropriate use of specialists clinical resources ✓ health outcomes for people with chronic diseases ✓ patient care and safety	✓ total patient complications ✓ length of hospital stay ✓ tension and conflict among caregivers ✓ staff turnover ✓ hospital admissions ✓ clinical error rates ✓ mortality rates

Note: Adapted from WHO "Framework for Action on Interprofessional Education & Collaborative Practice" (WHO, 2010)

Joint advisory statements. The AHA historically has published guidelines for antibiotic prophylactic premedication for dental procedures. These guidelines apply to patients who have certain heart conditions and are meant to assure that the dental patient does not contract bacterial endocarditis, an inflammation of the pericardium that may be caused by infective agents in the oral cavity being introduced into the bloodstream during dental procedures (Wilson, et al., 2007).

The American Academy of Orthopedic Surgeons (AAOS) currently recommends antibiotic premedication for some dental procedures for persons with artificial joints for a period of two years post joint placement (Fitzgerald et al., 2003). These recommendations are currently being updated in collaboration with the American Dental Association (ADA) (Rhodus, 2012). These recommendations show concern on the part of these organizations that some connection between the oral cavity and other parts of the body exists.

Another way in which dental and medical professionals could and should practice collaboration occurs with the use of dental panoramic images. Based on the findings of Romano-Sousa, et al. (2009) panoramic images may help detect calcifications in the cervical regions or carotid arteries of patients. Panoramic images are common in dental practice. Patients with these calcifications could be at risk for myocardial infarction or cerebrovascular accidents. This presents an excellent opportunity for an interdisciplinary approach to medical treatment and best outcomes (Romano-Sousa, et al., 2009).

There is little empirical evidence to show that dentistry and cardiology have collaborated. What evidence does exist shows dentistry reaching out to cardiologists for dental treatment recommendations for their mutual patients. For years dentists have relied on the feedback and recommendations cardiologists provide about procedural management of the cardiovascular patient. Dentists have to be concerned about the potential for causing infective endocarditis, anti-platelet and anti-coagulant therapy, pacemakers, and implantable cardioverter defibrillators (ICD) (Ruscovici, et al., 2012). However, no empirical evidence could be found that cardiologists reach out to dentists for their expert opinion regarding oral infections or periodontal diseases. If the AHA can

publish guidelines recommending prophylactic antibiotics for certain cardiovascular patients undergoing dental treatment, then it seems plausible for the profession of cardiology to embrace the oral-systemic link when educating their patients.

Problem as Developed from Theories and Research

A historical review of the literature suggests a relationship between periodontal inflammation and cardiovascular disease referred to as the oral-systemic link. Conversely, there is little evidence to indicate cardiologists understand or value this connection. Evaluation of the knowledge cardiologists have concerning the link between periodontitis and cardiovascular disease has potential to ascertain why cardiologists may or may not refer to an oral health care provider upon patient assessment, diagnosis, and care planning for patients with risk factors for or who have cardiovascular disease. The data from this study may reveal perceived barriers both real and perceived that exist for cardiologists to view oral health care providers or dental teams as collaborators in delivering care to persons who are at risk or have cardiovascular disease.

A historical perspective suggests health care providers practice in *silos* focusing on their discipline when providing care. The advent of interprofessional education as a competency recognized by health educators has begun to affect how dental and medical students are educated (Mouradian et al., 2006; Reeves, 2009; Wilder et al., 2009). Implementation of interprofessional activities within the curriculum has potential to instill a sense of collegiality among health care professionals resulting in an innovative approach to providing comprehensive care.

This new model of care suggests that when health care providers work mutually and respect each other's expertise, the ultimate benefactor is the patient. Recognizing the

oral-systemic link as it relates to oral and cardiovascular health, the potential to understand the perspective of the cardiologist regarding relying on the dental team may aid in diminishing potential barriers. Resulting data may provide oral health care providers information needed in order to promote collaboration.

Summary

Published research regarding empirical evidence on cardiologists referring patients to oral health care providers for periodontal evaluation is minimal. The oral-systemic link is recognized repeatedly in the literature (Billings, 1916; Barnett, 2006; Ebersole, Machen, Steffen & Willmann, 1997; Genco, Beck & Offenbacher, 2002; Mattila, et al.; Wu et al., 2000). While the oral health of a person has the potential to influence their cardiac health, the question remains do physicians particularly cardiologists refer to oral health care providers when a person has risk factors or has cardiac disease? Core competencies in interprofessional education suggest the importance of IPE experiences (Interprofessional Education Collaborative Expert Panel, 2011) . Further research is required to identify best practices for integrating IPE experiences into real life practice of the health care provider. To promote collaboration among health care providers as well as assist them in practicing outside silos it behooves the investigation of methods to decrease real and or perceived barriers to interprofessional collaboration resulting in comprehensive care.

The inflammatory response is linked to cardiac and oral disease. Similar markers for bacteria are noted throughout the body including the mouth. Risk factors for cardiac disease are linked to oral disease. Mortality of cardiac disease is prominent in the US (CDC, 2011; Veronique et al., 2011). Educators may consider the potential of IPE

experiences to assist the health care professions in reaching out to each other in order to provide comprehensive care. Core competencies in both medicine and dentistry indicate collaboration among health care providers is recognized as a powerful tool for building health care teams (ACGME, 2012; ADA CODA, 2010; Interprofessional Education Collaborative Expert Panel, 2011). The current nature of practice however tends towards silos of specialties including dentistry and cardiology. To reduce perceived and or real barriers in order to establish mechanisms resulting in comprehensive patient care, an opportunity to discern why cardiologists do or do not collaborate with and or refer to oral health care providers warrants research.

Methodology

Design

This study utilized a qualitative method to investigate the current beliefs and practices that cardiologists use in their treatment and education of cardiac patients. In addition, the researcher attempted to determine how these beliefs affect treating patients in an interprofessional manner. The standardized open-ended interview technique was chosen for this study. This technique requires all participants to be asked identical questions but allows participants to contribute as much detailed information as they desire to express their viewpoint (Turner, 2012). Interview questions were designed to garner the most information on how the oral-systemic link determines the therapy recommendations of cardiologists for patients with cardiovascular disease.

Problem or research question.

1. What are the cardiologist's beliefs about the oral-systemic link and the cardiac health of a patient?
2. Are cardiologists including an evaluation of the oral cavity by an oral health care provider as a component of their proposed care plan for their patients with cardiovascular disease?
3. Do cardiologists feel collaboration with an oral health care provider may lead to outcomes that are more positive for their patients with cardiovascular disease?

Variables. Demographic data was collected at the beginning of the interview verbally and recorded by audio recorder. Age, sex, years in practice, medical school attended, internal medicine residency, cardiology fellowship attended and sub-specialties

were the variables in this study. The researcher categorized these variables. In qualitative research the principle investigator (PI) attempts to utilize a sample that has similar variables to the population. In this study only board certified cardiologists were enrolled as subjects thus limiting variables. Some assumptions were that the medical school and fellowship experiences may vary greatly and as such the PI attempted to minimize these variables by reporting interview results and demographic data and comparing themes among similar variables.

Description of Setting

For each interview the PI preferred to meet the participant in a casual interview location outside of the workplace. The location of the interview is very important in helping the participants to feel comfortable when speaking about their opinions and experiences. The location needs to be chosen to avoid distractions. However, the PI needed to accommodate the participants' wishes and meet wherever they suggested. Allowing the participants to choose the location gave each participant a feeling of power and lended to the ease of interaction with the researcher (Elwood & Martin, 2000). The PI respected the time constraints of the interviewee and was available at their convenience.

Sample

A convenience sample of cardiologists was utilized for this study. The PI made contact initially with local cardiologists near Redding, CA to enroll the first participants. Using the snowball sampling technique (also referred to as network sampling), additional subjects were enrolled. Snowball sampling involves gathering data from a few members of the target population, and then asking those individuals to provide information on

additional subjects whom they know. Snowballing technique is useful when subjects are hard to locate that fit the criteria of the study (Snowball sampling, 2012). The researcher attempted to enroll enough participants in order to gather enough data for statistical power. The interviews were conducted for a period of five weeks. Demographic data was gathered for all participants for descriptive purposes.

Human subjects' protection. In order to protect the study participants and because the primary investigator is a graduate student at Eastern Washington University (EWU) this study was reviewed and approved by the EWU Institutional Review Board (IRB) prior to initiating the study. Informed consent was obtained for each participant of the study. A description of the study and the purpose was included with the consent. The PI used a script included in the Interview Guide (see Appendix A) when obtaining consent. Additionally, participants were offered the opportunity to receive a copy of the study results in order to include study participation on their professional dossier.

To insure participant confidentiality, audio files were transferred from recording device to the PI's computer and erased from original recording device. Audio data was then transcribed into word document immediately after interview. The participant's actual name was removed during the transcription and coded as follows:

R1= respondent number one (first interviewee)

R2= respondent number two (second interviewee) and so on

Audio files, interview transcriptions and associated notes were stored on PI's password protected computer during the data collection and data analysis phase of the research. Back-ups of data were stored in a locked, fireproof safe at the PI's residence. All handwritten notes and notecards were kept in the locked, fireproof safe at the PI's

residence. At the conclusion of the study, the transcribed documents were removed from the PI's computer and stored on an external storage device. This storage device will be kept in a locked, fireproof safe for three years according to the United States Health and Human Services. Any handwritten notes or notecards (not containing actual names) associated data analysis will be kept in locked fireproof safe as well.

Sample source. For pragmatic purposes, participants were recruited from Cardiology offices in Redding, CA, the investigator's geographic place of residence. Additionally, the investigator used snowball sampling where the primary investigator asked study participants for referrals of subjects who may wish to participate.

Criteria for sample selection. The criteria for inclusion in this study were that a subject be a cardiologist currently practicing and willing to take the time to meet with the PI for the interview. Cardiologists from any state of residence would have been included if they are agreeable to be interviewed via SKYPE or telephone.

Sampling plan. The researcher used purposive sampling to recruit study participants. Purposive sampling is used to select certain participants for the study that can teach the researcher the most about the research question (Burns & Grove, 2009). The first subjects included practice in the researcher's local area. After these participants, snowball sampling was utilized to identify potential subjects. The first participants were asked for their assistance in recruiting similar subjects. The disadvantage of this sampling technique is that it contradicts the notion of random selection. In addition, the PI has very little control over the sampling method. Nonetheless, this sampling technique showed the most promise to locate and recruit cardiologists willing to participate in the study. Effort was made to find subjects to

participate that come from different areas of practice, various years in practice, cultural backgrounds, and a variety of medical schools. Recruiting efforts will continue for the pre-determined time frame the PI has set aside for the interview and data collection phase of this study. This length of time is a minimum of four weeks and will continue until saturation.

Sampling size. In qualitative research the guiding principal is saturation. Saturation occurs when additional sampling provides no new information to the data collection process (Burns & Grove, 2009). The typical number of participants is typically 5-25. The quality of the data collected highly influences the sample size. The higher the quality and richness of the data, the fewer participants are needed. Because this was a thesis study and time an important consideration, the PI attempted to schedule at least two interviews a week. The plan for the interviewing stage was to continue for 8 weeks or until saturation of the emerging themes was attained.

Data Collection

In grounded theory study, the data collection is referred to as fieldwork (Burns & Grove, 2009). Interviews are conducted to gain insight into the experiences and beliefs participants hold in regards to the phenomenon being studied. In this study, the PI attempted to find explanations for an observed phenomenon, the lack of collaboration between cardiology and periodontology. While there exists a healthy collaboration between cardiology and other fields of healthcare, why does oral health seem left out or forgotten as a source of inflammation?

Interviews of all study participants were conducted by the examiner face- to- face. An interview guide was developed to collect and analyze data (see Appendix A).

Interviews were recorded with permission by the interviewee using an audio recorder. The audio files were transcribed by the researcher and analyzed to discern and document consistent themes using grounded theory technique. With this technique, data are analyzed and a theory emerges that helps to explain the phenomenon being studied.

Method. The investigator used an interview guide with a set of 12 open-ended questions to interview cardiologists in order to conduct this qualitative study (see Appendix A). The interview method is best for collecting in-depth information to research questions and well suited for obtaining the story behind participants' beliefs and experiences (McNamara, 2007). The interviews were recorded on an audio recorder. Interviews were structured and efficient in order to not take too much time. However, the PI scheduled at least one hour to conduct each interview in order to allow time for the PI and interviewee to discuss other ideas and concepts that emerged from the open-ended questions.

Instrument. The PI is the primary instrument in this study as the PI conducted all of the interviews. A set of 12 standardized open-ended questions were used for conducting interviews of study subjects (see Appendix A). The interview questions were practiced with a friend who works in cardiologist's office. Practicing the questions before the interview phase of the study helped to identify changes needed to improve the questions and interview process. In addition, demographic data was gathered by asking subjects to answer a set of items (see Appendix A).

Reliability and validity. An interview guide was used by the PI for each interview (see Appendix A). This guide insured the same information was asked of, and collected from, each interviewee. The open-ended questions used in interviewing

allowed for more thought and spontaneity of responses. This type of questioning was more appropriate to this study than the survey form of questioning often used in quantitative study. The interview method was more personal than a survey. In qualitative research, the instrument is the researcher and the credibility of the results depends on the effort and ability of the researcher (Golafshani, 2003). Bias can interfere with the interpretation of the interview responses. Accordingly, the PI strived to reduce bias by self-analyzing these biases and critically reflecting on personal feelings about responses. The PI did not show strong emotional reaction to any responses. The PI made every effort during the interview to show the interviewee that the PI is neutral. This was an effort to make the interviewee comfortable in the responses provided and that they were not judged by how they answered (McNamara, 2007). By using the audio recorder, it was not necessary for the PI to make notes during the interview, which may have been be distracting to the interviewee. In addition, using audio recordings allowed the PI to review and transcribe the interview accurately resulting in reliable data gathering.

Procedure. Upon approval of the EWU IRB, the PI started the interview stage of the study with the first participant who met the inclusion criteria and agreed to participate. It took five weeks to enroll the first subject and conduct the interview. Additional subjects were enrolled using the snowballing technique. Once the subject agreed to participate and was interviewed, the primary investigator asked for referrals of colleagues that might allow an interview. The literature suggests allowing at least one to two hours for conducting each interview (Leedy & Ormond, 2010). In this study, with time constraints being paramount on the side of the interviewees, the PI attempted to

keep all interviews efficient and brief. The time to conduct the interviews ranged from 9 minutes to 38 minutes.

At the arranged time of the interview the PI used the interview guide (see Appendix A). The first part of the interview consisted of thanking the interviewee for his/her time and explaining the purpose of the study. Next, the PI started the audio recording device and conducting a sound test. Once established that the audio recorder was working properly and at an easy to hear playback volume, verbal informed consent was obtained and recorded. The participant was given a chance to ask questions of the PI. Once any questions were answered, the PI gave the participant the contact information of the PI.

In the next part of the interview process the PI asked the participant to answer some demographic questions. These items were as follows: name, age, years in practice, medical school attended, and place of internal medicine residency, location of fellowship, and any sub-specialty.

After demographics were collected, the questioning part of the interview began. There were 12 standardized open-ended questions. At the conclusion of the questioning, the PI thanked the participant once again and offered to send results of the research if desired.

As soon as possible after the interview, the PI hand wrote any important observations from the time spent with the subject. The interview audio recordings were transcribed after the interview in order to prepare it for analysis.

Data Analysis

The investigator used the grounded theory method of qualitative research in order to answer the research questions. With grounded theory, the goal of data analysis is to uncover themes, patterns, concepts, and understandings. The transcribed interviews became the raw data. After each interview the PI studied the raw data and compared it with any previous collected data. The process involved note-taking, coding, categorizing and memoing which occurred simultaneously from the beginning (Dick, 2005). Theories began to emerge and categories for these theories developed. The first categories that emerged were broad, and then sectioned into smaller categories as more data was collected (Burns & Grove, 2009). Descriptive codes were developed to help organize the data. These codes used terms that were similar to the words used by the participants. This helped to sort the data. Interpretive codes were used later in the process as the researcher gained insight and meaning was attached to the statements made by the participants. Memos were made by the researcher to record insights and ideas as the data was being analyzed which helped link pieces of data together (Burns & Grove, 2009). These memos were taken whenever an idea emerged for the researcher and were taken down immediately, dated, and titled with the category. Eventually, saturation occurred for each category. When the interviews provided no new information for a category, the researcher was done coding for that category. The researcher utilized peer review to assist in validity testing of the emerging theories. This is a process whereby a disinterested peer (not involved directly in the research) challenges the researcher to provide solid evidence for the interpretations and conclusions the researchers has made.

The data collection/data analysis process began after the first interview. Figure 3 summarizes this process.

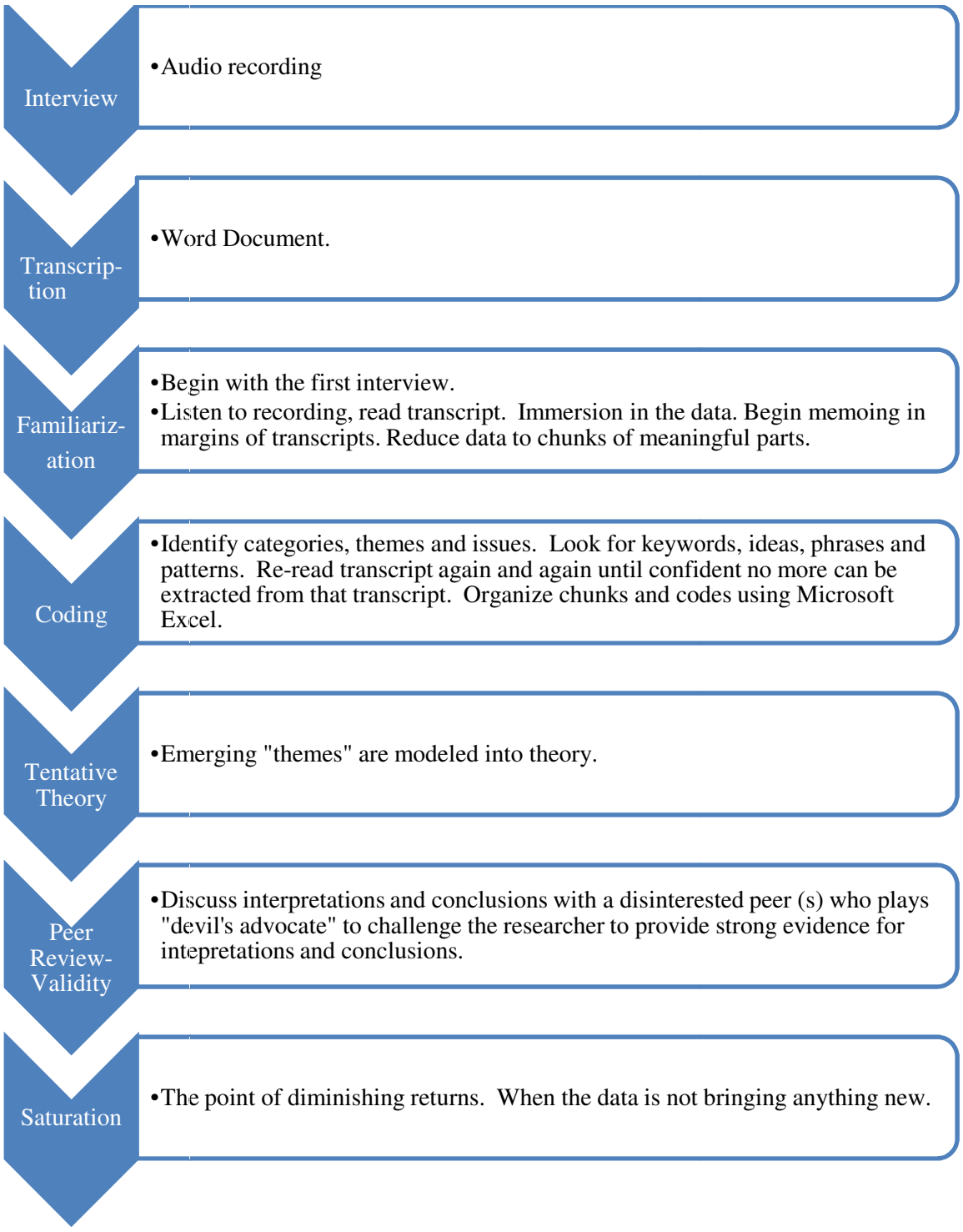

Figure 3. Data Analysis Flow Chart

Summary

The researcher used qualitative method, grounded theory, to investigate a phenomenon. The phenomenon is the level of collaboration between cardiology and dental practitioners. The PI investigated the current beliefs and practices that cardiologists use in their treatment and education of cardiac patients. While adhering to EWU IRB protocols the standardized, open-ended interview technique was chosen for this study as the best method to collect data. Qualitative and demographic data were gathered using a set of 12 questions and items respectively to answer the following research questions: 1.) What are the cardiologist's beliefs about the oral-systemic link and the cardiac health of a patient? 2.) Are cardiologists including an evaluation of the oral cavity by themselves or an oral health care provider as a component of their proposed care plan for their patients with cardiovascular disease? 3.) Do cardiologists feel collaboration with an oral health care provider may lead to outcomes that are more positive for their patients with cardiovascular disease?

Interviews were held in the location agreed upon and lasted from 9 minutes to 38 minutes. Participants were recruited initially in the PI's area of residence and then using the snowballing technique secondarily. The original goal was to enroll 15-20 cardiologists. However, it took five weeks to enroll a participant and conduct the first interview. An interview guide was used to ensure all participants were asked the same questions in the same format. Five interviews were conducted over a period of four weeks, when saturation of the developing themes was achieved.

Data analysis began immediately after the first interview. Interviews were audio recorded with permission and then transcribed by the PI using Microsoft Word. For data

analysis, the PI used a process involving note taking, coding, and memos in order to determine emerging concepts and themes expressed by the participants. Using peer review, trustworthiness and validity of the researcher's interpretations were tested (Johnson & Christensen, 2007). When saturation occurred for one code or theme, coding ended for that category. The process was followed until all categories that emerged became saturated.

Results

Introduction

As stated in Chapter 1, the purpose of this study was to increase the understanding of a phenomenon. The phenomenon referred to is a perceived lack of collaboration between the fields of cardiology and dentistry. This phenomenon has caused dental providers to assume cardiologists do not value the proven association between periodontal disease and cardiovascular disease (Buchmann, Hasilik, Van Dyke, & Lange, 2002; Ebersole, Machen, Steffen & Willmann, 1997; Genco, Beck & Offenbacher, 2002; Wu et al., 2000). The PI attempted to address three research questions that, when answered, should enhance the understanding of the stated phenomenon. This chapter presents the results of this qualitative study, starting with the description of the sample, the results of the data analysis and then the summary of the results.

Description of Sample

The participants in this study were cardiologists living and practicing in Redding, California, the PI's place of residence. Three participants were enrolled via the convenience sampling method. The remaining two participants were enrolled using the snowball sampling technique. The criteria for inclusion were met by all participants because they were all board certified cardiologists currently practicing in the PI's area of residence.

The sample consisted of five cardiologists, including two females and three males. They ranged in age from 42 to 67 (M=56.4). Three attended medical school outside of the United States; however, all five completed their cardiology fellowships

within the United States. Years in practice for all interviewees ranged from 10 years to 42 years for an average of 30 (M=30). Four participants had a sub-specialty of Interventional Cardiology and one had a sub-specialty of Cardiology Transplant.

Per EWU IRB approval, consent for participation in the interview was obtained via audio recording. After explaining the plan for the interview and allowing any questions, the following statement was read:

> "Dr._____, thank you for participating in my research about the oral-systemic link. Do I have your permission to record your responses and transcribe them later? Your identity will remain confidential. All audio recordings will be deleted after transcription."

Data Analysis

An open-ended interview method was used to gain insight into the opinions and experiences of the cardiologists regarding the oral-systemic link. The interview consisted of 12 questions designed to answer the following three research questions: 1.) What are the cardiologist's beliefs about the oral-systemic link and the cardiac health of a patient? 2.) Are cardiologists including an evaluation of the oral cavity by themselves or an oral health care provider as a component of their proposed care plan for their patients with cardiovascular disease? 3.) Do cardiologists feel collaboration with an oral health care provider may lead to outcomes that are more positive for their patients with cardiovascular disease?

Interview audio recordings were made with the PI's iPhone® 4S, using the "Voice Memo" application installed on the phone. Immediately after the interview, the PI began

the transcription process. During this process, data analysis began. This is one benefit of the PI doing the transcription herself. The process of note taking, memoing, and

Once the audio files were transcribed, the data was reviewed and responses were reduced to smaller sections of text. Qualitative researchers often use these smaller sections of text, referred to as *chunks* for analysis (Mousakas, 1994). The chunks of text were chosen because they best related to each of the 12 questions asked during the interview. This method of reducing data eliminated extraneous information that did not correlate to the question, thereby making it easier to manage the data. Next, each chunk of text was given a code or codes that represented the essence of what that chunk was *saying*. The chunks and corresponding codes for each question were arranged in a simple table format with Microsoft Word®. See Appendix B for complete transcriptions of all interviews.

The goal of the coding process was to focus on the different qualities of the responses and how the responses answered each interview question thereby addressing one of the research questions. Using constant comparison of new data to previous data, similarities in responses were noted and coded accordingly. This part of the data analysis began immediately after the first interview and ran in parallel with additional interviews. Using this data analysis procedure, it was determined after five interviews the responses were similar and new interviews were not likely to produce new information. Given this the data was considered to be saturated and the data gathering part of this study concluded.

Reliability and validity were insured by utilizing peer review. Three non-interested peers were emailed a table with the chunks of text and emerging codes. The

peers included a classmate of the PI, a dentist, and an internal medicine doctor. The peers were asked to review data analysis and coding to challenge or confirm the emergent codes. Peers were asked to respond to the PI via email or in person within three days. Email response from one peer confirmed all codes. In person discussion with another peer confirmed all codes. The final peer confirmed all codes, additionally it was suggested that the "probably" responses be coded "yes" and "not routinely" responses be coded "no."

Questions 1-4 of the interview as shown in Table 4 pertained to the first research question "What are the Cardiologist's beliefs about the oral-systemic link and the cardiac health of the patient?"

Table 4

Data Analysis Q1-Q4 related to Research Question 1on Cardiologist's beliefs on the oral-systemic link

Q#	**ID#**	**Question & Response** (A chunk of text from transcript.)	**Code** (May be more than one)
Q1		*In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?*	
	R1	Yes, I've heard about it. I am aware that they acknowledge a link, but nobody is saying that doing anything about PD will make a difference for CVD.	Yes, I've heard of it Not proven
	R2	I've heard the concern, but it hasn't been proven.	Yes, I've heard of it Not proven

	R3	I've heard the concept for years, just hard to prove.	Yes, I've heard of it Not proven
	R4	I've heard about the association, but causality, I'm not sure.	Yes, I've heard of it Not proven
	R5	Yes, I think the link is there, it's just not brought to the forefront yet.	Yes, I've heard of it Not proven
Q2		*Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?*	
	R1	I follow guidelines.	Following Guidelines
	R2	Guidelines suggest only when there is a prosthetic valve.	Following Guidelines
	R3	The definition of dental procedures varies. Dentist tries to cover himself by asking the cardiologist (CYA). Necessary for prosthetic valve, damaged valve, for deep cleaning, RCT, abscessed tooth.	CYA(Cover your ass) Following Guidelines
	R4	We follow recommendations. People do more than is necessary to avoid legalities.	CYA Guidelines
	R5	Only needed for certain situations.	Guidelines
Q3		*One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6. Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.*	
	R1	Absolutely. I agree that independent of other risk factors it's probably causing systemic inflammation (SI) and	Yes, it does Causes (SI)

		increasing the markers we use for heart disease. I'm not sure what comes first. Is it the systemic inflammation making PD worse, or is PD making the SI worse?	
	R2	Yes, anything that causes inflammation can.	Yes, it does Causes SI
	R3	PD is a portal of inflammation and infection, but how that links into atherosclerosis, I don't know.	Adds to SI
	R4	More than likely.	Probably/Yes
	R5	Yes, definitely. Triggers the immunological response.	Yes, it does Triggers SI
Q4		*Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?*	
	R1	I don't think so. I find it hard to believe that treating PD will make a measurable difference in CAD. Other factors more important (established). Treating other risk factors may make the PD better, but treating PD may not make the CAD better. I'm skeptical.	No Treating PD won't reduce CVD risk Other factors more important
	R2	It probably is. If it gets bad enough it can be a source of endocarditis, it elevates CRP and other reactants that may cause coronary problems so it makes sense.	Probably/Yes
	R3	No, until causation is proven. But important to general health. (yet untaught in medical school)	No Not proven Still important to health
	R4	Wherever there is a problem, it should be fixed. Unnecessary inflammation anywhere in the body is not good.	Probably Still important to health
	R5	No, too many other factors. But treating PD is important in reducing immunological response.	No Other factors more important Still important to health

When asked Q1, *Have you heard much about this link between oral health and cardiovascular disease,* all participants (*n*=5) agreed the oral-systemic link exists and is relevant, however each made the point that it has not been proven. Q2 was about the AHA scientific statement released in April 2012 that states "Observational studies to date support an association between PD and Atherosclerotic vascular disease (ASVD) independent of known confounders. They do not, however, support a causative relationship." In response, all interviewees (*n*=5) stated they were aware of the statement and the entire cohort (*n*=5) agreed the oral-systemic link had not been proven *causal* at this point, but acknowledged the *association* of PD and CVD.

When queried about the guidelines published by the AHA for preventions of Infective Endocarditis (Q2), each participant (*n*=5) agreed with these guidelines and stated they always follow them. Interestingly, with regards to the AHA guidelines for Prevention of Infective Endocarditis, two participants (R3 and R4) expressed that the guidelines seem to be more about CYA or "cover your ass" than being absolutely necessary.

When answering Q3 concerning the plausibility *that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease,* all cardiologists (*n*=5) agreed that PD can contribute to systemic inflammation. One doctor stated "I do agree that independent of other risk factors, it (PD) is probably causing inflammation, and increasing inflammatory markers, the same markers we look at in CVD (R1)."

Even though all the doctors (*n*=5) agreed with the association and the probability of PD increasing systemic inflammation, there was dissention amongst the doctors for

Q4. In replying to Q4, g*iven that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease*. Three responded that treating PD is not important in reducing one's risk of CVD (R1, R3, and R5); and two stated treating PD "probably" is important in the prevention of CVD (R2, R4). R3 added that in medical school training there was no dental training other than learning to look for symptoms of a suppressed immune system, such as thrush, stomatitis, or antibiotic misuse.

The next set of questions, Q5-Q9 as outlined in Table 5, relate to research question 2 "Are cardiologists including an evaluation of the oral cavity by themselves or an oral health care provider as a component of their proposed care plan for their patients with cardiovascular disease?"

Table 5

Data Analysis Q5-Q9 related to Research Question 2 about cardiologists including an evaluation of the oral cavity as a component of a proposed care plan for patients with cardiovascular disease

Q#	**ID#**	**Question & Response** (A chunk of text from transcript.)	**Code** (May be more than one)
Q5		*Could you describe your normal routine for new patient intake and physical examination?*	
	R1	Administrative paperwork, Health History, Vitals, Review of Symptoms, Consultation, EKG, treatment plan.	Standard NP exam No oral exam
	R2	Medical assistant gets basic vitals and history, review of symptoms, then I do exam and decide what the problems are and what to do.	Standard NP exam No oral exam
	R3	We meet in my office, go over tests, risks, exam, look in the mouth and ask about teeth for valve patients. Referral to DDs if necessary and if there is time (non	Standard NP exam Oral exam is

		emergency).	standard for valve patients
	R4	Paperwork, vitals, PA does exam, we do exam and come up with plan.	Standard NP exam Oral exam is routine
	R5	Paperwork, MA gets vitals, review questions, symptoms, history, EKG, discussion. Oral Exam	Standard NP exam Oral exam is routine
Q6		*Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?* *a. Are you comfortable screening your patients for PD?* *b. What indicators would you look for?*	
	R1	I do not, unless something is obvious. Most people in my population are older, PD is common. If I see clear poor oral hygiene, I will ask what's going on, but not that frequently.	Only discuss obvious signs Conditions of older population
	R2	I don't talk a whole lot about it, I do make notes about their dental condition, wearing dentures (a lot of the patients that I see, are), and smokers. I have a good idea of what healthy dental appearance is like.	If I see something obvious Conditions of the older population I know what healthy is
	R3	Valve patients only.	Valve patients
	R4	Generally not. But if proven stronger risk factor, I would. I do an oral exam routinely, but am looking for cyanosis; I may see something obvious at that time. I focus on established risk factors.	If I see something obvious Focus on known risks factors
	R5	In general no, if something is obvious during physical exam, I will mention it. This includes oral exam. Yes, I know what I am looking at.	When I see something obvious I know what I am looking at

Q7		*In your practice, who has the primary responsibility for patient education?*	
	R1	Me, sometimes the medical assistant. Handouts or discussion of risk factor modification.	I'm responsible for patient education
	R2	Definitely me.	I'm responsible for patient education
	R3	I do.	I'm responsible for patient education
	R4	Myself. But I train the team what to look for.	I'm responsible for patient education
	R5	Me	I'm responsible for patient education
Q8		*Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?*	
	R1	The information has not changed how I do things clinically.	I haven't changed my practice
	R2	No, I haven't done much of that.	No
	R3	Not on every patient, having educational material would be good.	Not routinely
	R4	**Didn't directly answer the question.** I will be interested to see if this proves causal to the heart. Inflammation needs to be taken care of anywhere in the body, especially the beginning of the GI tract.	No
	R5	I educate as much as possible, time is limited. If I see something I would discuss it just as I would any other issue I saw (mole on the back, etcetera).	Limited time Not routinely

Q9		*Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?* *a. If yes, how often and what types of procedures?* *b. If no, why not?*	
	R1	For heart valve replacement. If they have obvious poor oral hygiene or bad teeth, they will be sent for extraction or to dentist for evaluation. We don't have a lot of time to spend cleaning up PD at this point. To avoid endocarditis. Not for CAD.	For prevention of endocarditis related to heart valve surgeries only
	R2	Yes, for patients undergoing heart surgery, who have bad dental issues. That would have to be taken care of.	For prevention of endocarditis related to heart valve surgeries only
	R3	For patients having valve replacement when there is time. Otherwise just cover them with antibiotics.	For prevention of endocarditis related to heart valve surgeries only
	R4	For valve replacement, pacemaker, stents.	For prevention of endocarditis related to heart valve surgeries only
	R5	Yes, for heart transplant, valve replacement.	For prevention of endocarditis related to heart valve surgeries or transplant.

The objective of these five interview questions was to understand what the cardiologists currently do in their practices in relation to patient care, diagnosing, and

treatment planning. When responding to Q5, c*ould you describe your normal routine for new patient intake and physical examination,* consistently, the participants described similar routines for patient intake and initial exam. A standard exam, including paperwork, vitals, review of symptoms, review of history, physical exam and EKG was universal (*n*=5). Over half of the doctors (*n*=3) include an oral exam in their physical examination routine, although they are looking for additional signs of illness, not oral infection, or signs of periodontal disease (R3, R4 and R5).

When questioned if they ask patients about their oral health in Q6, the majority (*n*=4) responded that they do not. One doctor (R3) stated that he routinely does question patients on their oral health status if they have valve disease or will be undergoing valve replacement. The four doctors that do not routinely ask their patients about their oral health (*n*=4) stated that when they see something obvious about a patient's dental condition, they will question the patient about it. These four also stated that they know what a healthy oral condition looks like (R1, R2, R4 and R5). Additionally, one of these four doctors (R4) mentioned that he is busy focusing on the established risk factors and if the oral-systemic link were proven a stronger factor, he would routinely inquire about the patient's oral health.

With regards to Q7 and patient education, each of the participants (*n*=5) accepts full responsibility for the education of their patients in their practice. In addition, all doctors (*n*=5) stated they do not discuss the association of PD and CVD with their patients in response to Q8. Across the board, all the doctors (*n*=5) do recommend periodontal treatment for patients with active PD who need invasive heart procedures such as valve replacement. This would apply to patients with an abscessed tooth as well.

Two participants (R1 and R3) mentioned that sometimes there is not enough time to treat dental infections prior to heart surgery and it is necessary to administer antibiotics until dental work can safely be undertaken.

Table 6 summarizes responses to the last three interview questions Q10-Q12, that addressed the concept of intercollaboration between cardiology and dentistry and were designed to answer research question 3 "Do cardiologists feel collaboration with an oral health care provider may lead to outcomes that are more positive for their patients with cardiovascular disease?

Table 6

Data Analysis Q10-12 related to Research Question 3 with regards to collaboration with an oral health care provider and more positive outcomes for patients with CVD.

Q#	**ID#**	**Question & Response** (A chunk of text from transcript.)	**Code** (May be more than one)
Q10		*An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?*	
	R1	Collaboration needs to be done. Most my collaboration currently revolves around the DDS office asking if a patient requires prophylaxis or to discontinue a medication prior to a dental procedure. I fax them the form back. With EHR I can just push a button and records will be sent to whoever the patient asks me to. It won't take up my time or my staff's time.	I will collaborate with whoever refers to me With DDS when faxed a form EHR will make it easier to collaborate with all providers

	R2	I work with them every day, PA's, FNP's I consult with.	I collaborate every day
	R3	Yes. Dentists, PT's, Nurses, FNP, PA's	I collaborate every day
	R4	Yes. PA's, FNP	I collaborate every day
	R5	Any type of provider that refers to me I will communicate with just as I would a physician. I fax my notes.	I will collaborate with whoever refers to me. Fax
Q11		*Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?*	
	R1	I don't.	No
	R2	No, but it's a good idea.	No
	R3	No. Only for valve replacement.	No
	R4	Not routinely.	No
	R5	Not necessarily, actually the DDS will ask me if something needs to be done differently for a patient.	No
Q12		*In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?*	
	R1	They should keep me in the loop and I should keep them in the loop. Just pertinent info. EHR will make it easier for patients to get their own records and take to other providers on their own. My population not computer savvy though.	Two-way street, bi-directional
	R2	If a patient has periodontal disease, and seeks treatment, then someone else is emphasizing the need to quit smoking and other changes, so that is very good.	Another healthcare provider to teach patients about risk modification
	R3	Helpful if it proves out….	?
	R4	When DDS sees a problem, he can refer to me, I can test for CVD. Vice Versa Not determined to be a strong enough risk factor yet to be part of normal routine. But it may turn out to be.	Bi-directional referrals
	R5	Repetition is important, aggressive prevention important; refer to myself, or primary Physician.	Bi-directional referrals

			Another healthcare provider to teach patients about risk modification

When questioned about their current collaborative practices with Q10, all of the participants (*n*=5) responded that they collaborate every day with non-physician providers such as physician assistants, physical therapists, and nurses. The only collaboration with oral health care providers occurs when a dental practice has called or faxed regarding the need for premedication of a mutual patient. In this case, faxing is the method of communication.

The question Q11 asked, do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease? None (*n*=5) of the respondents collaborates with dentists to reduce a patient's risk for heart disease (Q11).

Q12 asked for their opinion about how collaboration between the two fields might benefit patients with CVD. Three of the doctors stated that it should be a bi-directional referral process (R1, R4 and R5). As stated by R1, "…it's not a bad idea for them to keep me in the loop and I should keep them in the loop." The other two respondents (R2 and R3) felt that having another healthcare provider reinforcing risk factor modification is important. An interesting opinion from R1 is that Electronic Health Records (EHR) should make collaboration easier in the future. It will be a quick step to send notes or records on a patient to any other provider. The issue of limited time available was mentioned by participants (*n*=2) at least three times during the interviews (R1 and R5).

Summary

Using interviews to gather data from cardiologists enrolled in this study, the PI transcribed all data and used chunking and coding to determine data saturation. Results of this qualitative study provide insight into the opinions and practices of this cohort of participating cardiologists (*N*=5). They accept the oral-systemic link as relevant and important to overall health, however there was no consensus that screening or questioning patients about their oral health will impact a patient's cardiac health. Given their current beliefs, the respondents do not feel it necessary to routinely perform an oral evaluation or refer to a dentist unless the patient is in need of invasive cardiac surgery. Finally, the participating physicians see collaboration with oral health care providers as an important practice that could lead to more positive health outcomes for mutual patients by reinforcing risk management in both offices. The next chapter presents a detailed discussion of the findings and their relevance to healthcare providers.

Discussion

Summary of Major Findings

With the absence of empirical data reported on the lack of collaboration between cardiology and periodontology, this study's ambition was to provide original research results addressing this phenomenon. Using a qualitative approach and grounded theory methodology, the PI interviewed cardiologists to gain insight into their thoughts, opinions, and practices in relation to the oral-systemic link. The objective of the interview process was to answer three research questions: 1) What are the cardiologist's beliefs about the oral-systemic link and the cardiac health of a patient? 2) Are cardiologists including an evaluation of the oral cavity by themselves or an oral health care provider as a component of their proposed care plan for their patients with cardiovascular disease? 3) Do cardiologists feel collaboration with an oral health care provider may lead to outcomes that are more positive for their patients with cardiovascular disease? After thorough analysis of the interview data and peer review of the emerging themes, the PI summarized the results as follows:

1. Cardiologists agree that the association between PD and CVD exists but it has not been proven causal or a more significant risk factor. All of them routinely follow the AHA guidelines for premedication to prevent Infective Endocarditis, even if it seems more of a liability concern than an actual need. And although four of the doctors believe PD increases systemic inflammation, they don't agree that treating PD will positively influence CVD outcomes.
2. The cardiologists perform analogous new patient exams and three of them include an oral exam. In this oral exam they are looking for other signs of

illness, not oral infection or PD. All of the doctors state that when they see something obvious about the patient's oral health during their exam, they would discuss it with the patient. Additionally, they all feel comfortable assessing oral health. Only when a patient needs to undergo invasive heart surgery, such as a valve replacement, would they suggest treatment for existing PD or oral infection. The research on the oral-systemic link has not changed the way these cardiologists practice or evaluate their patients.

3. In relation to professional collaboration, the cardiologists think collaboration is important; however, they do not currently collaborate with dentists to improve health outcomes for their patients with CVD. A concept that did emerge was the doctors feel patient education about CVD risk factors at both the dental and cardiology practice might encourage patients to change their risk factors.

Discussion

The results of this study clearly answered the research questions and provided understanding of the phenomenon studied. The goal of the analysis was to develop theories that explain the phenomenon. The following discussion is organized around emerging theories (see Table 7). The significance, relationship to previous research, assumptions of the PI, as well as explanations of unanticipated findings of each theory is presented. Implications of these theories are discussed (see Table 7).

Table 7:

Emerging Theories and Implications

Emerging Theories	Implications
Cardiologists are not going to change what they believe about the oral-systemic link, how they educate and evaluate their patients regarding the oral-systemic link, or begin collaborating with dentists to improve health outcomes until the oral-systemic link is proven causal.	*Dental teams need to be prepared to meet this need instead. The OSL is well accepted in the dental field. Dentists and dental hygienists need to take the lead in addressing this for all patients.*
"We don't have enough time; we focus on the known risk factors."	*Dental teams must take accountability to educate patients on the risk PD poses to CVD, just as they do for diabetes and other disease risks.*
If it is obvious, I will discuss it with them.	*Cardiologists are missing an opportunity to positively affect health outcomes for their patients. They have not been formally trained to detect PD.*
I follow guidelines; practice standards.	*The legal system has stronger influence on practice protocols than good common sense does. Practitioners want to wait until new evidence has become standard practice before they will change practice habits.*
I will collaborate with those who seek to collaborate with me, but I am not likely to seek the collaboration first.	*Patients who do not routinely go to the dentist may be overlooked for an associative CVD risk factor when the cardiologist fails to inquire about dental health and subsequently refer to a dentist or periodontist.*

Oral-systemic link. The overarching theory that emerged is *cardiologists are not going to change what they believe about the oral-systemic link, how they educate and evaluate their patients regarding the oral-systemic link, or begin collaborating with dentists to improve health outcomes until the oral-systemic link is proven causal*. PD is

one of the most common diseases in man and its impact on overall health has been rigorously studied in the last several decades (Genco & Williams, 2010). This large amount of scientific evidence supporting the association between PD and CVD has not convinced cardiologists that PD is a significant risk factor for cardiac events. CVD patients and PD patients share most of the same known risk factors; age, diabetes, smoking, stress, and genetics (World Heart Federation, 2011; Darby & Walsh, 2010). Nonetheless, cardiologists are not concerned that PD could negatively influence CVD.

Cardiologists acknowledge that CVD is inflammation driven (Pearson, et al., 2003). Additionally, this cohort agrees that PD should be treated to reduce systemic inflammation. This is where this study's findings display a discrepancy in thoughts and practices of cardiologists. Since they agree that one disease causes an increase in risk for another disease, why are they not yet convinced of the importance of evaluating patients for the first disease? Along with cholesterol testing, cardiologists order hsCRP testing to determine risk for cardiovascular events (Shanies & Hein, 2006). The presence of CRP in the blood indicates the body's heightened state of inflammation (Cho, 2010). Many studies have shown PD is associated with elevated levels of CRP and other markers of inflammation (Buchmann, et al., 2002; D'Aiuto, et al., 2004; Ebersole, et al., 1997; Loos, et al., 2000; Mattila, et al., 2002). Again, cardiologists are missing an opportunity to reduce risk of CVD events. The evidence for a new model of collaboration between cardiology and dentistry is observed. Clearly, it is time for a new paradigm of interprofessional health care delivery incorporating the latest evidence on the relationship of PD and CVD.

Provider time. To support this overarching theory, the PI suggests this supporting theory: *We don't have enough time; we focus on the known risk factors.* Lack of time could explain why cardiologists have not given oral health the place of importance that other risk factors have. Each of the respondents in this study have exceptionally hectic practices, and with heart disease being the number one cause of death in America, that is not likely to change. Creating more time during the examination phase of treatment is not likely.

This theory of insufficient time in providing care is reinforced in the results of The Survey of America's Physicians: Practice Patterns and Perspectives, 2012. The survey reported the average physician sees 20 patients per day (The Physicians Foundation, 2012). If the average workday is 8 hours, they see 2.5 patients per hour, or about 24 minutes per patient. The average dental hygienist sees one patient per 40-60 minutes (Levin, 2012). Unmistakably, the dental hygienist has more time to educate the patient than does the cardiologist. In their text *Dental Hygiene Theory and Practice,* Darby & Walsh (2010, p. xi) state "Oral health and systemic health are inextricably linked; therefore collaboration with other healthcare professionals is essential for quality client care." Furthermore, dental hygienists are trained to be competent in making assessments, diagnoses, and treatment plans that address the oral and systemic health of their patients (Darby & Walsh, 2010). This is supported by the Accreditation Standards for Dental Hygiene Education; standard 2-17, addressing the Dental Hygiene process of Care (ADA, 2013). If the field of cardiology does not have the time to educate patients on the association between the two diseases perhaps dentistry needs to take this on. Dentists and dental hygienists are well educated and practiced on providing patient

education for health risks. Accreditation Standards for Dental Education mandate, in standard 2-25, that graduates must be competent in providing, among other things, patient assessment, diagnoses and health promotion and disease prevention (ADA, 2010).

Perceived presence of periodontal diseases. All of the cardiologists expressed confidence in recognizing a poor oral condition; accordingly the theory *If it is obvious, I will discuss it with them,* emerged. This result was unexpected. The PI held a strong assumption that even in clear presence of oral infection; the cardiologists were not likely to address it. This is based on the PI's 26 years in dentistry and not once having a patient referred to the dental practice because their cardiologist suggested they have something obvious in their mouth evaluated. Learning that cardiologists are certain they know what healthy, infection free oral condition looks like, brought to question how they know this? Referring back to a study by Mouradian, et al. (2005), the medical students at U of W receive 4 hours of oral health related education during their 4 years of medical training. Understandably, we are talking about specialists who have not only completed medical school, internal medicine residence, and a cardiology fellowship, but they have also spent thousands of hours evaluating patients. It is logical that they should feel self-assured in their abilities to recognize oral infection or PD if it is obvious during a physical exam. The question that arises is, because cardiologists have never received formal education on evaluative measures for periodontal disease, or oral infection, how do they know what they are looking at?

Dental professionals are well aware of the silent nature of periodontal disease. There are observable signs of PD and they include: gingival erythema, edema, and bleeding (Nield-Gehrig & Willmann, 2008). It is presumed by the PI that these would be

the *obvious* signs noticed during the cardiologists' patient exams. These signs are universal for most infections. Conversely, there are hidden signs of PD and they include: bone loss, bleeding on probing, and exudate (Nield-Gehrig & Willman, 2008). These are the symptoms of PD that can be assumed the cardiologists do not notice. Given the unnoticeable signs of PD, there is a potential that many active PD infections are undoubtedly missed by the exams cardiologists are currently performing. The impact of this finding is countless patients with CVD or risk for CVD are overlooked in regards to their periodontal condition. It is plausible that in choosing a treatment plan that lacks referral for an oral assessment for their patients cardiologists are missing a great opportunity to help reduce systemic inflammation.

Professional guidelines. *I follow guidelines*. All respondents in this study adhere to the AHA guidelines for premedication to prevent infective endocarditis. When a patient requires a valve replacement, the cardiologists recommend a periodontal evaluation. Once more, this is only if they see *something obvious* during their physical exam. With the serious nature of invasive heart surgery, relying only on overt signs of infection could be detrimental to the surgery outcome and the longevity of the prosthetic. A study by Schmelzeisen, Yabroudi, and Dannon (2009) and published in *Internet Journal of Cardiovascular Research* concluded patients who are to receive a prosthetic valve should have all indicated dental treatment done prior to surgery since they are more susceptible to infective endocarditis, which is uncommon but potentially fatal (Schmelzeisen et al., 2009).

A point the PI would like to make is that Infective Endocarditis is extremely rare. The AHA guidelines are merely expert opinions and based on what seems *rational or*

prudent and have changed over the years (Wilson et al., 2007). However, because it is standard practice to follow the guidelines, providers, both dental and cardiology, will abide by them. One motivation is to avoid accusation of not following standard practices if they were in a court of law. Dentists and cardiologists follow these guidelines; even though the guidelines are not based on scientific evidence that proves administrating antibiotics will prevent IE.

The question arises, with all the evidence showing an association between PD and CVD, what will it take to convince a cardiologist that suggesting or referring a patient for oral evaluation has the potential for improved outcomes? The PI would suggest that if the AHA released a statement that provided a guideline for cardiologists to evaluate or refer patients for periodontal disease screening or odontogenic infection, in order to prevent atherosclerotic events, they would follow them. Unquestionably, because the governing body of cardiology had made the statement, soon it would become standard practice, thus motivating cardiologists to follow them in order to avoid liability. This also speaks to how legal issues have influenced medical practice. One might argue that to date there is no scientific evidence that supports a causal relationship between PD and CVD, therefore, why would the AHA develop such a statement? However, remember there is no evidence that premedication for prevention of IE reduces the incidence of IE (Wilson et al., 2007). The AHA report on The Prevention of Infective Endocarditis states "No prospective, randomized, placebo-controlled studies exist on the efficacy of antibiotic prophylaxis to prevent IE in patients who undergo a dental procedure" (Wilson et al., 2007, p. 1742). What makes IE more important than arterial plaque rupture (influenced by systemic inflammation) and subsequent stroke or heart attack?

Collaboration between cardiology and dentistry. Developing a theory that explains the lack of collaboration was the most difficult. The cardiologists interviewed believe patients would benefit from interprofessional collaboration in the following manner: *I will collaborate with those who seek to collaborate with me, but I am not likely to seek the collaboration first.* Presently, cardiologists have no motivation to reach out to dentists or periodontists for their expertise in order to reduce a patient's risk of CVD. This theory suggests cardiologists do not feel there may be anything to be gained by this interaction. Dental professionals have long reached out to cardiologists for their expert opinions on the need for premedication, or issues about medications prior to some dental procedures. Dental professionals consider these questions best answered by the cardiologist, being his or her specialty.

The dentist, and in particular, the periodontist, is the specialist in periodontal disease and oral infection. If the goal is to reduce inflammatory markers such as CRP, then just as the cardiologist relies on other specialists for their expertise treating patients for certain contributory risk factors, so too they should rely on dentists for treating PD to reduce the influence of systemic inflammation. Much of this lack of collaboration ties back to the education physicians receive in their medical school training. Historically, there has been a separation medical and dental education resulting in physicians having very little involvement or concern with oral health (Mouradian, 2012). Oral health education has not been given importance as a source of disease affecting overall health. We have physicians unprepared to identify one of the most common diseases found in mankind. However, is it their fault? Traditionally, medical schools have failed to recognize oral health education in their curriculums (Mouradian, 2005) and studies have

shown physicians have inadequate oral health knowledge and practices (Lewis, Grossman, Domoto & Deyo, 2000; Bader, Rozier, Lohr & Frame, 2004). Physicians do not know what they do not know. Figure 4 summarizes the model theory and supporting concepts.

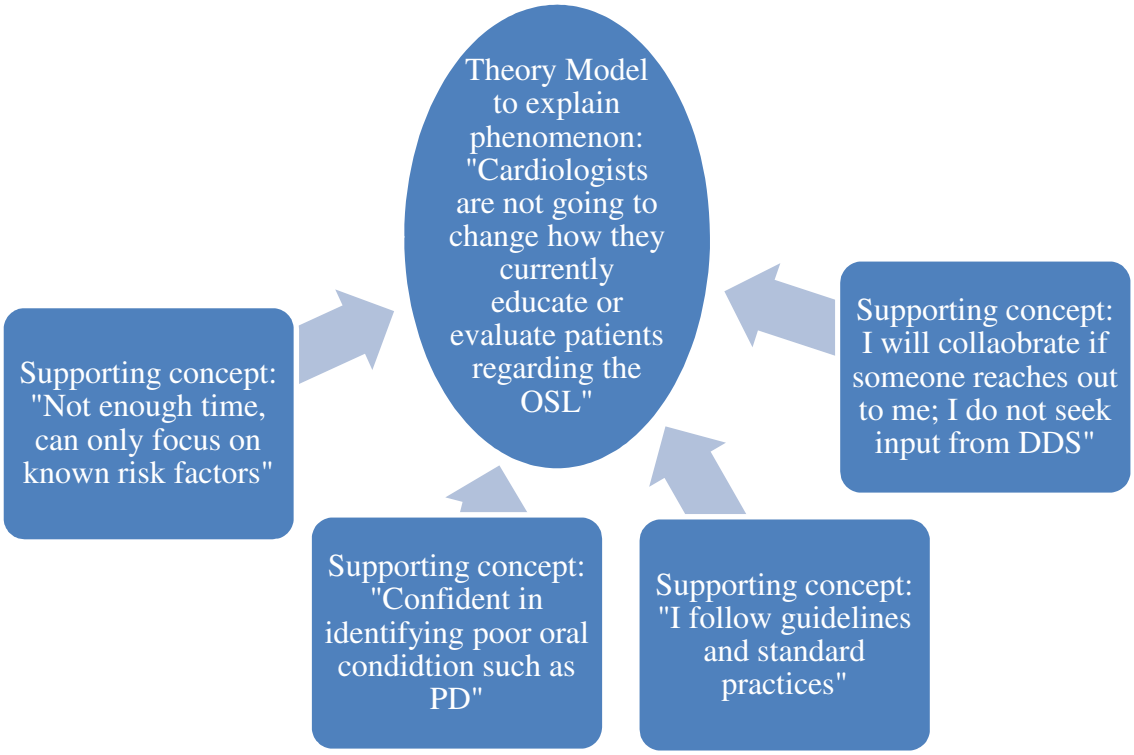

Figure 4. Theory development and supporting concepts.

Limitations

The study was limited to cardiovascular specialists because they are the provider most likely to evaluate and counsel patients on risk factors for CVD. The findings of this research were also limited by the PI's novice abilities. A more experienced interviewer may know how to bring out richer quality to the responses. A proficient interviewer can recognize when the interview questions need to be altered or added to in order to direct the participant to thoroughly answer all aspects of the question. The PI attempted to abide by the time limits in order to respect the interviewees time constraints resulting in potential loss of quality discussion.

Additionally, the size of the sample, though adequate for theories to develop, may cause some to question generalizability. In spite of the small sample, the PI was confident in saturation of the emergent concepts as there was little variation in the responses. There was diversity among the participants in regards to their gender, sex, age, cultural background, and education, however all participants currently practice in the same community. Three of the participants attended medical school outside of the United States. Students who attend medical school in areas outside of the United States may have been educated in a different manner than those educated in the United States. This could cause the responses from these participants to vary from the others. There is a potential for differences in study results with participants in different geographical regions of the United States, or types of practice. Cardiologists in the education arena may have different experiences and therefore respond differently than this cohort.

Recommendations

These findings highlight the need for dentistry to take the lead on oral-systemic health education for patients diagnosed with or at risk for CVD. Presently, cardiologists are not ready to implement screening and education of the oral-systemic link into their practice. Patients need to be aware of the associative connection between PD and CVD. Because of the accreditation standards as well as standards of care related to prevention, both dental hygienists and dentists are well equipped and educated to handle this important mission. Therefore, it falls to the dental practitioners to educate patients and help prevent disease. It is a matter of accountability

Additionally, the professions of dentistry and dental hygiene have the potential to establish policies related to standard of care for those patients with CVD or at risk for CVD. This study suggests patients are not likely to hear about the association at the cardiology office. Considering the fact that cardiologists receive little or no oral health education in medical school (Mouradian, 2005) and then little emphasis on oral health in their Internal Medicine Residency (ACGME, 2012), it is not surprising they do not value oral health and the connection to systemic health.

Once again, the opportunity for medical and dental professionals to collaborate with a focus on current evidence has been overlooked. A new model of interprofessional reliance is justified. Patients at risk for co-morbidities of PD and CVD need to be given information and treatment accordingly. If cardiologists do not feel referral or collaboration with a dentist is warranted, they should be educated and trained in screening for PD or other oral infections. The PI is convinced that cardiologists will not undertake this education unless practice standards have changed, stronger evidence on the

oral-systemic link has been published, or the American Heart Association publishes new guidelines. However, with interprofessional collaboration, patients may benefit by having an opportunity to reduce systemic inflammation and improve overall health and reduce risk for CVD events.

It is unfortunate that physicians are undereducated on oral health issues, and as such, they do not give oral health a place of importance in their practice. This translates to a society that also does not value oral health and its connection to systemic health. Society relies on the medical profession to set ideals and norms related to acceptable health. The medical profession relies on scientific evidence to influence their standard of practice. At what point does evidence move an entire profession to change their views and motivate them to incorporate new recommendations for their patients? Although diabetes was long suspected of contributing to heart disease, it was not fully accepted as a risk factor until the Framingham Heart Study. In 1974, the association of diabetes mellitus and heart disease was strengthened when analyses from the Framingham study data after 16-20 years, revealed cardiovascular death was three times more likely in individuals with diabetes than the general population (Kengne, Turnbull & MacMahon, (2010). It was this landmark study prompted additional studies and eventually put diabetes on the list of risk factors for CVD, and thus changing an entire model of understanding about a disease process. Perhaps more longitudinal research providing evidence of the risk PD poses for CVD will change the medical professions thinking in the near future.

Suggestions for future research

Additional research would be beneficial to compare with these results. Similar

study design and methods could be used in a larger more diverse cohort to establish what cardiologists are doing throughout the nation. Online surveys or focus groups within professional societies for cardiology specialists could be implemented to further research the emerging theories of this study. A study on the referring habits of dentists or periodontists to medical doctors would be enlightening. Are dentists making it a habit to refer their patients who exhibit risk factors for heart disease, diabetes or other systemic illnesses to their medical doctor for evaluation?

The oral-systemic link is currently studied rigorously in several fields of medicine. As more and more associative and possible causative relationships are established, learning the practices of primary care and other specialty fields may contribute more insight on the problem of collaboration.

This study results suggests that cardiologists may benefit from learning more about the profession of dentistry including the knowledge and skills of all levels of oral health care providers. Additionally, the potential for learning from dentistry about the components of an oral examination including mucosal, gingival, and periodontal assessments suggests a possible interprofessional education experience as a useful component within medical education. Further research into the need for and implementation of interprofessional education is warranted.

Conclusions

Until the scientific evidence on the oral-systemic link between PD and CVD is proven causative, cardiologists will not change the way they practice. They are not convinced at this point that taking the time to educate their patients on the oral-systemic link will result in measurable health improvement. Cardiologists agree that PD

contributes to systemic inflammation, still they are not concerned with evaluating patients for PD or recommending their patients see a dentist or periodontist for evaluation. Lack of time is one reason quoted for not educating patients on the association. Cardiologists feel strongly they should focus on the known risk factors during their limited time with each patient.

The respondents are very comfortable with their ability to recognize oral disease in a patient during their routine physical exam. Although they do not look in the mouth for signs of PD or question the patient about their current oral health status, they are certain they would recognize something obvious. However, the *hidden* signs of PD are being missed with this philosophy.

These physicians are also motivated by current practice standards and following guidelines published by the AHA. Following these guidelines, regardless of the lack of scientific evidence supporting the guidelines, gives the physician a sense of confidence that he or she will be protected from possible litigation. The PI suggests that if the AHA developed and released guidelines for the evaluation and subsequent referral to periodontists or dentists, the cardiologists would follow them.

Finally, the dental field cannot expect to see cardiologists reaching out to them for their expertise on PD or oral infections. Cardiologists do not see anything to gain by this collaboration for their patients with CVD and PD co-morbidities. The evidence of PD contributing to systemic inflammation has not proven to the field of cardiology that treating PD could lower systemic inflammation, thereby improving health outcomes.

As previously quoted in this document, the editors of *The American Journal of Cardiology* and *Journal of Periodontology* make a profound statement about the body as

a whole, “The human organism is a single unit composed of a seemingly infinite number of biologic processes so intertwined that abnormalities of almost any of its parts or processes have profound effects on multiple other body areas…” (Friedewald, 2009, p. 1021). The separation of medical and dental professions has contributed to a sense that the mouth is separated from the rest of the body. In fact, disease in the mouth can have an effect throughout the body. Health professionals need to collaborate to identify and educate those at risk for both PD and CVD.

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Appendix A

Interview Guide

Explain the study.

"Dr. __, thank you for meeting with me today and participating in my research about the oral-systemic link. This research is part of my requirements to obtain my Master's Degree in Dental Hygiene and I am very interested in interprofessional collaboration. The purpose of this research is to discover the beliefs and opinions that cardiologists have in regards to this link, and to identify barriers, if any exist, to collaboration between the fields of cardiology and dentistry.

I will ask demographic questions first, followed by 12 interview questions regarding your beliefs and experiences. You are free to not answer any questions which you find objectionable. Washington State law (where I am obtaining my master's degree) provides that private conversations may not be recorded, intercepted, or divulged without permission of the individuals involved. I will be audio recording your responses to the interview questions. The audio recording will be transcribed, by me. **Your identity will remain confidential**."

Do you have any questions about the study or about this interview?

Turn on recorder

> "Dr._____, thank you for participating in my research about the oral-systemic link. Do I have your permission to record your responses and transcribe them later? Your identity will remain confidential. All audio recordings will be deleted after transcription."

Begin with demographics

1. Name
2. Age
3. Years in practice
4. Medical school attended
5. Internal medicine residency
6. Fellowship attended
7. Any sub-specialty

Interview Questions

1. In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?
    a. If, yes what have you heard about it?
    b. If no, "No problem, basically, research suggests an association between periodontal disease and cardiovascular disease. Inflammation is recognized as the common denominator. Periodontal disease increases the inflammatory burden of the body."
2. Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion

among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?

3. One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6. Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.
4. Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?
5. Could you describe your normal routine for new patient intake and physical examination?
6. Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?
    a. Are you comfortable screening your patients for PD?
    b. What indicators would you look for?
7. In your practice, who has the primary responsibility for patient education?
8. Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?
9. Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?
    a. If yes, how often and what types of procedures?

b. If no, why not?

10. An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?
    a. How do you think this might help to improve patient care?
    b. What do you perceive as the possible barriers?
11. Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?
12. In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?

Appendix B

Interview Transcripts

Interview date: April 12, 2013

Length: 17 min. 9 sec.

1. Name R1
2. Age 42
3. Years in practice 6
4. Medical school attended Gov't Medical College, Punjab, India
5. Internal medicine residency Alleghany General Hospital, Pittsburgh, Pennsylvania
6. Fellowship attended same
7. Any sub-specialty Interventional Cardiology

Interview Questions

1. In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?
    a. If, yes what have you heard about it?
    b. If no, "No problem, basically, research suggests an association between periodontal disease and cardiovascular disease. Inflammation is recognized as the common denominator. Periodontal disease increases the inflammatory burden of the body."

    R1 *I've heard about the statement, I read it briefly when it came out, but I also know that some, I don't even know the name of the dental organization, came out with a similar statement about the same time. Beyond that I haven't heard much. I am aware that it exists, and I believe that it makes sense, but I haven't really done anything about it clinically. It hasn't changed what I do because even though I know that they are acknowledging that there's a link, no one is saying that doing something about the periodontal disease will make a difference from a cardiac standpoint. So yes, I'm aware of it, but that's about it.*
2. Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion

among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?

R1 *Um, I've been following guidelines, I've personally haven't really seen any endocarditis, that's the infection of the heart valves, directly related to getting any dental procedures, so my personal opinion is that it's probably not needed that often, but I was basically following guidelines. Until a few years ago the guidelines were relatively extensive and we would decide who was low risk/ high risk depending the procedure about 5-6 years ago they came out with relatively simple guidelines which basically states that if you have a complex, structural cardiac disease, or if you've had endocarditis before, or prosthetic valves, those are the only patients who need pretreatment, so in my mind it simplified it a lot, so I still pretreat those patients, but I don't treat anyone else Having said that I think a lot of dentists still feel they need to pretreat based on the old guidelines. I personally don't think that it is needed, but obviously if I hear about an isolated case here and there, you wonder if it's worth it. But generally, I personally follow guidelines.*

3. One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6. Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.

R1 *Absolutely, I think that most of the early, the little that I know, the studies that were done do seem to suggest that systemic inflammation, whether it's the*

underlying inflammation that causes periodontal disease, or periodontal disease makes that worse, I'm not sure what causes what. I do agree that independent of other risk factors, it's probably causing inflammation, which is basically the same marker we use for heart disease, I agree that there is probably a relationship, but I'm not sure what comes first.

4. Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?

R1 *I don't think so. I agree that going to the dentist regularly and getting that taken care of for your teeth is a very good idea maybe even from an infection standpoint important, but from a coronary artery disease standpoint I think it's going to be hard to prove, that fixing that, the plaque, that cleaning the plaque off, or treating the periodontal disease, will make a measurable difference in CAD. I find it hard to believe, there are so many other things that I think will have some correlation and where do we start and where do we stop? There might be, I think it's going to be very hard to prove.*

PI So it seems like kind of a small thing in a huge ocean of…

R1 *Yeah, there's so many, honestly, from a cardiology standpoint, I see how many patients are under treated with the very well-known risk factors, diabetes, cholesterol, blood pressure, in my mind, if we do a better job with those established risk factors , then we focus on the little one. I… I'm skeptical that treating that will make any difference in someone who's more susceptible to have periodontal disease. Even if I, even if they go for a regular cleaning, they are*

still susceptible, to the same disease, so how do I, I don't think that that changes the scene, the CAD prevalence in that patient. The Endocarditis, that's a little bit different, that's the infection, So if you avoid the bacterial growth on your teeth, that's probably less likely to cause problems, but CAD, I don't know, eventually, it might pan out to be, I suspect it's going to be a small.

PI I understand what you are saying though, these are big things…

R1 *Yes, they are so big …*

PI **Yeah**, that taking care of those…

R1 *So even if you, I think of diabetics, they have such a high incidence of PD, because of poor sugar control, or more bacterial growth or whatever, so If I fix the diabetes aggressively, won't that help more than the teeth, plus reduce the diabetes, so I'm skeptical.*

PI I totally understand.

R1 *I'm skeptical.*

5. Could you describe your normal routine for new patient intake and physical examination?

R1 *I mostly see hospital patients, but I do see some office patients. Here (the hospital) it's different, it's based on the symptoms, but basically when a patient comes to the office and they are a new patient coming to me, first we have them do the basic paperwork, administrative stuff. Then they get roomed, initially we check the weight, bp, heart rate, their height, then BMI, which is calculated, and then they go through a list of all the questions, what are they here with, what else has been bothering them, their health history, what medications they take, what*

else in the past that seems pertinent, whether its related or unrelated to the heart and then we do an EKG on every patient, so that is the routine for the medical assistant, takes about 20-25 minutes for the new patient. Then they give me the paperwork and I go in and focus obviously on those issues and do testing or whatever needs to be done from a cardiac standpoint.

6. Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?

   R1 *Um…I don't unless I see something, if I see clear poor oral hygiene I will ask what's going on. But it's not that frequent that I address that.*

   PI It would have to be something really obvious, or

   R1 *Yeah, and unfortunately, in my population, with the older people, it's so prevalent, no, I don't specifically, some of them are meth users, that's what triggers it more often, if I see a young person and I see no teeth, or a lot of missing teeth, but generally I don't address that.*

   c. Are you comfortable screening your patients for PD?

   d. What indicators would you look for?

7. In your practice, who has the primary responsibility for patient education?

   R1 *It's primarily me, but the medical assistant plays a role as well, we have some handouts I'll ask them to give out sometimes, but most of the time, I'm the one discussing risk factor modification or primary or secondary treatment.*

8. Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?

R1 *I have not, yeah, I have not.*

PI You kind of answered that earlier when you said it has not changed how you approach things.

R1 *Yeah*

9. Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?

R1 *Um, not for what I do, I typically do interventional cardiology, basically means an angiogram or stent, but if a patient's going to have a heart valve replacement and they have bad teeth, or bad oral hygiene, yes, those patients will be sent for tooth extraction or evaluation by a dentist because again, that's more of the infection, not coronary artery disease, because of the risk so I have sent two or three people for extraction before I would agree to send them for heart valve replacement.*

PI Ok, is that because you questioned them about their teeth and they said, "I have these teeth bothering me..."

R1 *Basically, you see, valve replacement is a smaller aspect of what we do, a majority of the patients are not here because their valves are bad, so that happens when I do send a patient for valve replacement, I know the surgeon is going to ask me about any other potential sources of infection, those are the people when I do look at their teeth, or, I ask them when was their last dental visit, and if it's clearly decay and rotten teeth, I'll tell them, and sometimes it's not me but the surgeon that says "you know what, I need the teeth out." But it's generally too*

late by this time to start cleaning things up, and fixing things, we don't have months and months to see the results.

a. If yes, how often and what types of procedures?

b. If no, why not?

10. An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?

R1 *At this point, I agree with that, I think it needs to be done, I don't, unless I get something specifically for another office, or I need to communicate with them, I'll fax it. But I have not been, I routinely fax, as soon as I'm done with my notes to all the other physicians, I'll fax it to whoever the patient wants me too, but we have not been including podiatrists, chiropractors, dentists, unless the patients specifically says that that's what needs to be done. A lot of times, my interaction with the dental office are the forms that they have sent to me asking "does this patient need any prophylaxis?" "Does this patient need to stop any medication?" Those obviously I will fax back, but routinely I don't fax my, nor do I ask the patient "who's your dentist?" I don't even ask them.*

PI Somebody brought up to me that as a cardiologist, actually you are the end point in the referrals, you're not sending…

R1 *Yeah, but it's not a bad idea for me to send, the problem is since I don't ask them, patients don't think of them as "who's your regular doctor?" "Who do you want me to send records to?" And we haven't made it a habit at all, it probably makes sense I think, but I haven't thought of doing that routinely.*

a. How do you think this might help to improve patient care?

b. What do you perceive as the possible barriers?

11. Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?

R1 *Again, I don't.*

12. In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?

R1 *So I , honestly I haven't really thought about doing that, but I think it makes total sense to collaborate more, at least to be in touch, I should, not just me sending them their forms, but maybe them including me, especially if they find significant disease. If it's just a routine check, I probably won't even look at that, but if they find something concerning, it probably is not a bad idea for them to keep me in the loop, and me keep them in the loop. So I think that there's a lot of room for collaboration, I'm a big proponent of electronic health records, patients being able to access their records. Because that's probably the easiest way for the patients. If I as a patient download my records, I can take them to the next one, instead of relying on the physician to send.*

PI See, I didn't know that patients are going to able to do that, is that the overall goal with EHR, that patients will be able to download their own.?

There are a lot of systems, in our office we don't let them have access, but I think, even labs and stuff, it's so much more convenient for patients to access their labs, if they have any questions, call us, that way they always have access to that. Like I said I am a huge proponent of that, we haven't done that, mostly because

cardiology is harder, majority of our patients don't have access to that, they are not savvy enough, because they are all older. So I don't want questions as to "how do I access that?" because that's going to bog me down. The other part is the expense, because the patient portal becomes expensive and I wouldn't have that many patients to start paying extra money to have access. For younger patients, I think it makes perfect sense. But sometimes we get bogged down, let's say, it's a foot fracture, and the patients getting treated, and they send it out to every single physician who is seeing the patient, the majority of us don't really care. So, I don't want too much communication but I don't see how this could hurt. I think it should be done, I don't think it's done enough.

PI Is there any barrier that you can see, as to why it is not…

It just hasn't been the norm, with EHR I can see there is no barrier, because all I do is literally, as long as the dentist is in my system, all I do is one click, it's not taking up my staff's time, it's not standing in the fax, it's all electronic so it should be much more easy. And I think it's just telling the patients to include and from our standpoint to include the dentist.

Interview Date: 4/12/13
Length: 9 min. 56 sec.

1. Name R2
2. Age 66
3. Years in practice 38
4. Medical school attended Philadelphia College of Osteopathic Medicine
5. Internal medicine residency San Diego
6. Fellowship attended San Diego
7. Any sub-specialty Interventional Cardiology, Critical Care

Interview Questions

1. In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?

   R2 *Yeah, made my own observations over the years as well.*

   a. If, yes what have you heard about it?

      R2 *What I recall hearing about a year ago was there had been a concern that when you had Periodontal Disease there had been an increased risk of Atherosclerotic coronary disease, but that hasn't been proved, correct? That's what I have heard, but here's what I …well I don't want to get ahead of myself.*

   b. If no, "No problem, basically, research suggests an association between periodontal disease and cardiovascular disease. Inflammation is recognized as the common denominator. Periodontal disease increases the inflammatory burden of the body."

2. Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?

   R2 *Well for most people, well I suppose it depends on what you mean by susceptible individuals, but current guidelines don't suggest using antibiotics*

routinely for dental work unless there's a prosthetic valve. There used to be a number of indications for using antibiotic but they are no longer present as the low risk of endocarditis is outweighed by the risk of side effect from antibiotics.

3. One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6. Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.

   R2 *Well, anything that causes inflammation can, that's just one other place.*

4. Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?

   R2 *Probably is. I think that if it gets bad enough it can be a source of endocarditis as well as elevation of CRP or other acute reactants that may cause coronary problems so it makes sense to (read it)(not sure).*

5. Could you describe your normal routine for new patient intake and physical examination?

   R2 *Medical assistant gets basic vital signs and past history and puts that in the electronic med record; she also asks them a detailed review of symptoms, a set of questions. So then I see them, get their history, do an exam, and decide what the problems are and what we are going to do about them.*

6. Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?

R2 *Um, I actually don't talk a whole lot about it, but I do make notes about what their dental condition is like, providing they are not wearing dentures, and a lot of the patients that I see, are. Smoking.*

a. Are you comfortable screening your patients for PD?

R2 *Well, I don't do an exam like you would get at the dentist, but I have a pretty good idea of what healthy dental appearance is like.*

b. What indicators would you look for?

7. In your practice, who has the primary responsibility for patient education?

R2 *That's definitely me.*

8. Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?

R2 *Um, actually no, I have not done much of that.*

9. Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?

R2 *Um, not for a cardiac catherization, but if a patient were going to have heart surgery, then if the patient has bad dental issues, that's something that would have to be taken care of.*

a. If yes, how often and what types of procedures?

b. If no, why not?

10. An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?

R2 *Well I work with them every day in the cath lab, in that sense. A lot of the people that I get consults from are PA's and Nurse Practioners from doctors' offices, there seems to be fewer and fewer doctors doing primary care anymore.*

a. How do you think this might help to improve patient care?

b. What do you perceive as the possible barriers?

11. Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?

R2 *No, not that I don't think it's a good idea, but I don't.*

12. In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?

R2 *Well, it's quite likely that if a person has periodontal disease, and they see a doctor about it, it's quite likely they are going to get counseled about it and a lot of things and it will be somebody else emphasizing they need to stop smoking, and changes so of their eating habits. So from that standpoint I think it's very good. Whether or not fixing PD lessens their risk of coronary problems, my bet it that it does. For a couple reasons, one of them is changes in life style; the other one is maybe the inflammatory problems will lessen the chance of coronary problems.*

PI Was there something else you were going to say earlier; when you said that you didn't want to get ahead of yourself?

R2 *Well I can tell you that when we see somebody with very good dental health, even if they are smokers, the likelihood of coronary problems is extraordinarily low, that's not common, that's very uncommon, but there are very few long term smokers that have healthy teeth and gums, but when they do, it's very rare to find*

any problems. And if somebody is not a smoker and they have very health teeth, the likelihood of having coronary problems is extraordinarily low.

PI Have you seen infective endocarditis yourself related to dental procedures?

R2 *Um, rarely, some time ago somebody who had not very healthy teeth can gums and had some teeth extracted, developed endocarditis related to mitral valve prolapse.*

Interview Date: 4/24/13
Length: 38 min. 23 sec.

1. Name R3
2. Age 67
3. Years in practice 42 MD
4. Medical school attended UCLA Medical School
5. General and Cardiac and thoracic residency UCLA Medical School
6. Fellowship attended UCLA
7. Any sub-specialty Interventional Cardiology

Interview Questions

1. In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?

   R3 *I have heard that concept discussed for years. Over the years people have looked for an infectious agent that causes that, it's just been hard to prove. If indeed there is and infectious etiology of atherosclerosis, this wouldn't be the first time that an entire model for a disease process has been turned upside down.*

   a. If, yes what have you heard about it?

   b. If no, "No problem, basically, research suggests an association between periodontal disease and cardiovascular disease. Inflammation is recognized as the common denominator. Periodontal disease increases the inflammatory burden of the body."

2. Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?

   R3 *This is where you get into the cardiac surgeon's role of the valves. Just about everybody in whom we place a prosthetic valve, it becomes an issue when these patients go to get dental procedures, but the definition of*

dental procedures varies, I've noticed from office to office. Often to cover themselves, the dentist is asking the cardiologist or the cardiac surgeon to "check some boxes" and send it back to them. So there is an element of CYA. All doctors know that the mouth is basically a cesspool. If you have a prosthetic valve in place, that can be seeded. Or, if you have an already damaged heart valve; in truth all valves calcify as they age, but we don't routinely go around putting everybody on 24 hour prophylaxis. A lot of people have bad valves, they just aren't known to have valve disease because they haven't been symptomatic, or studied. But people who have an artificial valve, particularly if it is new, in the first several months, then they can get seeded, and that's a disaster. *(He showed me an artificial valve at this point and the area of it that has stitches that can get infected).*

PI *Do you tell patients, after you have placed a prosthetic valve, "from now on you need to be pre-medicated before dental work?"*

R3 *Yes I do. I tell them "don't worry about routine dental procedures, if you're going to have a filling." But if they are going to have deep cleaning, or if you have abscessed pocket or a root canal with an abscessed tooth, then you need to be covered very early in the whole process. And people with dental pain and an abscess generally start on antibiotics because they aren't going to see the doctor right away anyhow. So that linkage is pretty well established and we do tell them "this is in your blood stream" and most every dentist that I have seen is pretty well on to this.*

3. One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6. Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.

   R3 *Wow, well there is no question that periodontal disease is sort of a portal for inflammation and infection, so therefore, having CRP elevated and the interleukin, that's a response to that, how that then links into having atherosclerosis, I don't know. And the other part of it is, atherosclerosis is very segmental…it's usually only in the first third of the distance, so if there really is a systemic inflammatory disease causing this, then why isn't the whole vessel diseased? Or why not the radial artery in your wrist, you don't get atherosclerosis in your wrist, or the mammary artery. If you had a systemic inflammatory agent that affected the inner lining of vessels of a certain diameter, then why primarily the heart? Not your big toe? But that also goes for cholesterol metabolism, doesn't it? So why is it segmental? That's what is the great mystery. If you are really trying to come up with a total body systemic issue, like your diet, then why are only certain vessels affected?*

4. Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?

R3 *Well, ok, association is different from causation, so the pure answer to your question is until causation is proven you have to answer that question "no." But, I think treatment of PD is very important to your general health management, in terms of septicemia, erosion, in other words, good dental health is part of your life…it's totally un taught in medical school. {In my second year of medical school the instructor called me to answer the question "what is the etiology and pathophysiology of dental caries?} I had studied everything except that; I hadn't studied that, because we have a dental school next door. Not a single person out of the 105 people in there knew what the organism would be. We didn't study that because that's what the dental students study, we don't do that. So that was a big awakening. I had to tell him that I know every other thing, but I can't answer that honestly, and that was my oversight. I know several dental students and I wish they were here right now.*

PI I read in my research that medical students get about 4 hours of oral infection over 4 years of medical school.

In my training 1967-1971, we got nothing on dental, other than what we learned on the various units to do with suppressed immune systems, thrush, antibiotic misuse, stomatitis, these were secondary to their primary illness, so we became familiar with the oral presentations of complications of their primary illnesses. But no medical student could tell you what the etiology of halitosis. In fact personally I was never trained on taking care of my own teeth. I wasn't going to the dentist, I wasn't flossing. But it was a poorly

taught subject in medical school. So I will claim institutional ignorance. I'm much smarter now. {I think the role of the dental hygienist is much more respected that it used to be.}

5. Could you describe your normal routine for new patient intake and physical examination?

R3 *I meet a patient here and I show them their angiograms and their films, and we talk about what the cardiologist has suggested and I tell them that I agree. We talk about the operational risks, how long in the hospital, all the normal educational stuff. Then I do an exam, and I do look in the mouth and ask about teeth, in valve patients, not necessarily all patients. But on the valves it's very specific "do you have any teeth pain any loose teeth, or bleeding in your gums with brushing your teeth?" And then I will look in their mouth with a small flashlight. I'm looking for any evidence. And there are people with valve surgery coming up that I will send to a dentist before we do the surgery. I have had people get extractions, and then we wait for a week or two, depending on if there was infection. If a tooth is going to abscess I don't want it to do that three weeks after a new heart valve. If it's an elective surgery I have this opportunity, when it is an emergency, I don't.*

PI Do you find that the patients are surprised that you are concerned about their oral health?

R3 *Well there is a group of patients that have never been concerned about their oral health. Then there are some that will ask me and I explain that we are about to put a valve in their heart and it can get an infection, and then they*

get it. So from my very early days of training, we were very aware of the danger of smoldering and chronic and flaring mouth or dental abscess or processes.

6. Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?

   R3 *In the valve patients, yes, but not every patient.*

7. In your practice, who has the primary responsibility for patient education?

   R3 *I do.*

8. Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?

   R3 *Yes, I do, but I can't do it on every patient, so it's probably a good idea to have some material. Because my patients are elderly, some have dentures but I'm in the medicare age group. Some have access to dental care, others don't. So it wouldn't be bad, to have materials.*

9. Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?

   R3 *Yes I do, for valve replacement. {I don't always have the option, sometimes we just have to cover them with antibiotics.}*

   a. If yes, how often and what types of procedures? *Valve replacement*

   b. If no, why not?

10. An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?

    R3 *Well, let's see, I collaborate with dentists on the valve patients, with the physical therapists post op, nurse exercise folks, about three to four week past surgery. I collaborate with nurse practitioners, PA's at various offices and clinics.*

    a. How do you think this might help to improve patient care?
    b. What do you perceive as the possible barriers?

11. Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?

    R3 *Yes*

    a. If yes, how often.
    b. Do you think that this is a common practice in the field of cardiology?

    R3 *I think they are all trained in the danger of mixing valve surgery with bad teeth. So I hope that's the case, but I couldn't tell you.*

12. In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?

    R3 *Well, assuming this link is more than just associative, or that it's felt that one way* …lengthy story about stent closure, didn't really answer the question.

Interview Date: 4/29/13
Length: 34 min. 5 sec.

1. Name R4
2. Age 54
3. Years in practice 31
4. Medical school attended Bangalore Medical School, India
5. Internal medicine residency Loma Linda
6. Fellowship attended Loma Linda
7. Any sub-specialty Interventional Cardiology

Interview Questions

1. In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?

   R4 *I have heard about the association, but the causality, I'm not sure.*

   a. If, yes what have you heard about it?

   b. If no, "No problem, basically, research suggests an association between periodontal disease and cardiovascular disease. Inflammation is recognized as the common denominator. Periodontal disease increases the inflammatory burden of the body."

2. Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?

   R4 *You know we have done this for a long time. More from the recommendations, but also people always worry about the legality, "what if someone gets endocarditis?" so people are on the side of doing more than is necessary, but in the recent guidelines, they have taken away a lot of the indications, so, it is becoming much less and less of a clear cut indication.*

3. One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6.

Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.

R4 *More than likely. We have had come to know the relationship between general inflammation and the coronary tree itself. One of the manifestations in the endothelium of the coronary artery itself and the rupture of plaque, clearly there is lots of evidence that there is lots of inflammatory cells at the edges of the plaque and when the plaque ruptures it is a terminal event. And once the plaque ruptures then the heart attack ensues. We don't have a good way of detecting where this inflammation is in the coronary tree or where is the inflammation the most? There are lots of people trying to find out where the most of the inflammation. If someone can come up with a simple way of detecting "where is the inflammation the maximum?" that would be the key. I'm sure that inflammation elsewhere in the body can also create problems so you can hypothesize that if you have chronic ongoing periodontal disease it can cause problems in other areas as well.*

How do you know where the CRP is coming from?

4. Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?

R4 *I think I always believe in the holistic approach, and I think wherever there is a problem, we need to fix it. Whether in the periodontal area or some chronic*

arthritis or chronic sinusitis, I think it needs to be fixed. Unnecessary inflammation in the body is not good.

5. Could you describe your normal routine for new patient intake and physical examination?

   R4 *Normally they fill out the paper work; if they want they can fill it out online. The Medical Assistant brings them in and gets their vital signs, then with a brand new patient, my PA goes in and examines the patient, then he presents it to me and then we both go in and evaluate and come up with a treatment plan.*

6. Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?

   R4 *Generally not, I'm geared more towards the cardiovascular risk factors. Of course now if you prove it, may be people will start doing that, but right now, I'm more focused on the very well-known risk factors like diabetes, hypertension, cholesterol, smoking. You know if someone has a bad smell probably I will tell him, but not in general to everybody.*

   PI So it's not something in your general examination, but if something is obvious to you?

   R4 *I mean, oral examination is part of my regular routine, at least I will ask them to stick out their tongue*,

   PI What are you looking for?

   R4 *I'm looking for any pallor, or cyanosis, but if I can see a sign of a bad oral health that jumps out at me, probably I will tell him.*

   PI So you are comfortable looking in someone's mouth

R4 *Oh yes, that's part of the normal physical examination.*

a. Are you comfortable screening your patients for PD?

b. What indicators would you look for?

7. In your practice, who has the primary responsibility for patient education?

R4 *I take it upon myself, because the buck stops with me. My goal is to train everyone in my office, starting with the front office, we are here as a team. They can come to me and tell me "Dr. _____, I found this while talking to the patient…" give me some more information about the patient so I can help them. If they are smoking start talking to them about cessation. The more they hear it from more people the better, it doesn't have to be the MD.*

8. Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?

R4 *I guess as I said earlier, if there is a problem in one part of the body you need to take care of it, why ignore it? I think all the parts are important. I will be interested to see how this is casual relationship between the heart, I'm sure even if it is negative, it will be something else that it is not good about it. So it needs to be taken care of, we can't have bad inflammation anywhere in the body, especially, the beginning of the GI tract.*

9. Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?

R4 *Not specifically, unless I see something that is glaring out at me. Of course if they need a prosthesis in the body.*

a. If yes, how often and what types of procedures?

Valve implant, pacemaker, and stents. Not for angiogram, because I'm not convinced that's going to hurt them. But anytime I'm going to place a foreign body in the body. I don't want to have any source of inflammation in the body, many times I will reschedule my procedures, and bad oral infection would be one reason.

b. If no, why not?

10. An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?

R4 *PA's FNP, there is a growing number, they are stepping into the shoes. I have had a PA for 8 plus years now.*

a. How do you think this might help to improve patient care?

b. What do you perceive as the possible barriers?

11. Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?

R4 *I have not been routinely doing it, but I just tell them, go ahead and see your dentist or your primary doctor, I am just one part of the picture. I think it is important to educate the patient, at least you can tell them. I think we should do what is good for the patient, and not worry about legalities because of lawsuits, people are afraid. As a human being, if someone needs attention, just go ahead and take care of it.*

PI Do you think the EHR would make it easier to collaborate with other healthcare fields?

R4 *Maybe eventually, we are at the beginning, but it may happen eventually. Right now, no.*

12. In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?

R4 *Every time the dentist sees a problem, maybe I will come up in his mind, and I can look for it, or at least do a screening, or vice versa, if I am seeing a cardiac patient and I see PD I can tell them you need to go take care of it, because it is all interrelated. Unless you take care if it I'm just putting a band aid on it. Even if it is disproven, to me the human body is a temple that houses the soul; you better take care of it. Whether it is the ear, the nose, the throat, any part of the body, they work with each other. Each part by itself is necessary for the proper function of the human body.*

PI So If I am understanding what you are saying over all, if this is proven to be a stronger risk factor, like in the category of diabetes, or HBP, or high cholesterol, then you would put it into your regular routine, it just hasn't proven to be a strong enough risk factor?

R4 *Oh yea, if it was stronger. But in general, I think that it is still important. Even without the relationship proven, and it may be stronger than I think, which you are going to prove, or your generation may prove, then the emphasis to take care of it.*

PI What do you think changes something from and being associated to being causative?

R4 *I think that when the causation has been worked out to some degree, chronic ongoing changes have been proven. It's the end organ damage, maybe the inflammation works the same way, the endothelium gets inflamed and affects the oxygen exchange.*

Interview Date: 5/9/13

Length: 14 min. 55 sec.

1. Name R5
2. Age 53
3. Years in practice 25
4. Medical school attended Autonoma University in Guadalajara, Mexico
5. Internal medicine residency University of Connecticut, New Britain.
6. Fellowship attended California Pacific Medical Center , San Francisco
7. Any sub-specialty Transplant

Interview Questions

1. In 2012, the American Heart Association released a scientific statement that concluded studies to date "**do** support as association between Periodontal Disease and ASVD independent of known confounders." Their review, however, **did not** support a causative relationship. Have you heard much about this link between oral health and cardiovascular disease?

   R5 *Yes, I think that there is an inflammatory issue that supports the vascular, and then certainly periodontal or any inflammatory issue, so I think the link is actually there, it is just a matter of people really getting into the actual biochemistry of it to bring it more in to the fore front.*

   a. If, yes what have you heard about it?
   b. If no, "No problem, basically, research suggests an association between periodontal disease and cardiovascular disease. Inflammation is recognized as the common denominator. Periodontal disease increases the inflammatory burden of the body."

2. Since 1955 the American Heart Association has published guidelines for antibiotic prophylaxis for certain dental procedures for the prevention of Infective Endocarditis. Over the years there has been much controversy and confusion among healthcare providers and the public. What are your thoughts or opinions on the need for premedication of susceptible individuals?

   R5 *So I think there are very few people that need to be premedicated for any type of procedure, and I think those people are very limited, so in general people do not need to be premedicated. Certainly if they have had a preexisting, or*

previous endocarditis then they need to be pretreated, valve patients, certain congenital heart condition, but in general they don't need to be pre medicated.

3. One of the mechanisms proposed as a link between PD and CVD is Systemic Inflammation. PD has been shown to increase C-reactive protein and Interlukin-6. Do you think it is plausible that PD can contribute to the overall inflammatory burden of the body, thereby increasing the risk of cardiovascular disease? Please explain.

   R5 *Yes, I definitely think that is true. When you understand the immunology of these hormones that get triggered by an inflammatory process, and maybe not even an infectious process, it clearly becomes a systemic disease, if you look at a person with overwhelming infection, frequently you will see some changes in the heart, heart muscle function, so clearly the hormones that are released, the immunological response, if you will, does have a systemic effect and more specifically for the heart it probably does have an effect on the heart muscle function and even on the vasculature.*

4. Given that the evidence supports and association between PD and CVD, do you think that treatment of periodontal disease is important in the prevention of cardiovascular disease? Why or why not?

   R5 *I'm not sure that prevention, but I think there are so many facets in coronary disease, so certainly treating PD is not really going to be the only thing. Certainly making sure that you don't trigger the immunological response would be the key here. So be it PD or repetitive infection somewhere else, I think that is*

the key is to really have a very clean lifestyle if you will. So it is one aspect of prevention, not the only aspect.

5. Could you describe your normal routine for new patient intake and physical examination?

   R5 *They fill out paperwork, my medical assistant will then bring them into the room, go through all the questions as well, primarily because I have noticed that patients sometimes give one person information, but not another person, so double teaming has helped in terms of getting as much information out of the patient as possible. In terms of review of symptoms, past history, and then obviously physical exam, EKG and we talk about other testing, diagnoses, in terms of symptom relief, medications, side effects, etc.*

6. Do you question your patients about their oral health or suggest that they have a periodontal exam to assess for periodontal infection?

   R5 *In general I don't, but when I do a physical exam, you know, you are up close, you're looking, so clearly if there is something obvious, I do make mention of it.*

   PI Okay, so do you look in their mouths?

   R5 *Uh, with a lamp itself, no, but I do actually look in their mouths.*

   PI It is something that you are physically accessing about the patient as you are talking to them, there might be an odor or a broken tooth, and at that point you would say something…

   R5 *Right…right…*

   PI So you are comfortable looking in their mouths, if you had to look further…

R5 *Right…correct*

PI And you know what you are looking at, if there was an abscess or…

R5 *Correct...yup.*

a. Are you comfortable screening your patients for PD?

b. What indicators would you look for?

7. In your practice, who has the primary responsibility for patient education?

R5 *Me.*

8. Given the recent research on the link between periodontal disease and cardiovascular disease, do you currently or have you considered educating your patients about the association?

R5 *I essentially try to educate my patients as much as I can, but realize it's very limited time, I think if I see there is an oral problem, I will certainly address it as much as I see if someone has another type of problem that is not in my field; I will bring it up to them and say "you need to go to a dermatologist I see something on your back." So, it works out that way, but specifically every time, the answer is no.*

9. Do you ever recommend periodontal treatment to patients before undergoing invasive heart procedures?

R5 *Actually, the answer is yes. Especially in the world of transplant, so when you see that a person has very poor dentition, you want to make sure that that gets dealt with before you do anything that could potentially introduce more infection through the system. Clearly people with valve disease, who need valve*

replacement, you want to essentially make sure that the person is clean from any source of infection, so that would not become an issue down the road.

PI So if a person is going to have a valve replacement…

R5 *That's one of the examples.*

PI Then that is a case where you are checking routinely? But not for the general patient?

R5 *Right, for example, you talking to me I can see that your teeth are very nice, so I'm not going to necessarily go in and…*

PI Right, but if I had to have valve replacement, then you would ask me, even if it wasn't obvious?

R5 *Correct.*

a. If yes, how often and what types of procedures?

b. If no, why not?

10. An emerging concept in health care is a greater collaboration between health care professionals. How do you, as a cardiologist, collaborate with non-physician health care professionals?

R5 *I pretty much, if someone refers a patient to me that is a non-physician, I relate to them just as if they were a doctor. So if there is a problem that I see that is outside of my field, I correspond by faxing my notes, occasionally, if I need to speak with them, but it is pretty much when I see a patient, I fax the information to the person that sent the patient.*

a. How do you think this might help to improve patient care?

b. What do you perceive as the possible barriers?

11. Do you typically consult with dentists or periodontists regarding a patient's periodontal condition in order to reduce that patient's risk for heart disease?

    R5 *I don't necessarily consult, actually its more the dentist will refer a patient for a certain procedure and question whether this is something reasonable, or do we need to do anything differently.*

12. In conclusion, what is your opinion about how the collaboration between cardiology and periodontology could benefit patients with cardiac disease?

    R5 *I think actually just realize, and repetition is certainly the way to go. When people understand that an infection, wherever it is, is potentially the trigger for future problems, and understanding that dealing with that initial infection is the most important thing to do, and hence, oral, dental hygiene is certainly very cleary beneficial, and we see, that certainly in the pediatric world, when children have poor dentition, they have lots of other problems as well. I think that keeping a very hygienic lifestyle is really important.*

    PI Do you see a bi-directional kind of referral being best for the patient?

    R5 *I think referring to myself or the primary care doctor, they really need to stay integrated in all of the (care)….but I think being very aggressive in prevention, is super important. So if you can prevent the triggering of future immunological events, then really treat the small problem at that level, and then you can avoid treating a big problem down the road. I think we are not very good at that at this point. We have not emphasized the prevention, and I think prevention, certainly oral hygiene, is a very important role.*

Curriculum Vitae

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EDUCATION

Graduate Education

Master of Science in Dental Hygiene 2010-2013
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Cheney, Washington

Undergraduate Education

Bachelor of Science in Dental Hygiene 1987-1988
Oregon Institute of Technology
Klamath Falls, Oregon

Associate of Science in Dental Hygiene 1984-1988
Oregon Institute of Technology
Klamath Falls, Oregon

RESEARCH

Cardiologists Referring to Patients for Periodontal Evaluation
Completed June 2013
Qualitative Research Study & Thesis

TEACHING EXPERIENCE

Career Strategies 2012-2103
Eastern Washington University
BSDH Expanded Degree Program

Radiology I	1991-1992
Clinical Dental Hygiene Practice I-VI	
Oregon Institute of Technology	
Associate Degree Program	
Clinical Dental Hygiene Practice I-VI	1987-1989

PRESENTATIONS

The Oral-Systemic Link	May 2011

WORK EXPERIENCE

Dental Hygiene

Brian Cass, DDS Redding, California	1999-present
Leon Nelson, DDS Redding, California	1992-1999
Curtis Gottfried, DDS Redding, California	1996-2000
Len Dobry, DDS Klamath Falls, Oregon	1991-1992
John Fitzpatrick, DMD Point Pleasant, New Jersey	1990-1992
Robert Hersh, DMD, Periodontist Freehold, New Jersey	1989-1991
John Goodman, DDS Klamath Falls, Oregon	1987-1989

Dental Assisting

Charles Meinershagen, DDS 1986

Dental Hygiene Board Exam Recorder

Committee on Dental Auxiliaries 2006-2007
Dental Board of California

LICENSURE

Oregon Dental Hygiene 1987-1993
Oregon Board of Dentistry

New Jersey Dental Hygiene 1990-1993
New Jersey State Board of Dentistry

California Dental Hygiene 1992-present
Dental Hygiene Board of California

AFFILIATIONS

American Dental Hygienist's Association
California Dental Hygienist's Association
American Dental Educators Association- Student member
American Academy for Oral Systemic Health- Founding member
American Association for Dental Research- Student member
Redding Advanced Dental Hygiene Club
Redding Toastmasters

COMMUNITY SERVICE

Give Kids a Smile 2005
Pioneer High School 1992-1997
Taught teenage mothers about infant oral care