

North Carolina Cardiologists' Knowledge, Opinions and Practice Behaviors Regarding
the Relationship Between Cardiovascular Disease and Periodontal Disease

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A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in
partial fulfillment of the requirements for the degree of Master of Science in Dental
Hygiene Education in the Department of Dental Ecology, School of Dentistry.

Chapel Hill
2013

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ABSTRACT

MEGAN MOSLEY: North Carolina Cardiologists' Knowledge, Opinions and Practice Behaviors Regarding the Relationship Between Cardiovascular Disease and Periodontal Disease

(Under the direction of Rebecca S. Wilder)

The purpose of this study was to address cardiologists' knowledge, opinions and practice behaviors regarding oral systemic health. A survey was developed, revised, pilot tested and mailed to 625 licensed, practicing cardiologists' in NC. Three mailings were conducted. Data were analyzed using descriptive statistics. The response rate was 19% (N=119). Respondents were mostly males (86%) and working in private group practice (48%) or academia (32%). Sixty percent of respondents stated that medical students and dental students should be trained to work corroboratively. Half of cardiologists' surveyed are unsure that treatment of PD can decrease a patient's risk for CVD. The majority are interested in learning more about the relationship between CVD and Periodontitis. It is important for educators and administrators in higher education to examine the need for interprofessional education and collaboration between medicine and dentistry.

ACKNOWLEDGEMENTS

I would like to thank Professor Rebecca Wilder for her support, time and commitment with my thesis research; Dr. Ceib Phillips, Dr. Christopher Granger and Dr. Steve Offenbacher for their knowledge and expertise.

I want to thank Debbie Price for her contribution and organization with my surveys and always willing to help me. I would also like to thank Doug Brockett for helping me with the logistical process of sending and receiving surveys.

I want to thank my classmate Brandon Johnson for being a supportive colleague and friend during every experience in graduate school. To my classmates that will follow me: Brittany, Kristen, Whitney and Jessica. I wish you all the success.

To my mom, Margo, my biggest supporter, thanks for being my number one fan and supporting me on achieving another goal. To Kimberly and Jeremy, the two best friends that anyone could ask for. Thank you.

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LIST OF ABBREVIATIONS

AHA:	American Heart Association
CAD:	Coronary Artery Disease
CDC:	Center for Disease Control and Prevention
CODA:	Commission on Dental Accreditation
CVD:	Cardiovascular Disease
DH:	Dental Hygienist
IPE:	Interprofessional Education
IOM:	Institute of Medicine
IRB:	Institutional Review Board
NC	North Carolina
NCHS:	National Center for Health Statistics

INTRODUCTION

The National Center for Health Statistics (NCHS) reports that cardiovascular disease (CVD) is the leading cause of mortality in the United States.¹ According to the World Health Organization (WHO), CVD is also the number one cause of deaths worldwide. An estimated 17.3 millions people died from CVD in 2008 representing 30% of the world's population.² The number of deaths due to CVD will increase to 23.3 million by 2030.³ States in the southeast have a higher prevalence of death than any other area of the country. The life expectancy in the United States was 78.7 years of age in 2011.¹

Periodontal disease (PD) is defined as a chronic oral infection that affects tooth supporting structures and tissues. The etiology of periodontal disease is caused by the accumulation and the complex interaction between bacteria and the host response. PD including gingivitis and periodontitis can affect one tooth or many teeth.⁴ According to the CDC, periodontitis affects approximately 47.2% of adults.⁵ A dentist or periodontist clinically diagnoses PD using measuring variables such as tooth loss, recession, clinical attachment loss, periodontal pocket probing, tooth mobility and radiographic bone loss.⁶⁻¹²

Recent investigations have examined the relationship between CVD and PD.¹³⁻¹⁵ A recent meta-analysis used a methodological process of reviewing 215 epidemiological studies. The meta-analysis examined the association between exposure to periodontitis and CVD. Of the 215 studies, 22 case-control and cross sectional studies along with 7 cohort studies were selected to use in the analysis. The results supported a

causal relationship between persons with periodontal disease and cardiovascular disease.⁷ The Surgeon General's Report on Oral Health noted that there is an association between chronic oral infection and diseases such as diabetes, heart disease, and pre-term low birth weight babies.¹⁶ Although there is some evidence that there is an association between PD and CVD, little is known about medical providers' knowledge about the link. The purpose of this study was to examine the knowledge, opinions, and practice behaviors of North Carolina (NC) cardiologists' regarding the association between CVD and PD.

REVIEW OF THE LITERATURE

Periodontal Disease

Periodontal disease (PD) is a common oral disease that affects approximately 47.2% of the adult population in the United States. In adults aged 65 and older the prevalence increases to 70%.⁵ Periodontitis is a bacterial induced, chronic inflammatory disease that destroys the supporting tissues and bone surrounding teeth. A dentist or periodontist clinically diagnoses PD using measuring variables such as tooth loss, recession, clinical attachment loss, periodontal pocket probing, tooth mobility and radiographic bone loss.⁶⁻¹² Factors such as smoking, type 1 and 2 diabetes mellitus, cardiovascular disease (CVD), and obesity have also been linked to the risk associated with developing PD.^{8, 12,17-23}

Cardiovascular Disease

CVD is the leading cause of mortality in the United States.²⁴ Approximately 11.5 % of Americans have been diagnosed with CVD.²⁴ High blood pressure, low-density lipoproteins and smoking all risk factors associated with CVD.²⁴ The Center for Disease Control and Prevention (CDC) estimates that coronary heart disease costs the US \$108.9 billion dollars each year.²⁵ Several studies have reported that PD pathogens and inflammatory markers are common between CVD and PD.^{8-11, 13,26}

Cardiovascular Disease and Periodontal Disease

CVD and PD have many of the same contributing risk factors such as smoking, diabetes, and obesity.^{6, 17, 20-21} It has been reported that periodontal disease is a direct

pathway for which the two diseases could be associated. Mucci et al. reported that inflammatory mediators that react in response to periodontal pathogens could have a possible effect on the systemic inflammatory response to the development of atherosclerotic plaque.²² Periodontal infections could be a casual pathways to CVD though bacteremia or inflammatory mediators provoked in response to the pathogen. Therefore, this systemic inflammatory response may induce the development of atherosclerotic plaque.²²

Blaizot et al. conducted a meta-analysis of observational studies using a methodological process of reviewing 215 epidemiological studies.⁷ The meta-analysis examined the association between exposure to periodontitis and CVD. Of the 215 studies, 22 case-control and cross sectional studies along with 7 cohort studies were selected to use in the analysis.⁷ The results supported a causal relationship between persons with periodontal disease and cardiovascular disease. This analysis provided evidence that many of the risk factors associated with CVD and PD are independent of each other. It concluded that further research is needed to examine the pathophysiological process between the two.⁷

Poor oral hygiene is the major cause of periodontal disease. This chronic oral infection is related to a systemic inflammatory response. It has been reported to cause an increase in the C-reactive protein levels in patients.^{9, 13, 26} Systemic inflammation could signify the mechanism that links PD and CVD. de Oliveira et al. conducted a survey to measure if self-reported toothbrushing and oral hygiene is associated with an increase in CVD.²⁶ The results indicated that persons with reported poor oral hygiene had higher risk of cardiovascular disease and low-grade inflammation but the causal nature is yet to be determined.²⁶

Another meta-analysis focused on prospective cohort studies conducted among the general population. The purpose of this meta-analysis was to determine the relationship between PD and coronary heart disease. This analysis also reported that biological markers such as C-reactive protein serve as an indicator for additional coronary heart disease (CHD). It reported that PD results in approximately 24-35% increase risk for CHD.¹⁰

With a potential effect from PD to increase risk for CVD, it is important for the dental and medical professions to work together to help reduce the risk for adverse outcomes for patients. In 2009, *The American Journal of Cardiology* and *Journal of Periodontology* published a set of clinical recommendations for patients with PD and/or CVD.¹⁴ These recommendations were established to provide guidance to both cardiologists and periodontists regarding the link between CVD and periodontitis and a potential approach to reducing the risk for CVD in patients who have periodontitis. The recommendations were important because they represent the first of its kind between cardiologists and periodontists.

In 2012, the American Heart Association (AHA) issued a scientific statement regarding the association between CVD and PD. Healthcare professionals from dentistry, infectious diseases, cardiology and epidemiology formed a group to assess and measure the scope of evidence for an association or causality between the two diseases. Between 2008 and 2011, they conducted a series of literature searches on articles that discussed the association between PD and CVD. A total of 282 peer-reviewed publications were selected for a literature review.¹⁵

The literature that was reviewed in the AHA statement discussed risk factors associated with both PVD and CD as well as the pathogenic mechanisms proposed as links between the two diseases. The statement suggests that there are significant gaps in our

scientific understanding of the interaction of oral health and CVD. Therefore, it is reported that while there is an association between CVD and PD there is not a causal relationship.¹⁵

Health Care Practitioners' Knowledge and Practices Regarding Oral Systemic Diseases

The research surrounding oral systemic health is continuing to grow in this country. It is important to assess the current knowledge and practices of health care practitioners' regarding oral systemic diseases. It is also imperative to examine the roles of both medical providers and oral health care providers in assessing the practice behaviors regarding patient care.

Lewis et al., published a study in *The Journal of the American Academy of Pediatrics* to assess pediatricians' knowledge, attitudes, and professional experience regarding oral health and to determine willingness to incorporate fluoride varnish into their practices.²⁷ They conducted a survey to 1600 pediatricians. Participants were randomly sampled through the American Medical Association. The survey assessed the knowledge, current practice and opinions on their role as a pediatrician to promote oral health. The response rate for this survey was 62% with 1386 eligible survey recipients. The results concluded that two-thirds of respondents observed caries in their school aged patients.²⁷ While the majority of respondents referred patients to a dental office or clinic, only 55% reported difficulty in achieving referral for uninsured patients. Ninety percent of the respondent's agreed that they played an important role in promoting and educating patients on the importance of oral health.²⁷

Owens et al. surveyed 1,000 internists and 115 endocrinologists to determine their knowledge, opinions and practice behaviors regarding periodontitis and diabetes.²⁸ The survey received a 34 percent response rate. Knowledge about periodontal disease was high

and the respondents agreed that physicians should be taught about periodontal disease and be trained to screening for periodontal disease. The majority of respondents indicated that there is a link between periodontal disease and diabetes however the majority were not familiar with studies regarding the relationship between the two diseases.²⁸

Wooten et al. surveyed 404 nurse practitioners' and certified nurse midwives' to determine their knowledge, opinions and practice behaviors regarding periodontal disease and adverse pregnancy outcomes.²⁹ The results indicated that nurse practitioners and certified nurse midwives had limited knowledge about oral health. Both the Owens and Wooten surveys concluded that collaborative efforts between healthcare providers and oral health care providers would benefit patients in various areas of healthcare.²⁸⁻²⁹

Oral Health Care Practitioners' Knowledge and Practices Regarding Oral Systemic Diseases

Collaborative efforts made by the dental team and cardiologists could help to identify and reduce oral/systemic diseases. The dental hygienist (DH) is an essential component to the dental team. Dental hygienists receive extensive training on medical histories, systemic diseases as well as oral diseases such as periodontal disease. The dental hygiene process of care is multifaceted to include several phases such as assessment, implementation, and evaluation of outcomes.³⁰ Bell et al. stated that it "is the responsibility of the dental hygienist to make assessments based on patients' systemic health to promote a healthy lifestyle in addition to providing safe and effective dental hygiene care."³¹

Bell et al. reported on practice behaviors of dental hygienists incorporating oral systemic evidence into patient care.³² A survey was conducted to assess whether dental hygienists updated medical histories at every appointment, assessed blood pressure, and

obtained blood sugar readings. During the assessment phase of care, 84% of the respondents reported that it is the DH who performs a periodontal exam on new patients. The survey also indicated that 64% of the respondents performed periodontal examinations at every visit for periodontal maintenance patients.³² Sixty-eight% of respondents reported that medical histories were updated at every visit. It was also reported that the 92.9% of respondents discussed medications and medical diagnoses with all patients.³² However, very few record blood sugar levels. The results from this survey indicate that respondents are incorporating some aspects of oral systemic evidence into patient care.³²

Purpose

Although there is some evidence that there is an association between PD and CVD, little is known about medical providers' knowledge about the link. The purpose of this study is to evaluate the knowledge, opinions, and behaviors of NC cardiologists' regarding CVD and PD. According to the NC Division of Aging and Adult Services, CVD was the leading cause of death in NC among adults aged 65 and older. In, 2010 NC ranked 10th across the nation in total size in population and 9th with a population of 65 and older.³³ With an aging population in NC, surveying NC cardiologists' is important. Given the number of cardiologists' and research intuitions in the state, surveying this population is an opportunity to investigate this area of healthcare.

INTRODUCTION AND REVIEW OF LITERATURE

Oral systemic health has been a topic that is gaining more attention in the United States. The Institute of Medicine (IOM) 2011 report on Advancing Oral Health in America concluded that in order to enhance the delivery of oral health care across America, a collaborative effort across multidisciplinary health related fields is necessary.³⁴

The United States Surgeon General's Report noted that there is an association between chronic oral infection and diseases such as diabetes, heart disease, and per-term low birth weight babies.¹⁶ The IOM report along with the report from the US Surgeon General on Oral Health in America discusses the association between oral health and other systemic conditions.^{16, 34} The report also states that there is a lack of knowledge or training of nondental healthcare providers in the area of oral healthcare. The IOM committee concluded that nondental healthcare providers could have an increased role in oral health care. It also stated that interprofessional, team- based care could provide the best care to patients.^{16, 34}

Periodontal disease (PD) is defined as a chronic oral infection that affects the tooth supporting structures and tissues. The etiology of periodontal disease is caused by the accumulation and the complex interaction between bacteria and the host response. PD including gingivitis and periodontitis can affect one tooth or many teeth.⁴ According to the CDC, periodontitis affects approximately 47.2% of adults in the United States have some type of periodontal disease.⁵ A dentist or periodontist clinically diagnoses PD using measuring variables such as tooth loss, recession, clinical attachment loss, periodontal pocket probing, tooth mobility and radiographic bone loss.⁶⁻¹²

CVD is the leading cause of mortality in the United States.²⁴ Approximately 11.5 % of Americans have been diagnosed with CVD. High blood pressure, low-density lipoproteins and smoking all risk factors associated with CVD.²⁴ The Center for Disease Control and Prevention (CDC) estimates that coronary heart disease costs the US \$108.9 billion dollars each year.²⁵ Several studies have reported that PD pathogens and inflammatory markers are common between CVD and PD.^{8-11, 13, 26}

CVD and PD have many of the same contributing risk factors such as smoking, diabetes, and obesity.^{16, 17, 20-21} It has been reported that periodontal disease is a direct pathway for which the two diseases could be associated. Mucci et al. reported that inflammatory mediators that react in response to periodontal pathogens could have a possible effect on the systemic inflammatory response to the development of atherosclerotic plaque.²² Periodontal infections could be a casual pathways to CVD though bacteremia or inflammatory mediators provoked in response to the pathogen. Therefore, this systemic inflammatory response may induce the development of atherosclerotic plaque.²²

Blaizot et al. conducted a meta-analysis of observational studies using a methodological process of reviewing 215 epidemiological studies.⁷ The meta-analysis examined the association between exposure to periodontitis and CVD. Of the 215 studies, 22 case-control and cross sectional studies along with 7 cohort studies were selected to use in the analysis.⁷ The results supported a causal relationship between persons with periodontal disease and cardiovascular disease. This analysis provided evidence that many of the risk factors associated with CVD and PD are independent of each other. It concluded that further research is needed to examine the pathophysiological process between the two.⁷

With a potential effect from PD to increase risk for CVD, it is important for the dental and medical professions to work together to help reduce the risk for adverse outcomes for patients. In 2009, *The American Journal of Cardiology and Journal of Periodontology* published a set of clinical recommendations for patients with PD and/or CVD.¹⁴ These recommendations were established to provide guidance to both cardiologists and periodontists regarding the link between CVD and periodontitis and a potential approach to reducing the risk for CVD in patients who have periodontitis. The recommendations were important because they represent the first of its kind between cardiologists and periodontists.

In 2012, the American Heart Association (AHA) issued a scientific statement regarding the association between CVD and PD. Healthcare professionals from dentistry, infectious diseases, cardiology and epidemiology formed a group to assess and measure the scope of evidence for an association or causality between the two diseases.¹⁵ Between 2008 and 2011, they conducted a series of literature searches on articles that discussed the association between PD and CVD. A total of 282 peer-reviewed publications were selected for a literature review.¹⁵

The literature that was reviewed discussed risk factors associated with both PVD and CD as well as the pathogenic mechanisms proposed as links between the two diseases. The statement suggests that there are significant gaps in our scientific understanding of the interaction of oral health and CVD. Therefore, it is reported that while there is an association between CVD and PD there is not a causal relationship.¹⁵

Collaborative efforts made by the dental team and cardiologists could help to identify and reduce oral/systemic diseases. The dental hygienist (DH) is an essential component to the dental team. Dental hygienists receive extensive training on medical histories, systemic

diseases as well as oral diseases such as periodontal disease. The dental hygiene process of care is multifaceted to include several phases such as assessment, implementation, and evaluation of outcomes.³⁰ Bell et al. stated that it “is the responsibility of the dental hygienist to make assessments based on patients’ systemic health to promote a healthy lifestyle in addition to providing safe and effective dental hygiene care.”³¹

Bell et al. reported on practice behaviors of dental hygienists incorporating oral systemic evidence into patient care.³² A survey was conducted to assess whether dental hygienists updated medical histories at every appointment, assessed blood pressure, and obtained blood sugar readings. During the assessment phase of care, 84% of the respondents reported that it is the DH who performs a periodontal exam on new patients. The survey also indicated that 64% of the respondents performed periodontal examinations at every visit for periodontal maintenance patients. Sixty-eight% of respondents reported that medical histories were updated at every visit. It was also reported that the 92.9% of respondents discussed medications and medical diagnoses with all patients. However, very few record blood sugar levels. The results from this survey exhibited that respondents are incorporating some aspects of oral systemic evidence into patient care.³²

Although there is some evidence that there is an association between PD and CVD, little is known about medical providers’ knowledge about the link. The purpose of this study was to examine the knowledge, opinions, and practice behaviors of NC cardiologists’ regarding the association between CVD and PD.

METHODS AND MATERIALS

A cross-sectional survey was designed to assess NC cardiologists' knowledge, opinions, and practice behaviors regarding the relationship between cardiovascular disease and periodontal disease.

The survey was adapted from a questionnaire developed at the University of North Carolina that focused on a similar topic regarding oral and systemic health. The survey was modified to address the current research questions. Thirty four questions were included and divided into six sections that included the following topics: 1) practice setting; 2) oral examinations; 3) oral and systemic health; 4) opinions about periodontal disease; 5) education; and, 6) demographics.

A list of cardiologists was obtained from the NC Medical Board. Although the list contained the names of 1,160 registered cardiologists in the state of NC, only 625 are actively practicing cardiology so surveys were mailed to 625 cardiologists. The selection criteria included cardiologists practicing full time or part time in a public, private or government practice in NC. Retired cardiologists, pediatric cardiologists or cardiologists practicing outside of the state were excluded from the study.

The survey was reviewed and approved by the Institutional Review Board (IRB). Following the approval, the survey was pilot tested with five practicing cardiologists. After minor changes, the survey was produced using Teleform, a scannable format that simplifies data entry. The survey, along with a cover letter explaining its purpose and business reply

envelope was mailed using the Salent and Dillman method.³⁵ There were two mailings in the fall of 2012 and a final mailing in January, 2013. To maintain confidentiality, there were no identifiers on the surveys and random identification numbers were assigned to each subject. All data was stored in a password-protected database that was only accessible to the research team and statistician. The data were analyzed using SAS version 9.1 (SAS Institute Inc., Cary, North Carolina) using descriptive statistics.

RESULTS

The surveys that were completed as requested and useable for data analysis was 119 (19%). Demographic data is reported in Table 1. Seven percent of respondents have been providing patient care for less than 5 years. Forty percent of providers reported providing more than twenty years of care to patients with cardiovascular disease. Eighty six percent were male and 78% were sixty years old or younger. Eighty-five percent of respondents reported receiving dental care within the last year and the majority (90%) report their oral health as “good” or “excellent.” Eighteen percent had been told that they have periodontal disease. (Table 2)

Practice Behaviors and Oral Examinations

Forty-one percent of cardiologists refer a patient to a dental facility when a patient expresses concern about his/her mouth and 31% refer if they see something that should be further examined. However, 22 % never refer a patient to a dental clinic or facility. In the past year, 46 % of respondents reported referring between one to five patients to a dental facility due to periodontal disease and 13 % referred more than 6 patients within the last year. Respondents' answers were similar for referring a patient for tooth decay. Forty-three percent of respondent referred between one and five patients to a dental facility for tooth decay whereas 12 % referred six or more patients (Table 3).

Physicians were asked how often they perform oral examinations on their patients. Eighteen percent of respondents perform an oral exam at the initial visit while 21 % never perform oral examinations on their patients (Figure 1). When asked the reasons for not doing so, 46 % responded that it is the responsibility of the dental professional and 45 % were not sure what type of exam to perform (Figure 2).

Knowledge and Opinions about Periodontal Disease and Systemic Health

Cardiologists' knowledge about PD was moderate. The majority of respondents reported that bone loss describes periodontal disease (70 %). Sixty three percent of respondents answered correctly about the first sign of periodontal disease as being bleeding gums. Half of respondents were aware that PD is an infection in the gums (50%). Conversely, 18% of respondents described tooth decay as a sign of periodontitis. Thirty-one percent recognized reversible redness/inflammation as a clinical indication of periodontitis (Table 4).

The majority of cardiologists agreed or strongly agreed that inflammation is a key component between PD and CVD (92%). Sixty-six percent agreed that controlling infection and inflammation is important for managing CVD. When asked about their knowledge about the studies regarding an association between CVD and PD, half of respondents agreed and half were unsure or disagreed. Over half (72 %) of respondents agreed that patients with periodontal disease are more likely to have increased atherosclerosis and risk for myocardial infarction and stroke (Table 4).

Less than half of respondents agreed (39%) that treatment of PD could decrease a patient's risk for CVD. However, 72 % are interested in learning more about the relationship between CVD and PD. The majority of physicians agreed (71%) that it is important for

cardiologists' and periodontists to work together to educate their patients about oral systemic disease risks (Table 4).

Cardiologists were asked if they were familiar with the 2009 clinical recommendations.¹⁴ Sixteen percent were slightly familiar while 78 % were not familiar. When asked if these recommendations changed the way they treat their patients, 76 % indicated they had not changed procedure. Twenty-two percent of respondents were familiar with the recent 2012 statement from the American Heart Association (AHA) and 86% of respondents said that the statement has not changed their opinion about the importance of oral health to overall health.¹⁵

Physician's Education

Twenty percent of respondents reported that their professional education included oral health content. However, 80 % reported not receiving any education on oral healthcare. For the majority of physicians who did receive oral health education, 90 % received less than 3 hours. Twelve percent reported having clinical requirements regarding assessments of the teeth or gums while only 5 % reported observing a dentist or dental hygienist. When asked to rate the quality of their oral health education, 69 % of respondents reported it as poor. Sixty percent of cardiologists believe that medical and dental students should be trained to work collaboratively and 39 % responded that "maybe" they should be trained to do so. (Table 5).

DISCUSSION

This study was the first of its kind to question cardiologists about their knowledge and behaviors regarding periodontal disease and the potential association with cardiovascular diseases. While other studies have been conducted with other healthcare providers, cardiologists have not been investigated.^{28-29, 36-37} It has been determined that individuals who have cardiovascular disease and periodontal disease share many of the same risk factors such as smoking, diabetes, obesity and age.^{8, 12, 17-23} But how this evidence is translated into clinical practice has not been published in the peer reviewed literature as of this date.

There is evidence that periodontal bacteria and the byproducts of the bacteria have a detrimental effect on distant sites^{14, 26} Although the specific mechanism has yet to be confirmed, scientists agree that there is an association between periodontitis and CVDs.¹⁵ When other healthcare providers have been questioned about their knowledge regarding the etiology of periodontal disease most have some knowledge of the bacteria and their detrimental effects. For example, a recent study of internists and endocrinologists found the physicians to know that bacteria was the etiology of PD (86%) and bone loss around teeth is a description of PD (77%).²⁸ Sixty six percent knew that bleeding gums were a first sign of periodontitis. But the physicians also thought that tooth decay was a sign of gum disease (30%). The current study found similar results with sixty-three percent of cardiologists reporting bleeding gums as a first sign of disease and 70% knowing that bone loss is congruent with PD. Sixty six percent reported the first sign of periodontitis as bleeding gums (66%). Eighteen percent of cardiologists also thought that tooth decay was a sign of

periodontitis. So while their knowledge is high in some areas, they are confused in other oral health topics. Most studies of other healthcare providers have reported that they view their oral health education in professional school as being poor and they are interested in learning more about oral disease^{28-29, 37}. The time is ripe for interprofessional education both didactically and clinically.

It was surprising that the respondents were not familiar with the recommendations published in the *Journal of Cardiology* and *Journal of Periodontology*.¹⁴ The research team for this study anticipated that more than 16% would be familiar with the guidelines. The most recent statement from the AHA regarding the association of PD to atherosclerotic vascular disease has gained much attention since it was published in May, 2012 however, the cardiologists in this study did not seem aware of the statement and indicated it had not changed the way they view the importance of oral health. While a cause and effect has not been established between PD and CVD, the statement does support an association between the two conditions.¹⁵ Clearly more work needs to be done to educate cardiologists about PD and the potential detrimental effects to systemic health.

The relationship between oral healthcare providers and medical providers is an area that needs improvement. Wooten et al reported that 62% of nurse practitioner's and certified nurse midwives conduct an oral exam as part of routine care at initial visits.²⁹ Our study concluded that only 18% of NC cardiologists' conduct an oral exam at the initial visit. Practitioners stated that it is the responsibility of the dentist to perform the exam. Another reason for not doing an exam is that they simply do not know what it entails. This is an area that could be incorporated into medical school education through interprofessional education (IPE).

With an increase in oral systemic disease, it is important to examine the need for IPE. Wilder et al. recommends that faculty development, curricular changes and IPE initiatives be incorporated into dental education.³⁸ Dental schools should seek relationships with local clinics and private practice dentists and other health professionals.³⁸ The paper reinforces the Commission on Dental Accreditation (CODA) recommendation that states students should be encouraged to participate in service learning.³⁹ Lopes et al. reported that 79% of diabetes educators did not receive any formal education on oral health.³⁶ Our study reported similar findings and concluded that while the majority of respondents did not receive oral health education, they believe it is an important area for students to work collaboratively. An IPE curriculum would provide the atmosphere for collaboration to occur.

Interprofessional education can be improved by providing options for continuing education in the area of oral systemic health. Higher education administrators and leaders should begin examining these areas and incorporating them into health profession curricula. The University of New Jersey School of Medicine and Dentistry and School of Osteopathic Medicine in New Jersey began implementing oral health modules into the second, third and fourth years of medical school. Modules in head/neck examination and oral cancer screenings are incorporated into the curriculum along with rotations throughout the dental school to learn more about oral conditions.⁴⁰ This study along with other studies concluded that oral health is important part of overall health.^{28-29, 36-40} To provide the best care and practices for our patients, it is in the best interest for multidisciplinary fields to join forces and work together.

Limitations of this survey include a low response rate. Cartwright investigated response rates of physicians from nineteen professional groups. The response rate varied

from 56-99 percent.⁴¹ Factors affecting response rates included length of questionnaire and the available time to complete it. While the method used for the conduct of the survey was a recommended procedure for survey research³⁵ it is also recognized that busy physicians may not take the time to complete a longer questionnaire. In addition, this sample of NC cardiologists may not be representative of all cardiologists, thus limiting the external validity. However, the study does provide a view of how oral health is incorporated (or not incorporated) into the clinical practices of cardiologists.

Future studies should investigate how oral health content can be incorporated into the curricula of medical providers. Other studies might evaluate scenarios where oral healthcare (dentists and dental hygienists) and medical providers work collaboratively in providing patient care

CONCLUSION

This study found that North Carolina cardiologists' have some knowledge about periodontal disease but are unclear in other areas. Half of cardiologists' surveyed are unsure that treatment of PD can decrease a patient's risk for CVD. Approximately half of respondents refer one to five patients to a dental facility for either tooth decay or periodontal disease. Further education in oral diseases will help physicians refer patients to the appropriate oral healthcare provider. Though NC cardiologists' are not implementing the published clinical recommendations into practice, the majority are interested in learning more about the association between the two diseases. Cardiologists agree that it is important for healthcare providers to work together to educate their patients on oral systemic diseases.

TABLE 1: Respondents' Demographics

	N=	% of respondents
Age in years		
30-40	19	16.24
41-50	40	34.19
51-60	33	28.21
61-70	19	16.24
>70	6	5.13
Gender		
Female	16	13.91
Male	99	86.09
Practice setting		
Private group practice	56	48.28
Solo practice	10	8.63
Academia	37	31.90
Other	13	11.21
Years providing care to patients with cardiovascular disease		
<5 years	9	7.56
5-10 years	22	18.49
11-15 years	13	10.92
16-20 years	28	23.53
>20 years	47	39.50
Hours per week providing patient care		
<=10 hours	7	6.30
11-20 years	11	9.91
21-39 years	7	6.30
>40 years	86	77.49

TABLE 2: Respondents' oral health information

	N=	% of respondents
Last time received dental care		
< 1 year	100	85.47
1-2 years	13	11.11
>2 years	4	3.42
never	0	0
Last time received a periodontal examination		
< 1 year	97	83.62
1-2 years	15	12.93
>2 years	4	3.45
never	0	0
How would you rate your oral health		
Excellent	46	39.32
Good	60	51.28
Fair	11	9.40
Poor	0	0
Very Poor	0	0
Ever been told you have periodontal disease		
No	94	82.74
Yes	21	18.26
Maybe	0	0

TABLE 3: Number of patients with CVD referred to dental facility by cardiologists within the past year

	N=	% of respondents'
Patients referred with PD		
0	47	41
≤ 5	53	46
≥ 6	15	13
Patients referred for tooth decay		
0	50	44
≤ 5	49	44
≥ 6	14	12
Patients referred to you from a dentist/dental facility		
0	69	60
≤ 5	22	19
≥ 6	24	21

TABLE 4: Cardiologists' opinions about periodontal disease and systemic health

	Strongly Agree	Agree	Unsure/Don't Know	Disagree	Strongly Disagree
Inflammation is a key component between periodontal disease and cardiovascular disease.	28.07 (32)	64.04 (73)	5.26 (6)	2.63 (3)	0 (0)
Good oral health is important to the rest of the body.	35.14 (39)	59.46 (66)	4.50 (5)	0.90(1)	0 (0)
I am knowledgeable regarding the studies linking periodontal disease and cardiovascular disease.	6.14 (7)	44.74 (51)	20.18 (23)	22.81 (26)	6.14 (7)
Patients with periodontal disease are more likely to have increased atherosclerosis and risk for myocardial infarction and stroke, even after adjusting for traditional cardiovascular disease risk factors.	13.27 (15)	58.41(66)	20.35 (23)	7.08 (8)	0.88 (1)
Controlling infection and inflammation is important for managing cardiovascular disease.	16.67(19)	48.25 (55)	30.70 (35)	4.39 (5)	0 (0)
Patients diagnosed with cardiovascular disease are more likely to have periodontal disease.	7.02 (8)	38.60 (44)	49.12 (56)	5.26 (6)	0 (0)
Treatment of periodontal disease can decrease a patient's risk for cardiovascular disease.	7.02 (8)	31.58 (36)	47.37 (54)	12.28 (14)	1.75 (2)
I am interested in learning more about the relationship about cardiovascular disease and periodontal disease.	14.91 (17)	58.77 (67)	21.05 (24)	4.39 (5)	0.88 (1)
It is important for cardiologists and periodontists to work together to educate their patients on these diseases.	17.54 (20)	53.51 (61)	24.56 (28)	3.51 (4)	0.88 (1)

TABLE 5: Physicians' education regarding oral health

	N=	% of respondents
Did your professional education include oral health content in the curriculum?		
Yes	23	20.18
No	91	79.82
How many hours of content regarding oral health/periodontal health were covered in the curriculum?		
<1 hour	12	40.00
1-3 hours	15	50.00
>10 hours	3	10.00
Did you have any clinical requirements regarding assessments of the gums or teeth?		
Yes	11	12.09
No	80	87.91
Did you receive any clinical experiences with dentists or dental hygienists?		
Yes	4	4.44
No	86	95.56
Regarding your medical training, rate the quality of oral health education you received.		
Very good	3	3.33
Good	3	3.33
Fair	21	23.33
Poor	41	45.56
Very Poor	22	24.44
Do you believe that medical and dental students should be trained to work collaboratively?		
Yes	56	60.22
No	2	2.15
Maybe	35	37.63

FIGURE 1: Frequency of oral examinations by cardiologists on their patients, by percentage of total population.

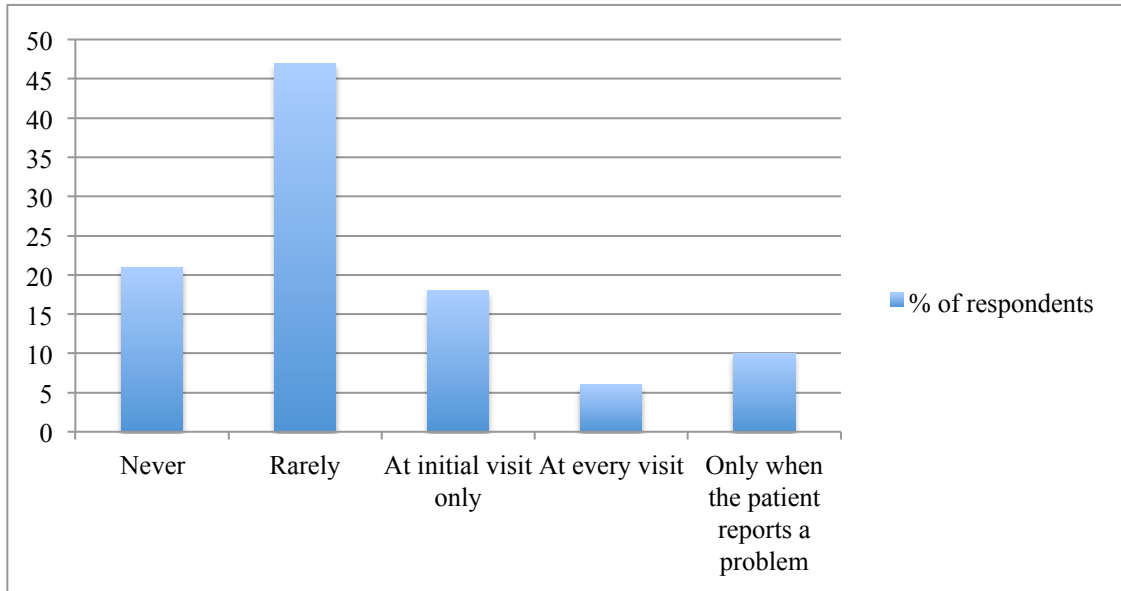
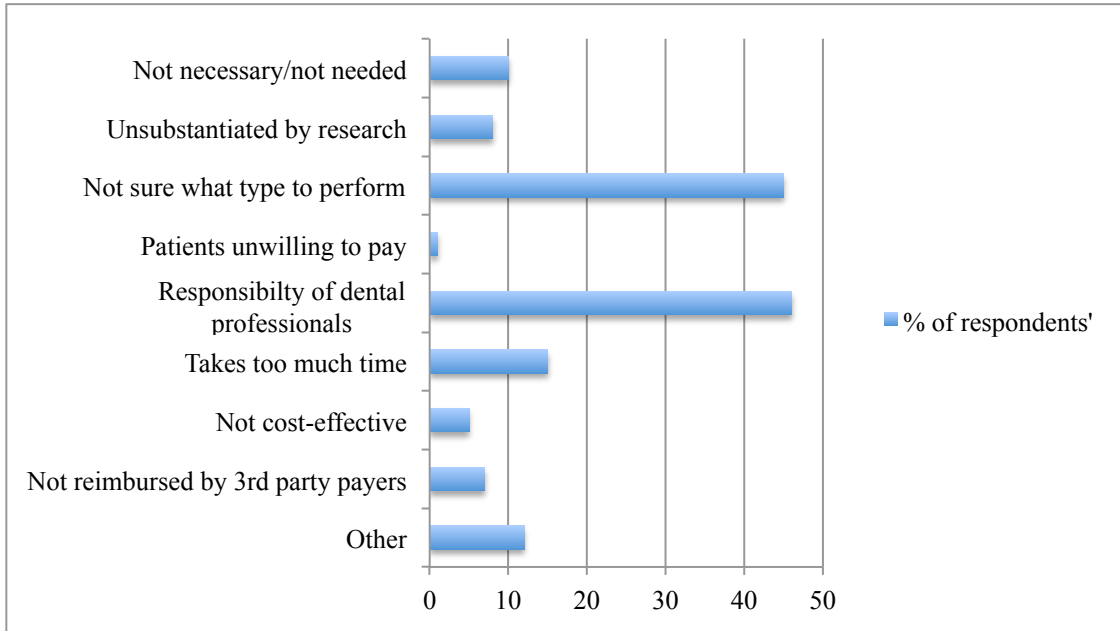


Figure 2: Cardiologists' reasons for not performing oral exams, by percentage of total respondents'



APPENDIX # A

October 12, 2012

Dear Dr. Abernathy,

The UNC School of Dentistry is conducting a survey of North Carolina cardiologists' knowledge, opinions, and practice behaviors regarding the relationship between cardiovascular disease and periodontal disease. Although there is some evidence about the relationship between the two diseases, little is known about medical providers' knowledge about this link. This research study will help us determine what is needed to improve the current practice of cardiology and dentistry regarding this area of medicine.

By completing this questionnaire and returning it in the provided envelope, you are agreeing to participate in this research study. This questionnaire is composed of questions regarding the services you provide, your knowledge, opinions and current practice behaviors. We need your help in obtaining valuable information regarding opinions and practice behaviors of oral systemic health and disease prevention.

Instructions for completing the survey:

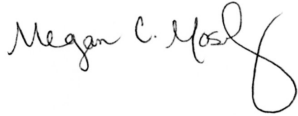
- You do not have to answer any questions you do not choose to.
- Please return the completed survey in the provided envelope by **October 31, 2012**.
- Please note that we are tracking surveys by number and will not record your name in any data files in association with this survey.
- Your participation is voluntary. If you decide not to complete the survey or do not provide clinical services to patients, please return the blank survey in the enclosed envelope. This will prevent you from receiving any follow-up notifications.

The UNC Biomedical Institutional Review Board has approved this project # 12-1579. There are no risks or benefits with your participation.

If you have any questions regarding this study, please contact me at megan_moseley@dentistry.unc.edu or (919) 724-5233 or my thesis advisor, Professor Rebecca Wilder at wilderr@dentistry.unc.edu or (919) 966-8221.

Thank you for your consideration of participating in this study. The information you provide will benefit and improve the knowledge regarding this important area of healthcare.

Sincerely,

Handwritten signature of Megan C. Mosley in cursive script.

Megan Mosley, RDH, BS
Master of Science Degree Candidate
UNC School of Dentistry

Handwritten signature of Rebecca S. Wilder in cursive script.

Rebecca S. Wilder, RDH, MS
Professor
UNC School of Dentistry

Thank you for taking time to complete this important survey and for providing your comments. Please write directly on the survey with a **BALCK PEN**. Read each question carefully and provide your most appropriate response. Fill in circles completely or fill in the boxes and blanks as indicated.

When completed, do not fold the survey, but place it in the enclosed business reply envelope and mail it back to us.

IF YOU WORK IN MORE THAN ONE PRACTICE, answer questions according to the one in which you work the most hours.

Are you currently providing patient care? Yes No

~~~~~ **IF NO, STOP HERE, PLEASE**, return the survey. Thank you for your time! ~~~~~

**PRACTICE SETTING**

1. What **BEST** describes the type of practice you are in?

- Private group practice  Solo practice  Academia  Other (specify) \_\_\_\_\_

2. How long have you been providing care to patients with cardiovascular disease?

- <5 years  5-10 years  11-15 years  16-20 years  > 20 years

3. Approximately how many hours per week do you provide patient care?

4. Of your patient population, estimate the percentage who have periodontal disease (gum disease).

- < 20 %  20-40%  41-60%  > 60%

**ORAL EXAMINATIONS**

5. How often do you perform oral examinations on patients with cardiovascular disease?

- Never  Rarely  At initial visit only  At every visit  Only when the patient reports a problem

6. If you **do not routinely provide** an oral health exam on your patients with cardiovascular disease, what are the reasons for not doing so? (Select **ALL** that apply)

- |                                                                   |                                                              |
|-------------------------------------------------------------------|--------------------------------------------------------------|
| <input type="radio"/> Not necessary / not needed                  | <input type="radio"/> Responsibility of dental professionals |
| <input type="radio"/> Unsubstantiated by research                 | <input type="radio"/> Takes too much time                    |
| <input type="radio"/> Not sure what type of exam to perform       | <input type="radio"/> Not cost-effective                     |
| <input type="radio"/> Patients unwilling to pay for the procedure | <input type="radio"/> Not reimbursed by 3rd party payers     |
| <input type="radio"/> Other (specify) _____                       |                                                              |

7. When you perform an oral examination, what are you looking for? (Select **ALL** that apply)

- |                                                |                                                    |                                                |
|------------------------------------------------|----------------------------------------------------|------------------------------------------------|
| <input type="radio"/> Oral ulcers              | <input type="radio"/> Oral Cancer                  | <input type="radio"/> Inflammation of the gums |
| <input type="radio"/> Dental caries (cavities) | <input type="radio"/> Xerostomia                   | <input type="radio"/> Tongue lesions           |
| <input type="radio"/> Bleeding gums            | <input type="radio"/> Other (please specify) _____ |                                                |

8. Is there a dental clinic, office or school (could be dental or dental hygiene school) located close to the practice setting in which you work?

- Yes  No



9. Which statement **BEST** describes when you refer patients with cardiovascular disease to a dental facility (dental clinic, dental school or dental office)? (Select only **ONE**)

- I refer anytime a patient expresses a concern about his/her mouth or gums.
- I refer a patient if I see something that I think should be further examined.
- I refer as part of the patient's health promotion and disease preventative care.
- I do not refer a patient to the dental clinic or dental office.

10. In the **past year**, estimate the percentage of patients with cardiovascular disease that you referred to a dental facility due to **periodontal disease**.    %

11. In the **past year**, estimate the percentage of patients with cardiovascular disease that you referred to a dental facility for **tooth decay**.    %

12. How many patients have been referred to you from a dentist / dental facility?

**PERIODONTAL DISEASE AND SYSTEMIC HEALTH**

13. Which of the following do you **believe** to be associated with the etiology of periodontal disease? (Select **ALL** that apply)

- Excess sugar consumption
- Bacteria
- Tooth decay
- Aging
- Plaque
- Genetics
- Smoking
- Systemic infection / inflammation
- Uncontrolled diabetes

14. Which of the following describes gingivitis? (Select **ALL** that apply)

- Tooth decay
- An infection of the gums
- A reversible redness and/or inflammation of the gums
- Lesions on the tongue
- Bleeding gums
- Bone loss around teeth
- Bad breath

15. Which of the following describes periodontitis? (Select **ALL** that apply)

- Tooth decay
- An infection of the gums
- A reversible redness and/or inflammation of the gums
- Lesions on the tongue
- Bleeding gums
- Bone loss around teeth
- Bad breath

16. Which of the following is the **first** sign of periodontal disease? (Select only **ONE**)

- Bad breath
- Bleeding gums
- Cavities
- Mobile

**OPINIONS ABOUT PERIODONTAL DISEASE, CARDIOVASCULAR DISEASE AND SYSTEMIC HEALTH**

17. Please indicate the extent to which you agree or disagree with each of the following statements.

|                                                                                                                                                                                                              | Strongly Agree        | Agree                 | Unsure / Don't know   | Disagree              | Strongly Disagree     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| I am knowledgeable regarding the studies investigating the association between periodontal disease and cardiovascular disease.                                                                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Inflammation is a key component of periodontal disease and cardiovascular disease.                                                                                                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Good oral health is important to the rest of the body.                                                                                                                                                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Patients with periodontal disease are more likely to have increased atherosclerosis and risk for myocardial infarction and stroke, even after adjusting for traditional cardiovascular disease risk factors. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Controlling systemic or local infection and inflammation is important for treating cardiovascular disease.                                                                                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Patients diagnosed with cardiovascular disease are more likely to have periodontal disease.                                                                                                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Treatment of periodontal disease can decrease a patient's risk for cardiovascular disease.                                                                                                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I am interested in learning more about the relationship between cardiovascular disease and periodontal disease.                                                                                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It is important for cardiologists and periodontists to work together to educate their patients about oral systemic disease risks.                                                                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**PERIODONTAL DISEASE AND CARDIOVASCULAR DISEASE**

18. In 2009, *The Journal of Cardiology* and *The Journal of Periodontology* Editors' Consensus: Periodontitis and Atherosclerosis Cardiovascular Disease,\* published a list of clinical recommendations for patients with cardiovascular disease and periodontal disease. Are you familiar with these clinical recommendations? (If **NOT** familiar, skip to question 21.)

very familiar     familiar     slightly familiar     not familiar

19. Have these clinical recommendations changed the way you treat your patients with cardiovascular disease and periodontal disease?  Yes     No

If yes, how have you changed the way you treat patients?

\_\_\_\_\_

\_\_\_\_\_

20. Has the 2012 statement from the American Heart Association about cardiovascular disease and periodontal disease changed your opinion about the importance of oral health to overall health?  Yes     No

If yes, how has your opinion changed?

\_\_\_\_\_

\_\_\_\_\_

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**CARDIOLOGISTS' EDUCATION**

21. Did your professional school education include oral health content in the curriculum?  Yes  No (SKIP TO Question 23)

22. If yes, how many hours of content regarding oral health/periodontal health were covered in the curriculum?

- <1 hour    1-3 hours    4-6 hours    7-10 hours    > 10 hours

23. Did you have any clinical requirements regarding assessments of the gums or teeth?  Yes  No

24. Did you receive any clinical experiences (observation, providing patient care, etc) with dentists or dental hygienists?  Yes  No

25. Regarding your medical training, rate the quality of oral health education you received.

- Very good    Good    Fair    Poor    Very poor

26. Do you believe that medical and dental students should be trained to work collaboratively?  Yes  No  Maybe

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**DEMOGRAPHICS**

27. When was the last time you received dental care from a dentist or dental hygienist?

- < 1 year    1-2 years    > 2 years    never

28. When did you last have an examination to assess the health of your gums?

- < 1 year    1-2 years    > 2 years    never

29. How would you rate your oral health?  Excellent    Good    Fair    Poor    Very poor

30. Have you ever been told you have periodontal disease?  Yes  No  Maybe

31. Gender:  Male  Female

32. Your age range?  <30    30-40    41-50    51-60    61-70    >70

33. Was there a dental school affiliated with the University or College that you attended for your medical degree(s)?  Yes  No

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**COMMENTS:**

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THANK YOU FOR YOUR PARTICIPATION!

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