

Knowledge, Opinions and Practice Behaviors of North Carolina Endocrinologists' and Internists' Regarding Periodontal Disease and Diabetes

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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
2010**

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ABSTRACT

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North Carolina Endocrinologists' and Internists' Knowledge, Opinions and Behaviors
Regarding Periodontal Disease and Diabetes
(Under the direction of Rebecca S. Wilder)

This study was to determine the knowledge and practice behaviors of endocrinologists and internists who treat patients with diabetes.

A 35-item questionnaire was mailed to 115 endocrinologists/1,000 internists in NC.

Questions were open and closed ended and Likert-scaled. Descriptive statistics and bivariate analysis were utilized.

The response rate was 34% (N=378). Endocrinologists' and internists' knowledge about PD was high. The majority agree that physicians should be taught about PD (88%) and should be trained to screen for PD (78%). Eighty-nine percent agreed that physicians need to collaborate with dental professionals.

NC endocrinologists and internists have some knowledge and think there is a link between PD and DM. The majority do not know the studies that link PD and DM. They agree collaboration with dental professionals is important. Interprofessional education and collaboration between medical and dental professionals is needed to prepare for the future increase in patient and treatment needs.

ACKNOWLEDGEMENTS

I would like to thank Professor Rebecca S. Wilder for her wisdom, support, time, and commitment with my thesis research; Dr. John B. Buse, Dr. Robb M. Malone and Dr. Janet H. Southerland for their knowledge and expertise. Thank you all for helping me to complete my thesis.

I want to thank Debbie Price for the many hours she put contributed to the data management for this research project, and for always having a smile on her face. I thank Dr. Ceib Phillips for here statistical expertise.

I would like to thank my special friends/classmates, who have supported me and were there with me for the past two years. Aubree, Katie and Mary, you are the best. May our paths cross many times on this journey we have started. To my friends/classmates who graduated before me: Ashley, Cherri, Lattice and Robbyne; your wisdom, advice and greatness helped each day to complete this program. To my friends/classmates who will follow me: Jessica, Lisa, Nuha and Julie. May the knowledge I have achieved help you. Thank you all for everything you have added to my life.

To my son Caleb and family, thank you for being there again to support me in achieving another goal in my life. Now, I will help some people achieve their educational goals and I will help other people improve their oral health.

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INTRODUCTION

The Centers for Disease Control and Prevention (CDC) data report that diabetes mellitus (DM) is the largest and fastest-growing chronic disease in the United States.¹ The World Health Organization (WHO) reported that the prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to raise from 171 million in 2000 to 366 million in 2030.² National survey data have documented that diabetes is a major health problem in both men and women and in all races and ethnic groups in the United States and that, its prevalence increases with age.¹ It is estimated that there are 23.6 million people (approximately 7.8% of the population) in the United States have diabetes; additional 5.7 million people have diabetes but are unaware of their condition.¹

Poor oral health is a public health problem, with chronic periodontitis being among the most common human infections. Periodontitis, a bacterially induced, localized, chronic inflammatory disease, destroys connective tissue and bone that supports the teeth.^{3 4}

Periodontal (gum) diseases, including gingivitis and periodontitis, are serious infections that, left untreated, can lead to tooth loss.^{5,6} Periodontitis is common, with mild to moderate forms effecting 30% to 50% of adults and the severe generalized form effecting 5% to 15% of all adults in the United States.^{3,4} Patients with periodontitis are often asymptomatic. The associations between periodontitis and diabetes have been established.⁷⁻¹⁰ Investigators have strongly suggested that diabetes is a risk factor for gingivitis and periodontitis.^{11, 12}

For example in a large epidemiologic study in the United States, adults with poorly controlled diabetes had a 2.9-fold increased risk of having periodontitis compared to non-diabetic adult subjects.¹³

While oral health care providers (dentists and dental hygienists) are taught about DM and the effects on the oral and systemic conditions, little is known about medical providers' knowledge in this area. It has been reported that many physicians often fail to examine the whole mouth including the teeth and the support around the teeth.^{14,15} This is vitally important when physicians are examining a patient with diabetes as the condition of the mouth and teeth have clinical relevance for treatment of diabetes. The aim of this study is to determine the knowledge and practice behaviors of North Carolina endocrinologists and internists who treat patients with diabetes.

REVIEW OF THE LITERATURE

Periodontal Disease

Periodontal disease (PD) is defined as any inherited or acquired disorder of the tissues surrounding and supporting the structures of the teeth that involves a loss of connective tissue attachment and/or alveolar bone (periodontium).^{16,17} The term PD usually refers to the common inflammatory disorders of gingivitis and periodontitis that are caused by pathogenic microflora in the biofilm that forms around the teeth on a daily basis.¹⁸ It begins, when the bacterium in plaque accumulates on the teeth and causes the gums to become inflamed (microbial infection). Periodontal (gum) diseases, including gingivitis and periodontitis, are serious infections that, left untreated, can lead to tooth loss.^{5,6} PD may develop around the supporting structure of one tooth then spread to many teeth due to undiagnosed and/or left untreated.^{5,6} PD is not a single pathologic entity. PD is a chronic bacterial infection. These diseases may be of developmental, inflammatory, traumatic, neoplastic, genetic, or metabolic.¹⁸⁻²⁰ Environmental and genetic factors as well as acquired risk factors such as diabetes mellitus accelerate the inflammatory processes in periodontitis.³

There are many forms of periodontitis. Chronic periodontitis, the most common type, can occur at any age but is most prevalent in adults. This form of periodontitis results in inflammation within the supporting tissues of the teeth, progressive attachment and bone loss. Progression of attachment loss usually occurs slowly, but periods of rapid progression can occur.^{6,20-22} Periodontitis as a manifestation of systemic diseases often begins at a young

age, but can also be diagnosed later in life. Heart disease, respiratory disease, joint disease and diabetes are all systemic conditions associated with this form of periodontitis.^{6,10,20-22}

Periodontal Disease and Systemic Health

It is widely known and recognized that certain systemic diseases, such as cardiovascular disease,^{23 24} aspiration pneumonia,^{25 26} adverse pregnancy outcome,^{27,28} stroke,^{28 8} and DM,^{7 9} may increase the risk for PD. More recently, the role of PD to systemic health has been explored.

Individuals with severe chronic periodontitis have been reported to have an increased risk to developing cardiovascular disease after adjusting for many of the traditional risk factors, such as age, gender, diabetes, smoking and family history.¹⁰ Another example of an association to oral health is that of obesity, in most industrialized countries there is an obesity epidemic.²⁹ There is increasing evidence that obesity is associated with periodontitis.²⁹ The literature on the relationship between PD and DM, both type 1 and type 2, is also steadily increasing and it is generally accepted that the relationship is a bidirectional one.^{8,10} The belief that oral conditions like periodontal infections may be risk factors or indicators for important medical outcomes represents a critical shift in thinking between oral and systemic associations.³⁰ Research that has been conducted indicates individuals that are at risk for PD has a different inflammatory trait compared to individuals at a lower risk for PD.²⁸ It is becoming clear there is a connection between PD and systemic health. If general health includes oral health, medical and dental care should be integrated to achieve optimal health.

Diabetes

The prevalence of diagnosed, undiagnosed and pre-diabetes in the United States is of concern. The 2007 data the most recent year for which data is available indicates that there are 23.6 million people or 7.8% of the population with diabetes.¹ There are 17.9 million people who are diagnosed, 5.7 million people are undiagnosed and 57 million people have pre-diabetes.¹ There are 1.6 million new cases of diabetes diagnosed in people aged 20 years and older each year. ¹ The total costs of diagnosed diabetes in the United States are \$174 billion. The cost is \$116 billion for direct medical costs and \$58 billion for indirect costs (exp. disability, work loss, premature mortality).^{1,31} Factoring in the additional costs of undiagnosed diabetes, pre-diabetes, and gestational diabetes brings the total cost of diabetes in the United States to \$218 billion.³¹

The patient with diabetes, particularly one whose condition is unstable or uncontrolled, has a lowered resistance to infection and a delayed healing process.⁹ Diabetics with PD tend to develop with increased severity at an earlier age than in the non-diabetic patient.^{10,32} The presence of infection, including infection in the oral cavity, may intensify the diabetic symptoms and contribute to difficulty in insulin regulation.⁹

There are four classifications of diabetes. Type 1 DM (absolute insulin deficiency); Type 2 DM (obligatory insulin action resistance); gestational DM (typically transient diabetes mellitus during pregnancy); and, other types of DM (result from specific genetic conditions). The types that have the most correlation to oral-systemic disease complications are type 1 and type 2 DM.⁷

Type 1 DM (formerly called type I, IDDM or juvenile diabetes) is characterized by beta cell destruction caused by an autoimmune process, usually leading to absolute insulin

deficiency.^{33 34} The onset is usually acute, developing over a period of a few days to weeks. Over 95 percent of persons with type 1 DM develop the disease before the age of 25, with and equal incidence in both sexes and an increased prevalence in the white population.¹³⁵ In adults, type 1 DM accounts for 5 percent to 10 percent of all diagnosed cases of DM.¹ Type 1 DM develops when the body's immune system destroys pancreatic beta cells, the only cells in the body that make the hormone insulin that regulates blood glucose.¹ To survive, people with type 1 DM must have insulin delivered by injection or a pump.¹ A family history of type 1 DM, gluten enteropathy (celiac disease) or other endocrine disease is often found. Most of these patients have the immune-mediated form of type 1 DM with islet cell antibodies and often have other autoimmune disorders such as Hashimoto's thyroiditis, Addison's disease, vitiligo or pernicious anemia.³⁵ A few patients, usually those of African or Asian origin, have no antibodies but have similar clinical presentation; consequently, they are included in this classification and their disease is called idiopathic form of type 1 DM.³⁴

Insulin resistance in peripheral tissue and insulin secretory defect of the beta cell characterizes type 2 DM (formerly called NIDDM, type II or adult-onset).^{1 34} This is the most common form of diabetes and is highly associated with a family history of DM, older age, obesity and lack of exercise.^{1 35} In adults, type 2 DM accounts for about 90 percent to 95 percent of all diagnosed cases of diabetes.¹ It is more common in women, especially women with a history of gestational diabetes, and in African Americans, Hispanic/Latino Americans, Asians/Pacific Islanders and Native Americans.^{1 35} Insulin resistance and hyperinsulinemia eventually lead to impaired glucose tolerance.¹ Defective beta cells become exhausted, further fueling the cycle of glucose intolerance and hyperglycemia.³⁵ The etiology of type 2 DM is multifactor and probably genetically based.³⁵

Diabetes and Periodontal Disease

It is largely accepted, that the relationship between PD and DM, (both type 1 and type 2) is generally a bidirectional one^{8,10,36} in that PD can influence glycemic control³⁷⁻⁴⁰ and uncontrolled diabetes can exasperate PD.⁴¹ Consequently, periodontal disease has been described as the sixth complication of DM.⁴² During the past 50 years more than 200 articles have been published, on the topic of the relationship between diabetes and PD.⁷ However, as stated by Mealey, “Interpretation of this research is made difficult by the numerous classifications for diabetes and periodontitis used over the years; varying clinical and radiographic criteria used to assess PD prevalence, extent and severity; evolving standards for the degree of glycemic control; and changing methods for assessing complications associated with diabetes mellitus”.⁷ Therefore Mealey also states “Researchers and clinicians must use caution when comparing the results of different studies, because research has focused on assorted populations and often has included relatively few subjects or lacked controls.”⁷

Research that is available has strongly suggested that diabetes is a risk factor for gingivitis and periodontitis.^{11,12} A classic study which was conducted over 30 years ago, found the prevalence of gingival inflammation was greater in children with type 1 DM than in children without diabetes who had similar plaque levels.⁴¹ A study by Ervasti et al. found an increase in gingival bleeding with patients who had poor control of their diabetes than controlled subjects without diabetes.⁴³

DM has been associated with an increased risk of periodontitis even at a young age. In a group of 263 type 1 patients with diabetes compared to 59 non-diabetic siblings and 149 non-diabetic unrelated controls, periodontitis was not seen among any of the subjects under

the age of 12. However, between 13 and 18 years of age, 13.6% of the diabetic individuals had periodontitis, and the prevalence increased to 39% among those aged 19 to 32 years. By comparison, the prevalence in non-diabetic control subjects was <3%.⁴¹

Epidemiologic studies in diabetic adults have often shown an increased in extent and severity of periodontitis.⁴⁴⁻⁴⁶ In a large epidemiologic study in the United States, adults with poorly controlled diabetes had a 2.9-fold increased risk of having periodontitis compared to non-diabetic adult subjects; conversely, well controlled diabetic subjects had no significant increase in the risk of periodontitis.¹³ In a multivariate risk analysis, diabetic subjects had 2.8 to 3.4-fold increased odds of having periodontitis compared to non-diabetic subjects after adjusting for the effects of confounding variables such as age, gender, and oral hygiene measures.⁴⁷ In the Pima Indians of Arizona, a population with highest occurrence of type 2 DM in the world, the prevalence and severity of attachment loss and bone loss was greater among diabetic subjects than among non-diabetic control subjects in all age groups.^{44,45} Longitudinal research has also shown an increased risk of progressive periodontal destruction in people with diabetes. Another study of the Pima Indians, the incidence and prevalence of PD were determined in 2,273 subjects 15 years of age or older.⁴⁸ The prevalence of periodontitis was 60% in subjects with diabetes and 36% in those without diabetes.⁴⁸ The incidence was determined in a subset of 701 subjects, age 15 to 54 years old, with little to no evidence of periodontitis at baseline.⁴⁸ Following these subjects for an average of over 2.5 years, the incidence of periodontitis was 2.6-fold higher in diabetic subjects than in non-diabetic subjects.⁴⁸ In another 2 year longitudinal study, patients with type 2 DM had a four-fold increased risk of progressive alveolar bone loss compared to non-diabetic subjects.⁴⁹

Periodontal pathogens, especially *P. gingivalis*, have the ability to invade deep vascular endothelium associated with the periodontium, and can be found within pathological vascular plaques.^{50,51} There have been studies, that investigated the relative prevalence of five periodontal pathogens *A. actinomycetemcomitans*, *Eikenella corrodens*, *T. denticola*, *Candida albicans*, and *P. gingivalis*, which are found among individuals with type 1 and type 2 DM. However, no statistically significant correlations were revealed.⁵² Some of the results suggested that *E. corrodens*, *T. denticola*, *C. albicans*, and *P. gingivalis* may play important roles in the periodontitis of individuals with either type 1 or type 2 DM.⁵³

Investigations have been reported to determine if the treatment of PD has an effect on the glycemic levels of patients with diabetes. Periodontal treatment that reduces periodontal inflammation may restore insulin sensitivity, resulting in improved metabolic control.³⁷⁻⁴⁰ In a study of subjects with type 2 DM and periodontitis, periodontal treatment resulted in a significant reduction in serum TNF- α levels, which was accompanied by a significant decrease in mean HbA1c levels from 8.0% to 7.1%.⁴⁰ Another study found that the HbA1c levels in the poorly controlled group with diabetes decreased significantly at three months after completion of periodontal treatment.⁵⁴

Other studies have given only marginal support to the relationship between glycemic control and the extent or severity of periodontitis, whereas some have shown no relationship.^{47,47,55,55-}

⁵⁷ In a study of 118 diabetic subjects and 115 healthy controls, deeper probing depths and greater gingival inflammation, bleeding on probing and attachment loss were seen in those with diabetes; however, the level of glycemic control among the diabetic subjects did not correlate to the periodontal parameters measured.⁵⁵

Insurance Companies and Dental Coverage for Patients with Diabetes

As of January 2009, 46 states and the District of Columbia require private market health insurance coverage for people enrolled in a health plan and who have a diagnosis of diabetes. Most individuals with diabetes had coverage through private insurance (39%) or Medicare (44%). Diabetics may have difficulties finding affordable plans that will accept them, especially if they have a pre-existing chronic disease such as diabetes.³¹ With all that Medicare does cover, an important coverage not included by Medicare is dental treatment. Therefore, the majority of patients with diabetes have no coverage for dental treatments that may improve their overall general health.

Most private insurance companies have coverage for dental treatment at an extra cost to the individual. Depending on the type of dental coverage the individual purchases determines what dental treatments that are covered. There are some insurance companies adding additional benefits for high-risk populations. For example Aetna inc. is adding additional periodontal maintenance for patients with diabetes, pregnant women and patient with heart disease.⁵⁸ In 2005 Blue Shield of Michigan in Detroit, started a pilot program that cover an additional regular cleaning per year for diabetics and heart patients.⁵⁸ With the research that is emerging, linking poor oral health and systemic conditions insurance companies are realizing the need for preventive care to save on medical expenses.

Patients with Diabetes: Knowledge and Behaviors regarding Oral Health

A research conducted over a three year period 1986 – 1988 by Moore et al, as part of a dental and periodontal examination, 406 subjects with type 1 DM completed a questionnaire regarding their oral health attitudes, behaviors and knowledge.⁵⁹ Moore et al

also evaluated 203 age-matched non-diabetic control subjects.⁵⁹ They found that 63% of the diabetic subjects and 64.3% of control subjects had dental insurance.⁵⁹ When asked tooth brushing frequency 50% of both groups brushed twice per day.⁵⁹ Twenty seven percent of the diabetic subjects compared to 19.8% of the control subjects only brushed once per day.⁵⁹ Both subject groups reported using fluoridated toothpaste >96.1% of the time.⁵⁹ The control subjects only used dental floss at least once per week 30.0% compared to diabetic subjects 33.0%.⁵⁹ When asked have you visited a dentist within the past twelve months, the diabetic subjects 68.9% reported they had seen a dentist compared to the control subjects 75.7% reported a dental visit.⁵⁹ Both subject groups reported the main reason for their last dental visit was for a checkup.⁵⁹ When asked, what is the reason you do not visit the dentist more often 51.6% of diabetic subjects and 39.7% control subjects answered cost too much money.⁵⁹

Moore et al concluded that this survey of an adult population of insulin diabetic subjects found that they frequently were unaware of the oral health complications of their disease and that they avoided dental care because of the cost.⁵⁹ Moore et al found that the prevalence of dental anxiety and fear was not greater among the diabetic subjects than among the control subjects, and the prevalence of smoking among the diabetic and control subjects (19.0% vs. 21.8%, respectively) was similar.⁵⁹ Prevention of these oral health sequelae-tooth loss, periodontal disease and soft-tissue disease on education and health promotion strategies such as early diagnosis, proper oral hygiene and diet, rigorous glycemic control measures, and smoking cessation counseling.⁵⁹ Annual dental examinations may benefit these patients by improving the likelihood that oral disease will be diagnosed early.⁵⁹

A study conducted in Finland by Syrjala et al was to develop a method for analyzing dental self-efficacy and to study the relationship between dental self-efficacy and reported oral health behavior and oral hygiene among patients with diabetes.⁶⁰ The relationship between oral health behavior and HbA1c level was also studied. The research was a cross-sectional survey relating to 149 IDDM patients.⁶⁰ The age of participants ranged from 16 years to 72 years (mean=34 years).⁶⁰ Patients were also placed in two categories for education: those who had passed through high school (n=49) and others (n=100).⁶⁰ Patients were also categorized in relation to professional education: university or college qualification (n=59) and other form of professional education or no professional education (n=87).⁶⁰ The questionnaire asked about frequency of tooth brushing and confident level, frequency of approximal cleaning and confident level and the frequency of dental visit and confident level.⁶⁰ The study by Syrjala et al, results showed that tooth brushing self-efficacy, approximal cleaning self-efficacy and dental visiting self-efficacy related to corresponding reported oral health behaviour ($p < 0.0005$).⁶⁰ Visible plaque index (VPI) correlated inversely with tooth brushing self-efficacy ($r_s = -0.208$, $p = 0.012$) and dental visiting self-efficacy ($r_s = -0.240$, $p = 0.004$).⁶¹ Approximal cleaning self-efficacy correlated with age ($r_s = 0.225$, $p = 0.006$) and dental visiting self-efficacy was related to higher professional level of education ($p = 0.009$).⁶¹ Those having better tooth brushing self-efficacy ($p = 0.020$), higher frequency of tooth brushing ($p = 0.032$) and lower VPI ($p < 0.0005$) had better HbA1c level.⁶¹ Syrjala et al concluded that perception of dental self-efficacy plays a decisive role in relation to oral health behavior in diabetic patients, and that compliance with dental recommendations is also related to HbA1c level.⁶⁰

A study out of Sweden conducted by Thorstensson et al, investigated dental care habits and knowledge of oral health in age- and sex-matched adult long and short duration insulin-dependent diabetics and non-diabetics.⁶² Ninety-four long and 86 short duration diabetics and 86 non-diabetics, aged 20–70 years, participated in the study.⁶² All subjects answered a questionnaire with 38 questions about dental visits, attitudes to and knowledge of dental diseases, tooth cleaning, dietary and smoking habits, and oral sensations.⁶² Thorstensson et al results found among the patients with diabetes most did not visit a dentist annually.⁶² The patients with diabetes also required more emergency dental care and were not as willing as the non-diabetics to spend time and money on their teeth.⁶² The compliance with dietary advice was poor among the patients with diabetes.⁶² Oral discomfort such as prickling and burning sensations, metallic and bad taste was rare in both diabetics and non-diabetics.⁶² In the patients with diabetes, however, a feeling of mouth dryness was common.⁶²

Physicians' Knowledge and Behaviors Regarding Oral Health

When a physician performs an examination one major area that is often overlooked or incorrectly examined is the oral cavity. Some physicians may lack the knowledge or skills to perform an oral examination correctly. A national survey conducted by Lewis et al collected data from 862 pediatricians. They found that 90% agreed that they had an important role in identifying dental problems and counseling families on the prevention of caries.⁶³ But, over 50% of the respondents reported no previous training in dental health issues during medical school or residency, and only 9% correctly answered all 4 knowledge questions. Seventy-two percent reported that they assessed fluoride intake to determine the need for supplementation. More than one half of respondents reported difficulty referring patients who were uninsured

(55.1%). Fifty percent of the respondents reported no previous training in dental health issues during medical school or residency.⁶³

In 2009, Lewis et al reported on a National Periodic Survey of Fellows which focused on oral health in pediatricians' office settings.⁶⁴ A survey was mailed to 1618 post-residency fellows of the American Academy of Pediatrics. More than 90% of pediatricians reported that they should examine their patients' teeth for caries and educate families about preventive oral health.⁶⁴ However, in practice, only 54% examine the teeth of the majority of their 0–3-year-old patients. The most common barrier to participation in oral health–related activities in their practices was lack of training, cited by 41%. Less than 25% of pediatricians had received oral health education in medical school, residency, or continuing education. Most pediatricians (74%) reported that availability of dentists who accept Medicaid posed a moderate to severe barrier for 0–3-year-old Medicaid-insured patients to obtain dental care.

A survey was sent out to obstetricians (N=138) in a 5 county area in central North Carolina, to assess their knowledge and practice behaviors concerning periodontal health and preterm delivery and low birth weight.⁶⁵ Fifty five obstetricians responded yielding a 40% rate. When asked about the description of gingivitis 95% answered correctly, however, when asked about the description of periodontitis only 67% were correct. When asked what causes periodontal disease, most 94% answered correctly. However, many thought that tooth decay (73%), aging (69%) and excess dietary sugar (51%) also caused periodontal disease. Most were correct in responding that periodontitis was more serious than gingivitis (80%).

These studies suggest that the knowledge and training physicians have in connection with the oral cavity is limited. They also confirm that most physicians feel they have an important role in helping prevent oral disease.

Although the incidence of diabetes is increasing at an alarming rate, no studies to date have been reported regarding endocrinologists' and internists' knowledge about the relationship of PD to DM. These physicians have a major role in treating patients with diabetes so investigating their knowledge and potential impact on patient education and oral health is important.

Purpose for this Study

The purpose of this study was to investigate NC endocrinologists' and internists' knowledge, behaviors and attitudes/opinions regarding DM and PD.

Introduction and Literature Review

National survey data have documented that diabetes mellitus (DM) is a major health problem in both men and women and in all races and ethnic groups in the United States and that, its prevalence increases with age.¹ It is estimated that there are 23.6 million people (approximately 7.8% of the population) in the United States have diabetes; additional 5.7 million people have diabetes but are unaware of their condition.¹ Future predictions for the disease are grim; the estimation is that there are 1.6 million new cases of diabetes diagnosed in people aged 20 years and older each year.¹

Chronic periodontitis has been linked to diabetes. Several investigations have produced strong evidence for an association between the two diseases.⁷⁻¹⁰ For example, in a large epidemiologic study in the United States, adults with poorly controlled diabetes had a 2.9-fold increased risk of having periodontitis compared to subjects without diabetes.¹³ In addition, it is also thought that the relationship between PD and DM, (both type 1 and type 2) is generally a bidirectional one^{8,10,36} in that PD can influence glycemic control³⁷⁻⁴⁰ and uncontrolled diabetes can exasperate PD.⁴¹ Consequently, periodontal disease has been described as the sixth complication of DM.⁴²

Dentists and dental hygienists are taught about the oral-systemic connection during their professional education.^{66,67} What is less clear is how medical providers are educated about oral-systemic research relating to periodontal disease and systemic complications. It has been reported that many physicians often fail to examine the oral cavity including the teeth and the supporting structures.^{14,15} This is vitally important when physicians are

examining a patient with diabetes as the condition of the mouth and teeth have clinical relevance for treatment.⁴⁰

Some physicians may lack the knowledge or skills to perform an oral examination correctly. A national survey conducted by Lewis et al collected data from 862 pediatricians. They found that 90% agreed that they had an important role in identifying dental problems and counseling families on the prevention of caries.⁶³ But, over 50% of the respondents reported no previous training in dental health issues during medical school or residency. In 2009, Lewis et al reported on a National Periodic Survey of Fellows which focused on oral health in pediatricians' office settings.⁶⁴ A survey was mailed to 1618 post-residency fellows of the American Academy of Pediatrics. The most common barrier to participation in oral health-related activities in their practices was lack of training, cited by 41%. Less than 25% of pediatricians had received oral health education in medical school, residency, or continuing education.⁶⁴

Wilder et al conducted a study of obstetricians in NC. Most answered correctly when asked about the description of gingivitis (95%). A lower number of respondents were correct when asked about the description of periodontitis (67%). When asked about what causes periodontal disease or what is associated with periodontal disease, most answered correctly with bacteria (94%), although many answered tooth decay (73%), aging (69%), and excess dietary sugar (80%). Most were correct in responding that periodontitis was more serious than gingivitis (80%).⁶⁵ These studies suggest that the knowledge and training physicians have in connection with the oral cavity is limited. They also confirm that most physicians feel they have an important role in helping prevent oral disease.

Another group of professionals who impact the life of individuals with diabetes is Certified Diabetes Educators' (CDEs). These professionals assist patients in living a healthier and longer life. However, little research has been conducted to study their knowledge about PD and practice behaviors regarding referral to dental professionals. Yuen et al conducted a study to investigate CDEs in South Carolina to determine their oral health education. The majority reported their curricula did not include an oral module. Respondents who lacked sufficient knowledge about oral health and its relationship to diabetes were less likely to provide adequate oral-health- related information ($p=0.008$), especially information about the effect of periodontal disease on diabetes ($p=0.016$).⁶⁸ Another recent study of CDEs was conducted by Vinson et al. who conducted a national survey of CDEs. Findings included 79% reported not receiving any oral health education (didactic or curricular) in their initial professional education and training in nursing or nutrition and 90% had not received oral health education since receiving their CDE certification. Of the 10% who reported having had oral health education since their CDE certification, 31% indicated the oral health education only covered general information on healthy teeth and gums. (Vinson, M. J Dent Res, 2010)

Although the incidence of diabetes is increasing at an alarming rate, no studies to date have been reported regarding endocrinologists' and internists' knowledge about the relationship of PD to diabetes. These physicians have a major role in treating patients with diabetes so investigating their knowledge and potential impact on patient education and oral health is important. The aim of this study was to investigate NC endocrinologists' and internists' knowledge, behaviors and attitudes/opinions regarding DM and PD. The findings of this study may impact the future collaborations between medical and dental professionals

in NC and generate discussion on future interprofessional collaborative efforts between the professions.

METHODS AND MATERIALS

A cross-sectional survey of internists and endocrinologists practicing in North Carolina was conducted. These groups of physicians were selected because of their ongoing treatment relationship with patients with diabetes. The sampling frames for the two groups of physicians were obtained from the NC Medical Board. All NC endocrinologists (N=115) were surveyed due to the small number. A random sample of NC internists (N=1000) were surveyed out of 4,445. The project was approved by the Biomedical Institutional Review Board of the University of North Carolina at Chapel Hill.

The thirty five item questionnaire consisting of six domains 1) practice setting, 2) oral examinations, 3) periodontal disease and systemic health, 4) opinions about periodontal disease and systemic health, 5) education, and 6) demographics. The survey was pilot tested and revised. Item responses were either close-ended or Likert scale. The survey, cover letter and a business reply envelope were mailed to 115 licensed endocrinologists and 1000 licensed internists in NC. Three mailings were conducted in accordance with the Salant and Dillman methodology.⁶⁹

The questionnaires were produced using Teleform, an optically scannable format that simplifies data entry. The data were analyzed using SAS version 9.1 (SAS Institute, Inc., Cary, North Carolina). Bivariate analyses using Fishers Exact or Chi-Square were used to assess whether specialty, age, gender, or medical-dental school affiliation were related to the physicians' behaviors or opinions, outcome separately. Level of significance was set at $p < 0.05$

RESULTS

Demographics

The response rate for the survey was 34% (N=378). The overall useable response rate was 23% (N=254). When comparing the two groups of physicians, endocrinologists' response rate was higher at 45% compared to the internists at 33%. Demographic data is reported in (Table 1). The majority of endocrinologists and internists worked in a group type practice (59%) and 30% practiced in a suburban area. Twenty-eight percent have been providing care for patients with diabetes between 11 and 20 years. Thirty-two percent of respondents reported providing patient care 41-50 hours per week. Fifty-nine percent of the respondents were 50 years of age or younger and more than half of the respondents (66%) were males. The majority (68%) had received dental care in the past 6 months; 53% rated their oral health as "good," and (19%) had been told they have periodontitis (Table 2).

Practice behaviors

Sixty nine percent of respondents reported that less than 40% of their patients have diabetes. When asked how many of their patients experience periodontal disease, 26% estimated that up to 10% of their patients have PD and 31% estimated that none of their patients with diabetes have PD. Internists estimated that they have a higher patient population with diabetes than endocrinologists ($p<=0.001$) (Figure 1). In the past year respondents reported referring 1-5 patients with diabetes (48%) and 18% referred 21 or more of their patients with diabetes to a dental professional. Almost the same percent of respondents

reported referring their patients with diabetes to a dental professional due to tooth decay; 43% referred 1-5 patients with diabetes, and 21% referred 20 or more of their patients with diabetes (Table 3). When referring a patient with diabetes because the physician saw something that he/she thought need further examination, internists referred often than endocrinologists [ends (N=20) (51.28%), ints (N=161) (74.88%)] (p=0.004). In addition male physicians referred more for this reason than females physicians [fem (N=58) (70.73%), mal (N=116) (71.60)] (p=0.020).

When asked what diabetic care services are provided at their work setting, 95% reported clinical medical management, 70% reported nutrition counseling, 53% reported education and counseling services, but only (5%) reported dental screening and oral health information. Seventy-seven percent reported having no oral health materials in their office to use for patient education however, 70% reported they would like to have oral health educational materials available for distribution.

Physicians were asked how often they perform an oral examination on their patients with diabetes. Fifty seven percent reported rarely or only when the patient mentions a problem. However, 24% reported at every visit and 5% reported never performing and examination. (Figure 1) If they did not provide an exam, 35% reported it was the responsibility of dental professionals and 33% reported they were not sure what type of exam to perform (Figure 2).

Knowledge and opinions about periodontal disease and systemic health

Endocrinologists' and internists' knowledge about PD was high. They knew that bacteria was the etiology of periodontal disease (86%), bone loss around teeth describes

periodontal disease (77%), and the first sign of periodontitis is bleeding gums (66%). However, 30% reported tooth decay as a sign of periodontitis. The physicians were also knowledgeable about the description of gingivitis. Ninety two percent reported it as a reversible redness and/or inflammation of the gums, 67% reported an infection of the gums, and 65% reported bleeding gums.

When asked their opinion about the link between PD and systemic health, 72% agreed the research is strong supporting a relationship. However, when comparing the two groups, internists agreed more than endocrinologists that there is a link between PD and systemic health [ends (N=22) (57.89%), ints (N=159) (74.65%)] ($p=0.048$). When asked if they are knowledgeable regarding the studies linking PD and DM, 79% were unsure and/or disagreed. The majority of the physicians agreed that patients with diabetes are at an increased risk for severe PD (78%), patients with poor glycemic control are more likely to have PD (82%), and treatment of periodontal disease may improve glycemic control (49%) (Table 4).

The majority of the respondents agree that physicians should be taught about PD (88%) and should be trained to screen for PD in their patients (78%). However, when asked if they are confident in providing an oral health screening for their patients the responses was evenly distributed from strongly agree to strongly disagree. Eighty-nine percent agreed physicians need to collaborate with dental professionals to reduce their patient's risk of developing PD (Table 4).

When comparing the two groups, endocrinologists agreed more that treatment of PD may improve glycemicy control [ends (N=25) (65.79%), ints (N=98) (46.45%)] ($p=0.034$). When asked if a patient with diabetes has PD, they are more likely to have

poor glycemic control than a patient with healthy gums, female physicians agreed more than male physicians [fem (N=60) (73.17%), mal (N=117) (72.67%)] (p=0.007). Also, comparing gender, female physicians agreed more than male physicians, that patients with poor glycemic control are more likely to have PD [fem (N=68) (82.98%), mal (N=133) (82.61%)] (p=0.003).

There was a statistically significant difference between physicians' who were at a university where a dental school was also located and those educated at a location without a dental school. Those who were located near a dental school during medical school agreed more that good periodontal health is important to overall health [yes (N=152) (98.70%), no (N=84) (91.30%)] (p=0.006). While only a slight difference, physicians affiliated with a dental school during medical school agreed more that the research is strong regarding a relationship between PD and DM.

Physician's education

The physicians were asked about the oral health education they received as part of their medical school training. Only 24% reported having any oral health information in their curricula. For the physicians who did receive information, the majority (62%) reported having three hours or less. Only 12% reported they had clinical requirements included assessments of the gums and teeth and/or some type of clinical experience (observation, providing patient care, etc) with dentists or dental hygienists (Table 5).

DISCUSSION

Individuals with diabetes are associated with an increase risk of developing inflammatory periodontal diseases.^{9,9,36} Due to the negative effect of these two diseases, they can impact the well being of an individual with diabetes. The projection of the number of people with diabetes in the United States will rise to 25.4 million in 2011, increase to 32.6 million in 2021 and by 2031 the total will be 37.7 million people.⁷⁰ With this increase in the number of patients with diabetes it might take the efforts of both medical and dental providers to assess and diagnose these patients and work collaboratively to manage the high number of patients who are at an increased risk for PD. When this project originated there were no published studies of endocrinologists and internists regarding their knowledge about PD, information they provide to their patients or their willingness to screen for PD and refer if appropriate. These groups of physicians are the primary continuing care providers for individuals with diabetes. The outcomes from this study may help facilitate interprofessional education and collaboration between medical and dental providers.

As the number of people with diabetes and other systemic diseases increase the need for interprofessional education and collaboration between medical and dental providers might be a solution to treating the rising number of patients. A pilot study was conducted at the University of Washington School of Medicine⁷¹ where 229 medical students were surveyed. The study revealed generally positive attitudes toward the importance of oral health training, but low student knowledge of caries, oral-systemic

interactions, and oral health disparities across all training years. The investigators estimated that medical students receive two hours or fewer on oral health education during their medical school years. The current study concurred with the Mouradian study⁷¹ in that physicians reported three hours or fewer on oral health and/or periodontal health. The present study found that NC endocrinologists and internists have some knowledge about oral health (periodontitis, gingivitis, etc) and they think there is a link between PD and DM however the majority do not have the knowledge about the studies that link PD and DM. A common finding between the two studies is that the physicians have a generally positive attitude about learning more about oral conditions and the relationship to systemic health. Perhaps this is an opportune time for developing collaborative teaching and practice.

Regarding practice behaviors only 5% offered dental screening or oral health information. The majority of the respondents agreed physicians should be taught about PD and how to screen for PD in their patients. However, it varied regarding who was confident in providing an oral health screening. Previous investigators have suggested that physicians may not look into patients' mouths due to a lack of training.^{63,72-74} A study conducted by Lewis et al reported that only 50% of the physicians surveyed had no training on oral examinations during medical school or residency.⁶³ This study found that only 12% of the physicians surveyed had clinical requirements regarding assessments of the gums and teeth and clinical experiences. It also has been reported, if an oral examination is preformed, many medical physicians often fail to examine the whole mouth including the teeth and the support around the teeth.^{14,15} This is vitally important

when physicians are examining a patient with diabetes, the condition of the mouth and teeth have clinical relevance for treatment of their patients with DM.

There was an adequate number of NC endocrinologist and internists to justify appropriate sample size. A high response rate is prudent to minimize non-response bias. The anticipated response rate for this sample size was determined to be 30%. The final response rate after the third mailing was 34%. Response rates to questionnaires sent to physicians have varied substantially.⁷⁵⁻⁷⁹ VanGuest et al and Cartwright in two different studies, investigated physician response rate to mailed surveys. The two studies surveyed 19 professional study samples and found response rates to range from 56% to 99%.^{75,79} Kaner et al investigated general medical practitioners on response to mailed surveys. They found that the response rate ranged from 32% to 68%.⁷⁶ It is recognized that this sample of NC physicians that were selected to be surveyed may not be the representative of all endocrinologists and internists providers, thus limiting the external validity. However, the respondents represent various medical schools across the United States indicating that the lack of oral health content in medical school curriculums may be a national problem.

Almost all of the physicians surveyed (89%) agreed that physicians need to collaborate with dental professionals to reduce their patients' risk of developing PD. The area of interprofessional education and collaboration is gaining national attention.^{80,81} In order for the oral healthcare crisis to be resolved, it may take the efforts of not only oral healthcare professionals but also the attention of the medical profession. Perhaps studies like the current report can serve as an impetus for change. New dental schools are evolving and have the capability to mold a curriculum with innovative strategies. One of

these strategies could be a model of interprofessional education that could serve to positively impact the healthcare of patients who have diabetes and are at risk for oral disease.

Future studies should investigate mechanisms to promote interprofessional education and collaboration between dental providers and medical providers who treat patients with diabetes. The investigators of the current study are encouraged that the physicians expressed interest in collaborating with dental providers and desired more information about PD and its impact on diabetes. Future investigations should build on this finding and study ways to provide interprofessional education between the professions.

CONCLUSION

NC endocrinologists and internists have some knowledge about oral health and they think there is a link between PD and DM, however the majority do not have the knowledge about the studies that link PD and DM. They believe physicians should be taught about PD and how to screen for PD. Also, they agree that there needs to be collaboration with dental professionals to reduce the number of patients with diabetes who are at risk for developing PD. Now might be the time to implement strategies to educate and promote interprofessional collaboration between medical and dental professionals to prepare for the future increase in patient and treatment needs.

TABLE 1: Respondents' demographics

	N =	% of respondents
Age in years		
< = 40	86	34
41 - 50	64	25
51 - 60	67	27
> 60	35	14
Gender		
Female	82	34
Male	164	66
Practice description		
Rural	41	16
Urban	63	25
Suburban	71	30
Solo practice	34	14
Group practice	149	59
Years providing care to patients with diabetes		
< = 1 year - 5 years	34	13
6 - 10 years	63	25
11 - 20 years	70	28
21 - 30 years	57	22
> 30 years	30	12
Hours per week providing care to all patients		
< = 10 hours	17	7
11 - 20 hours	27	11
21 - 30 hours	27	11
31 - 40 hours	67	27
41 - 50 hours	80	32
> 50 hours	34	14
Useable surveys per type of physician		
Endocrinologist	39	34
Internist	215	22

TABLE 2: Respondents' oral health information

	N =	% of respondents
Last time received dental care		
<= 6 months ago	171	68
> 6 months <= 1 year ago	41	16
> 1 year and <= 2 years ago	27	11
> 2 years ago	12	4
Never	1	1
Last time received a periodontal examination		
<= 6 months ago	169	67
> 6 months <= 1 year ago	43	17
> 1 year and <= 2 years ago	28	11
> 2 years ago	12	4
Never	1	1
Ever been told you have periodontal disease		
No	196	78
Yes	49	19
Maybe	7	3
How would you rate your oral health		
Fair	25	10
Good	133	53
Excellent	95	37

TABLE 3: Patient and referred information within the practice setting

	N =	% of respondents
Patient populations, percentage of those who have diabetes		
< = 10%	17	7
11 - 20%	61	24
21 - 40%	96	38
41 - 60%	49	19
> 60%	30	12
Percent of patients with diabetes experience periodontal disease		
0%	74	31
1 - 10%	63	26
11 - 20%	52	21
21 - 40%	41	17
> 40%	12	5
Past year, number of patients with diabetes referred to a dental professional due to periodontal disease		
1 - 5	111	48
6 - 10	48	21
11 - 20	30	13
21 - 30	22	9
> 30	21	9
Past year, number of patients with diabetes referred to a dental professional due to tooth decay		
1 - 5	98	43
6 - 10	51	22
11 - 20	33	14
> 20	46	21

TABLE 4: Opinions about periodontal diseases and systemic health

	Strongly Agree		Agree		Unsure / Don't know		Disagree		Strongly Disagree	
	N	%	N	%	N	%	N	%	N	%
The research is strong regarding the relationship between periodontal disease and systemic health	59	23	122	49	63	25	6	2	1	1
Good periodontal health is important to overall health	87	35	155	62	10	4	0	0	0	0
Brushing and flossing daily is essential to maintaining periodontal health	123	54	109	43	6	2	1	1	0	0
The research evidence is strong regarding an association between periodontal disease and diabetes	50	20	86	34	113	45	2	1	0	0
I am knowledgeable regarding the studies linking periodontal disease and diabetes	12	5	41	16	97	38	88	35	14	6
Patients with diabetes are at increased risk for severe periodontal disease	60	24	135	54	60	24	0	0	0	0
If a patient has periodontal disease, they are more likely to have poor glycemic control than a patient with healthy gums	48	19	136	54	66	26	2	1	0	0
Treatment of periodontal disease may improve glycemic control	35	14	88	35	116	47	8	3	2	1
Patients with poor glycemic control are more likely to have periodontal disease	49	19	160	63	42	17	1	1	0	0
Physicians should be taught about periodontal disease	64	25	159	63	22	8	7	3	0	0
Physicians should be taught to screen for periodontal disease in their patients with diabetes	57	22	141	56	44	18	8	3	1	1
Physicians need to collaborate with dental professionals to reduce their patient's risk of developing periodontal disease	66	26	158	63	19	8	6	2	2	1
I am confident that I can provide an oral health screening for my patients with diabetes	13	5	71	28	85	34	69	27	14	5
I am interested in expanding my practice to include oral health screening and education	15	6	88	35	90	36	49	19	10	4
I need additional information about periodontal disease and its impact on diabetes	43	17	150	60	32	13	20	8	3	1

TABLE 5: Physicians' education regarding oral health

	N =	% of respondents
Did your medical school education include oral health content in the curriculum?		
Yes	61	24
No	191	76
How many hours of material regarding oral health / periodontal health were covered in the curriculum?		
< = 3 hours	38	62
> 3 hours and < = 5 hours	14	23
> 5 hours	9	15
Did you have any clinical requirements regarding assessments of the gums and teeth?		
Yes	25	12
No	182	88
Did you receive and clinical experiences (observation, providing patient care, etc) with dentists or dental hygienists?		
Yes	22	12
No	184	88

FIGURE 1: Estimated internists' patient population with diabetes is higher than endocrinologists

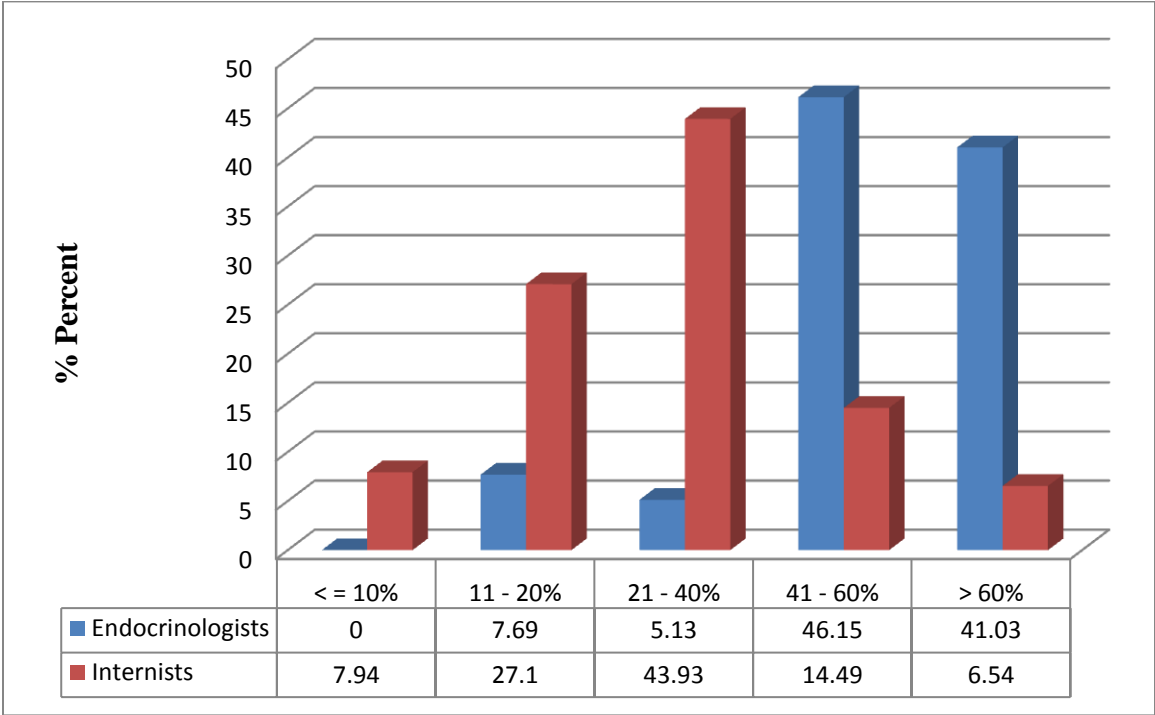
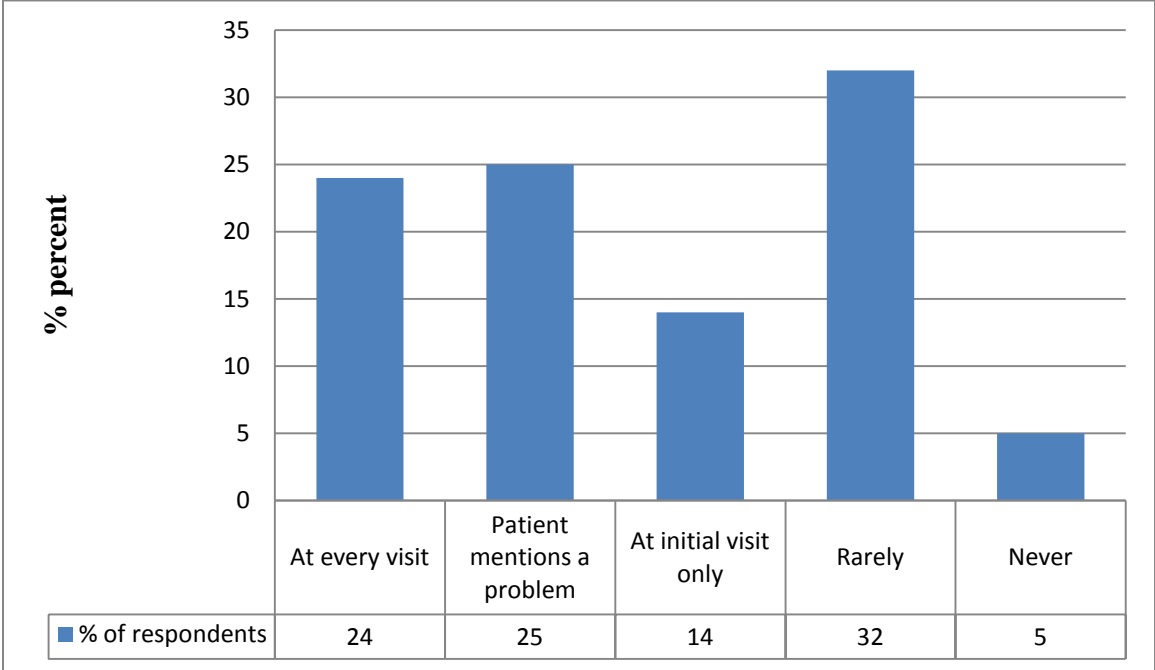
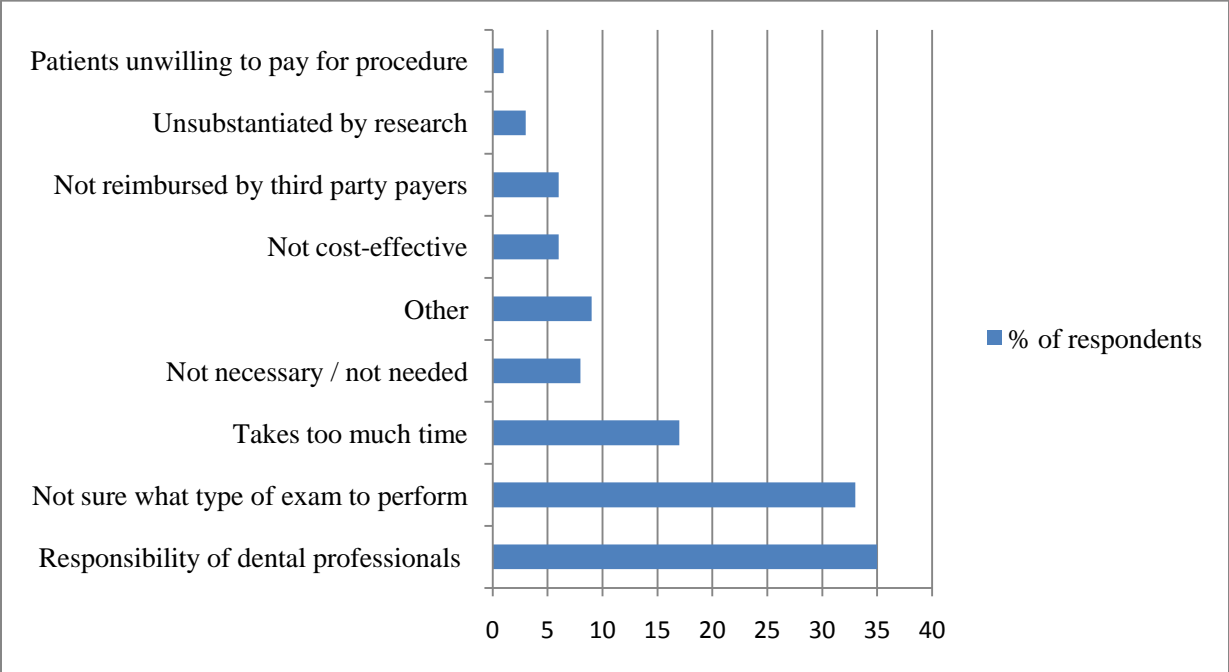


FIGURE 2: Frequency of oral examinations performed by physicians.



How often do you perform an oral examination on patients with diabetes?

FIGURE 3: Reasons for not performing oral examinations.



If you do not routinely provide an oral health exam on you patients with diabetes, what are the reasons?

APPENDIX A
SURVEY COVER LETTER

Date:

Address info:

Dear Dr.

The UNC School of Dentistry is conducting a **Survey of North Carolina Endocrinologists' and Internists' Practices and Opinions about Diabetes and Oral Health**. North Carolina has been a leader in this area of research; however, we have little knowledge regarding how physicians are incorporating this knowledge into clinical practice. This study will help us determine what is needed to improve the current practice of physicians regarding this emerging area of science.

You are one of 1,114 endocrinologists or internists who have been randomly selected to receive this survey out of over 4,565 licensed endocrinologists and internists in the state of North Carolina. **We need your help** in obtaining a good understanding of existing practices in your office and across the state regarding oral-systemic health and disease prevention. Because you are one of the randomly selected physicians, **it is important that you complete and return this survey**.

Instructions for completing the survey:

- Please answer as many questions as possible. If you choose not to answer specific questions, your answers to the other questions will still be of value to the study.
- Completion of the survey should take approximately 15 minutes.
- **Please complete and return the survey by Friday, October 23, 2009** in the enclosed business reply envelope. Late returns are accepted (and still appreciated).
- As a thank you to all those receiving the survey, **a free case of toothpaste will be mailed to your office**. Complete the mailing information and enclose it with your completed survey if you wish to receive the toothpaste.
- 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 completely voluntary. **If you decide not to participate, or do not currently provide clinical services to patients with diabetes, please return the blank survey in the enclosed, business reply envelope so we will know your intent**. This action will prevent you from receiving a follow-up notice.

The UNC School of Dentistry Institutional Review Board has approved this project. There are no anticipated financial risks or obligations to you for participating in this survey. However, the benefits to the participant include personal satisfaction in participating in research that is dedicated to the growth of the dental profession and contributing to the profession's own body of knowledge. Complete confidentiality is assured as no individual can or will be identified in the study. All data obtained in the study will be reported as group data. Access to the data is limited to the research team members, the statistical analysis personnel, and me. The results will be published and shared with other medical and dental professionals.

If you have questions about this study, please contact me at **jonathan_owens@dentistry.unc.edu or 919-966-0043 or my thesis advisor, Rebecca Wilder at rebecca_wilder@dentistry.unc.edu or (919) 966- 8221.**

Thank you for considering participation in this study. We hope that we can share your views with the greater professional community and use your response to help shape recommendations for addressing periodontal disease and systemic health information into practice.

Sincerely,

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Master of Science Degree Candidate
Dental Hygiene Education
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Chapel Hill, NC 27599-7450
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Janet Southerland, RDH, DDS, MPH, PhD
Clinical Associate Professor, UNC School of Dentistry

APPENDIX B

SURVEY

UNC DEPARTMENT OF DENTAL ECOLOGY
NC Physician Survey: Diabetes and Oral Health

ID:

Thank you for taking time to complete this important survey and for providing your comments. Please write directly on the survey with a 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 DO NOT CURRENTLY PROVIDE CLINICAL SERVICES TO PATIENTS WITH DIABETES, please return the survey in the enclosed business reply envelope. This action will help account for all surveys mailed and prevent you from receiving a follow-up notice.

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

PRACTICE SETTING

1. Are you currently providing clinical services to patients with diabetes? Yes No

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

2. Which of the following **BEST** describes your practice? (Select **ALL** that apply)

- Urban  Suburban  Rural
- Endocrinologist - Solo practice  Internist - Solo practice
- Endocrinologist - Group practice  Internist - Group practice
- Public health / Government  Hospital practice
- Certified Diabetes Educator
- Specialty practice (specify) \_\_\_\_\_  Other (specify) \_\_\_\_\_

3. How long have you been providing care to patients with diabetes?

- <1 year  1-2 years  3-5 years  6-10 years  11-20 years  21-30 years  > 30 years

4. Approximately how many patients with diabetes do you see each week?

5. Approximately how many hours per week do you provide patient care (all patients)?

- <5 hours  5-10 hours  11-20 hours  21-30 hours  31-40 hours  41-50 hours  >50 hours

6. Of your patient population, estimate the percentage of those who have diabetes.

- 0%  1-10%  11-20%  21-40%  41-60%  61-80%  >80%

7. What diabetic care services are provided at your work setting? (Select **ALL** that apply)

- Nutrition counseling  Diabetes self-management education (ADA approved)
- Education and Counseling Services (not ADA approved)  Medical nutrition therapy
- Clinical (medical management)  Health care professional education
- Telephone care management  Case management
- In-home diabetes education via home visits  Dental screenings / oral health information
- Other (please specify) \_\_\_\_\_

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Revised 09/2009

**ORAL EXAMINATIONS**

8. How often do you perform oral examinations on patients with diabetes?

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

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

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

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

- Oral ulcers
- Dental caries (cavities)
- Bleeding gums
- Oral Cancer
- Xerostomia
- Other (please specify) \_\_\_\_\_
- Inflammation of the gums
- Tongue lesions

11. 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

12. Which statement below best describes when you refer patients with diabetes to a facility (dental clinic, dental school or dental office)? (Select **ALL** that apply)

- 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 never refer a patient to the dental clinic or dental office. (SKIP TO QUESTION 15)

13. In the past year, estimate the number of patients with diabetes that you referred to a dental facility due to periodontal disease.

- 1-5
- 6-10
- 11-20
- 21-30
- 31-40
- 41-50
- 51-60
- > 60

14. In the past year, estimate the number of patients with diabetes that you referred to a dental facility for tooth decay.

- 1-5
- 6-10
- 11-20
- 21-30
- 31-40
- 41-50
- 51-60
- > 60

15. In your estimation, what percent of your patients with diabetes experience periodontal disease?

- 0 %
- 1-10 %
- 11-20 %
- 21-40 %
- 41-60 %
- 61-80 %
- >80%

16. Do you provide in-office oral health counseling such as good oral health habits?

- Yes
- No

17. What oral health materials do you have in your office to use for patient education? (Select **ALL** that apply)

- None
- Tooth brushes / dental floss
- Other (specify) \_\_\_\_\_
- Printed educational material / pamphlets
- Toothpaste
- Posters
- Videos / CDs on good oral health care

18. Would you like to have oral health educational materials available for distribution?

- Yes
- No



**PERIODONTAL DISEASE AND SYSTEMIC HEALTH**

19. 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

20. 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

21. 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

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

- Bad breath       Bleeding gums       Cavities (holes in teeth)       Teeth that move around (are mobile)

**OPINIONS ABOUT PERIODONTAL DISEASES AND SYSTEMIC HEALTH**

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

|                                                                                                                            | Strongly<br>Agree     | Agree                 | Unsure /<br>Don't know | Disagree              | Strongly<br>Disagree  |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|
| The research is strong regarding the relationship between periodontal disease and systemic health.                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Good periodontal health is important to overall health.                                                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Brushing and flossing daily is essential to maintaining periodontal health.                                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| The research evidence is strong regarding an association between periodontal disease and diabetes.                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| I am knowledgeable regarding the studies linking periodontal disease and diabetes.                                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Patients with diabetes are at increased risk for severe periodontal disease                                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| If a patient has periodontal disease, they are more likely to have poor glycemic control than a patient with healthy gums. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Treatment of periodontal disease may improve glycemic control.                                                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Patients with poor glycemic control are more likely to have periodontal disease.                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Physicians should be taught about periodontal disease.                                                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Physicians should be taught to screen for periodontal disease in their patients with diabetes.                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| Physicians need to collaborate with dental professionals to reduce their patient's risk of developing periodontal disease. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |

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**OPINIONS ABOUT PERIODONTAL DISEASES AND SYSTEMIC HEALTH (cont)**

23 (cont). Please indicate the extent to which you agree or disagree with each of the following statements.

|                                                                                           | Strongly<br>Agree     | Agree                 | Unsure /<br>Don't know | Disagree              | Strongly<br>Disagree  |
|-------------------------------------------------------------------------------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|
| I am confident that I can provide an oral health screening for my patients with diabetes. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| I am interested in expanding my practice to include oral health screening and education   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| I need additional information about periodontal disease and its impact on diabetes.       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |

**ENDOCRINOLOGISTS' AND INTERNISTS' EDUCATION**

24. Did your medical school education include oral health content in the curriculum?  Yes  No (SKIP TO Question 26)

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

- <= 1 hr    > 1 hr and <= 3 hrs    > 3 hrs and <= 5 hrs    > 5 hrs and <= 10 hrs    > 10 hrs

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

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

28. Regarding the medical training you received, how would you rate the education in teaching you about oral health?

- Very good    Good    Fair    Poor    Very poor

**DEMOGRAPHICS**

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

- <= 6 months ago    > 6 months and <= 1 year ago    > 1 year and <= 2 years ago    > 2 years ago    never

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

- <= 6 months ago    > 6 months and <= 1 year ago    > 1 year and <= 2 years ago    > 2 years ago    never

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

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

33. Gender:  Male  Female

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

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

**COMMENTS:**

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**THANK YOU FOR YOUR PARTICIPATION!**

**Please do not fold survey when mailing.**

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