DIABETES EDUCATORS' KNOWLEDGE, BEHAVIORS AND OPINIONS REGARDING PERIODONTAL DISEASE AND DIABETES

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ABSTRACT

Mary H. Lopes: Diabetes Educators' Knowledge, Behaviors and Opinions Regarding Periodontal Disease and Diabetes
(Under the direction of Ms. Rebecca S. Wilder)

The purpose of this study was to determine certified diabetes educators' (CDE) knowledge, behaviors and opinions about periodontal disease (PD) and diabetes. A questionnaire was distributed to CDEs who attended the 2009 American Association of Diabetes' Educators meeting and who provide counseling and education services to patients with diabetes. A total of 311 CDEs participated in the survey; only responses from nurses and registered dietitians were included in the final analysis (N=284). Descriptive statistics and bivariate analysis were utilized. Nurses had a higher proportion of correct answers compared to registered dietitians for questions regarding knowledge of PD. Most (62%) agreed that CDEs need to collaborate with dental professionals in disease management and 84% indicated interest in an oral health component being added to their continuing education. The findings suggest that collaboration with the dental profession would be a positive outcome for CDEs, as would oral health topics being added to their continuing education courses.

TABLE OF CONTENTS

LIST OF TABLES……..v

LIST OF ABBREVIATIONS……...vi

Chapter

I. INTRODUCTION……...1

II. REVIEW OF THE LITERATURE

Relating Systemic Health and Oral Health in the United States…….2

Definition of Periodontal Disease……...4

Relationship of Periodontal Disease and Systemic Health…….5

Epidemiology of Diabetes……...5

Types of Diabetes……6

Relationship of Diabetes to Oral Health……7

Relationship of Diabetes to Periodontal Disease……8

Insurance Companies and Dental Care of Patients with Diabetes……10

Knowledge of Oral Care Providers about Diabetes……..11

Knowledge of Health Care Providers about Oral Health……..13

Diabetes Educators' Knowledge, Opinions and

Behaviors Regarding Oral Health…….14

III. INTRODUCTION AND REVIEW OF THE LITERATURE……16

IV. RESEARCH DESIGN AND METHODOLOGY……..20

V. RESULTS……22

VI. DISCUSSION……26

VII. CONCLUSION……30

APPENDIX……..32

A. Survey Instrument……32

TABLE AND FIGURES……..37

REFERENCES…….....42

List of Tables

Table

1. Demographics of participants based on provider types……41

2. Certified Diabetes Educators' Opinions about Periodontal Disease and Systemic Health…….42

3. Oral health referral patterns of CDE nurses and registered dietitians to dental providers……43

4. Certified diabetes educators' knowledge about factors influencing periodontal disease……44

List of Abbreviations

CDE	Certified Diabetes Educator
CE	Continuing Education
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
IRB	Institutional Review Board
PD	Periodontal Disease

INTRODUCTION

One of the major links between oral and systemic health is the relationship between periodontal disease and diabetes mellitus. Diabetes has become a world-wide epidemic[1]; periodontal disease is one of the most common infections in humans.[2,3] Both diabetes mellitus and periodontal disease are chronic inflammatory diseases; the relationship that exists between the two is bi-directional.[2,4,5] In patients with diabetes and poor glycemic control, the periodontium is more susceptible to infection, which increases the risk of periodontal disease, as Campus et al. found in their case-control study. [6] The study found a significant increase in the amount of probing depths >4mm and the percentage of pocket depths >4mm, as well as a significant amount of bleeding on probing in patients with uncontrolled diabetes as opposed to patients with well-controlled diabetes. Periodontal disease in turn can exacerbate the glycemic control in patients with diabetes due to the inflammation of the periodontal tissues. According to Mealy and Rose, subjects with diabetes and periodontal disease have a six-fold higher risk for worsening of glycemic control over time compared to patients with diabetes but without periodontal disease.[2]

Little research has been done in the area of health care providers and their knowledge of oral health. According to the *Surgeon General's Report on Oral Health in America*, more time should be devoted to educating non-dental healthcare providers on the importance of oral health to the whole body.[7] Diabetes educators, the main source of

education and training for those diagnosed with diabetes[8] have been surveyed as to the extent to which they include oral health education in their counseling materials[9], but it is not known what their knowledge of the link between periodontal disease and diabetes is; what their opinions are about this link; and whether this knowledge affects their behaviors in referring patients with diabetes to a dental office or clinic.

The purpose of this study is to determine diabetes educators' knowledge, opinions and behaviors regarding periodontal disease and diabetes mellitus.

Review of the Literature

Introduction

The link between oral and systemic health has received much attention in the medical and dental literature. Studies have shown potential links between oral health and nutritional deficiencies[10], periodontal disease and cardiovascular disease[11], diabetes mellitus[2], obesity[3], and pre-term low-birth weight babies.[12] Since it is now known that the mouth can reflect the effects of systemic diseases and problems, it is time for dental and other health care professionals to work together in order to promote the health and well-being of their patients. The *Surgeon General's Report on Oral Health in America* states the need to have an oral health infrastructure, wherein all healthcare providers have the knowledge to discuss oral health with their patients.[7]

One of the major links between oral and systemic health is the relationship between periodontal disease and diabetes mellitus. Diabetes has become a world-wide epidemic [1] and periodontal disease is one of the most common infections in humans.[2,3] *Healthy People 2010* relates the importance of individual health in making a healthy society and states as two of it's objectives: "through prevention programs, to reduce the disease and economic burden of diabetes and improve the quality of life for all persons who have or are at risk for diabetes" and "prevent and control oral and craniofacial diseases, conditions and injuries and improve access to related services."[13] This is a challenge to healthcare professionals to work together to give comprehensive care to the

patient in relation to oral and systemic disease and especially in the area of periodontal disease and diabetes mellitus.

Periodontal Disease

Periodontal disease is an inflammation of the gingival tissues due to buildup of bacterial biofilm. It is the most prevalent chronic infection in humans worldwide.[3] It is currently known that over 500 different species of bacteria and viruses are associated with bacterial biofilm in humans.[14] This biofilm causes an inflammatory reaction in the gingival tissues. The first stage, and most common occurrence, is gingivitis. Gingivitis is described as inflammation of the gums characterized by redness, inflammation, swelling and frequent bleeding. Progression of this stage leads to mild, moderate, and severe or chronic periodontitis; these stages have similar characteristics, but with increased inflammatory response and biofilm.[15] In moderate and severe periodontal disease, the inflammation will reach the alveolar bone and cause destruction of the supporting structures which can result in tooth loss. Periodontal disease is measured clinically by probing depths; the sulcus is measured to the base at the junctional epithelium. A healthy periodontium will show no significant probing depths (>4mm) and no bleeding. In an individual with periodontal disease, the probing depths will measure 4mm and greater, with bleeding on probing. Bleeding on probing is a certain indicator of disease because it is the response of inflamed tissue. Treatment for periodontal disease includes scaling and root planing, localized antibiotics, and surgical removal of diseased tissue.[15]

Periodontal Disease and Systemic Health

Methods of systemic involvement include periodontal bacteria entering the bloodstream through ulcerated epithelium, which can provoke systemic inflammatory and immune responses[16] or through inflammatory mediators present in the diseased pocket which transfer directly into the systemic circulation.[17]

Research indicates there is a link between oral and systemic health. A high correlation exists between cardiovascular disease[11], diabetes[2], obesity[3], pre-term low birth weight babies[12] and periodontal disease, which may cause a lower immune response in patients with these conditions.[15] An example of the potential link between oral and systemic disease is in cardiovascular disease (CVD). The number of American adults with CVD is approximately 80,000,000.[18] It is the leading cause of death and disability in developing countries.[19] In the past, prevention of cardiovascular disease has been emphasized by controlling other risk factors, such as diabetes, tobacco use, blood pressure, cholesterol and obesity.[20] Due to recent research, however, more emphasis is being placed on inflammation as a causative agent in CVD, with the focus being on local or distant infections, including periodontal disease.[19]

Epidemiology of Diabetes

Diabetes mellitus is an inflammatory disease affecting the production and action of the hormone insulin. Beta cells on the pancreas produce the insulin, which regulates the levels of glucose in the body's blood supply. Insulin is released when the levels of glucose are too high (hyperglycemia). Diagnosis of diabetes is based on tests, which measure the amount of glucose in the bloodstream. The most commonly used test is the

FPG or Fasting Plasma Glucose test; an FPG result of 126mg/dl or above signals diabetes.[21] Another test used to measure blood glucose levels over time is the HbA1c test, which determines the amount of glycolated hemoglobin in the blood.[21]

Diabetes is characterized by increased vulnerability to other infections, ineffective healing of wounds and increased levels of mortality.[4] Approximately 7.8% of the American population have diabetes, that is 23.6 million children and adults.[1] About 5.7 million cases of diabetes are undiagnosed. It is estimated by the CDC that 57 million American adults have pre-diabetes, a condition that increases the person's risk for developing type 2 diabetes, heart disease and stroke.[22] In 2006, diabetes was the seventh leading cause of death, as listed, on United States death certificates.[23] Future projections say 1 in 3 Americans born in the year 2000 will develop some form of diabetes.[23] Although there has been an increase in diabetes for all age groups, it disproportionately affects the elderly; approximately 25% of adults over the age of 60 were diagnosed with diabetes in 2007.[24] Complications involved with this disease process include heart disease and stroke, high blood pressure, blindness, kidney disease, nervous system disease, amputations, dental disease and complications of pregnancy.[25]

Types of Diabetes

There are several types of diabetes, the two main types being Type I and Type II. Type I diabetes is characterized by lack of production of insulin; the body's immune system attacks the beta cells and destroys them, thus preventing the production of insulin. Risk factors affecting the disease process include autoimmunities, genetic predisposition or environmental stimuli. Type I diabetes typically affects children and young adults and

is responsible for 5-10% of diabetes diagnoses.[1] There is no known cure for this type of diabetes, and those diagnosed are dependent upon insulin injections or insulin pumps, which deliver insulin continuously through the skin.

Type II diabetes is characterized by the body's resistance to insulin production due to improper use of the hormone within the cells. As the amount of glucose in the blood increases and more and more insulin is needed to counteract it, the pancreas is unable to keep up and does not produce the needed amount of insulin. Risk factors for Type II diabetes include older age, obesity, a family history of diabetes, a history of gestational diabetes, impaired glucose metabolism, physical inactivity and race/ethnicity. This type of diabetes usually affects adults and accounts for 90-95% of diabetes diagnoses.[1] Type II diabetes can be controlled in several ways: having healthy eating, exercising and weight management plans, taking oral medications either to control their glucose levels or to control blood pressure and cholesterol, and attending a self-management program.

Relationship of Diabetes to Oral Health

One of the complications of uncontrolled diabetes mellitus is dental disease; this includes xerostomia, increased risk of caries, oral candidiasis, and periodontal disease.[26,27] Xerostomia results from the disruption in salivary flow due to effects of systemic disease, in this case, diabetes.[4] The reduction in salivary flow in turn may lead to an increase in caries,[28] though there does not appear to be a direct correlation between diabetes mellitus and increased dental caries.[29] In a controlled, cross-sectional oral health study in Switzerland, Sandberg, et al. found that more than half of their study participants

with diabetes complained of dry mouth (53.5%) compared to 28.4% of participants without diabetes.[30] The study also showed that patients with diabetes and good glycemic control reported less xerostomia than those patients with poor glycemic control (HbA1c levels above 7.5%).[30] Oral candidiasis can be a result of xerostomia and systemic infections such as diabetes.[4] Candidiasis is an opportunistic infection; when the body's immune system is lowered, as in diabetes, candidiasis is more prevalent.[31]

Relationship of Diabetes and Periodontal Disease

Both diabetes mellitus and periodontal disease are chronic inflammatory diseases; the relationship that exists between the two is bi-directional.[2,4,5]. Loe identified periodontal disease as being the sixth complication of diabetes.[32] In patients with diabetes and poor glycemic control, the periodontium is more susceptible to infection, which increases the risk of periodontal disease, as Campus et al. found in their case-control study.[6] The study found a significant increase in the amount of probing depths >4mm and the percentage of pocket depths >4mm, as well as a significant amount of bleeding on probing in patients with uncontrolled diabetes as opposed to patients with well-controlled diabetes. Tervonen and Karjalainen found in their study that patients with poorly controlled diabetes had more attachment loss at more sites throughout the mouth than did patients with good to moderately controlled diabetes and that the periodontal involvement of patients with good to moderately controlled diabetes paralleled that of patients without diabetes.[33] In summarizing this study, Ryan, Carnu and Kamer suggest that patients with good to moderately controlled diabetes may not have the same risk of developing periodontal disease as those patients whose diabetes is poorly controlled.[34]

Other studies have shown that the length of time a patient has had diabetes increases the risk for periodontal disease: Glavind and colleagues found that there was more periodontal attachment loss in patients who have had diabetes for 10 years or more, than in those patients who have had diabetes for less than 10 years.[35] Also, patients over the age of 40 who have had Type I diabetes for a long period of time show a significant increase in periodontally-advanced sites and bone loss than did subjects over the age of 40 without diabetes.[36] Periodontal disease in turn can exacerbate the glycemic control in patients with diabetes due to the inflammation of the periodontal tissues. According to Mealy and Rose, subjects with diabetes and periodontal disease have a six-fold higher risk for worsening of glycemic control over time compared to patients with diabetes but without periodontal disease.[2] Another study, done by Taylor and colleagues, studied the Pima Indians in Arizona. This longitudinal, epidemiological study found that subjects with diabetes and severe periodontal disease were more likely to develop poor glycemic control over a period of two years than those subjects without severe periodontal disease at the start of the two year period observed.[37] Collin and colleagues studied the periodontal status of elderly patients with Type II diabetes compared to patients without diabetes. They found that in patients with Type II diabetes and severe periodontal disease, the HbA1c levels significantly deteriorated as compared even to patients with Type II diabetes without severe periodontal disease. They conclude that there seems to be a correlation between severe periodontal disease and the impairment of metabolic control for patients with Type II diabetes.[38] Many studies have been done to determine if periodontal treatment for patients with diabetes and periodontal disease has any effect on glycemic control. Of those that show a correlation, some show a decrease in periodontal

severity for patients with severe periodontal disease and uncontrolled diabetes with use of periodontal debridement, but no alteration in glycemic control;[39,40,41,42] others show improvements in both periodontal status and glycemic control with the use of systemic antibiotics in addition to the periodontal debridement.[43,44,45] Taylor, in reviewing these studies, concludes that more trials should be performed in this area, but enough evidence has been gathered to support the idea that periodontal treatment could be beneficial in controlling glycemic levels in patients with diabetes.[46,47]

Insurance Companies and Oral/Systemic Disease

The estimated cost of diabetes in the United States, both direct and indirect, has increased from $23 billion in 1969 to $132 billion in 2002.[48] In 2007, the CDC estimate the economic cost of diabetes to be $147 billion.[49] On average, people with diabetes have medical expenditures almost three times that of a person without diabetes; approximately $1 out of every $5 health care dollars is spent caring for someone with diabetes within the United States.[49] Medicaid covers some services for patients with diabetes, such as dilated eye exams and foot care, supplies and self-management training, but dental care has very little coverage.[50] In a study done by Albert and colleagues, subjects with diabetes, cardiovascular disease and coronary artery disease who were enrolled in a preferred provider organization with continuous medical and dental coverage were examined. The study was designed to determine if subjects with the above mentioned conditions along with periodontal disease, had higher medical expenditures that subjects without any of these conditions. It was found that subjects who received periodontal treatment had

significantly higher medical costs than did subjects who did not have periodontal treatment or who had other or no type of dental treatment whatsoever.[51]

Knowledge of Oral Care Providers about Diabetes

Due to the increasing numbers of diabetic patients, and the projections for future diagnosis, it is important for oral care providers to consider treatment needs of the diabetic population. In a study done by Kunzel et al., surveys were mailed to general dentists in order to determine their knowledge and behaviors towards smoking cessation and diabetes management with their patients. The study found that while most of the dentists surveyed asked about their patient's diabetic status, fewer dentists took a more active role in advising their patients of treatment needs and options. Only 14 percent screened their patients for diabetes and only 15 percent communicated with the patient's general physician. As far as knowledge of diabetes and oral health, most viewed themselves as very confident in managing their patients with diabetes.[52] Another study, done by Wilder et al, evaluated what dental hygiene students are taught in their academic programs concerning the link between diabetes and oral health. The study surveyed dental hygiene directors in the United States.[53] Regarding diabetes, the study found that 90% of dental hygiene schools evaluate students on their ability to diagnose diabetes and 92 % evaluate the students on their discussion with the patient about the link between diabetes and periodontal disease. Another study was done by Boyd and Cunningham to determine if dental hygienists are applying this knowledge in private practice. This study mailed a survey to a convenience sample of members of the American Dental Hygienists' Association (N=392). The survey addressed their knowledge about oral health and

diabetes; beliefs about their role in diabetes care in the dental office; current practices in providing care to patients with diabetes; perceived barriers to addressing diabetes in the dental office and their preferences for a continuing education format for receiving more information about oral health and diabetes.[54] Results showed hygienists have knowledge about diabetes and oral health; common risk factors for diabetes; common complications associated with poorly controlled diabetes; and dental considerations for common diabetic medications. However, respondents felt less confident about requesting a patient's glycated hemoglobin; polycystic ovary syndrome, low HDL cholesterol and history of vascular disease as risk factors; new diabetes classifications; and newer diabetic medications. About 25 % responded that they believed education, assessment and referral of patients with diabetes were within the hygienists' scope of practice. Most felt confident in their ability to educate patients about oral health and diabetes, referring them for their medical checkup and working with other health professionals to control the patients' diabetes. Behaviors they were most likely to perform include referral to a medical professional and the use of diabetes educational material. Behaviors they were least likely to perform were using a glucose monitor to check a patients' blood glucose and knowing how to use a glucose monitor. Hygienists responded positively to the idea of a CE course that would update their knowledge about current diabetes medications, guidelines for care and basic instructions for using a glucose monitor. The study concluded that there is a need for enhancing the clinical knowledge of hygienists regarding their care of patients with diabetes.[54] This can be accomplished through the use of a CE course to update and refresh their knowledge.

Knowledge of Health Care Providers about Oral Health

Little research has been done in the area of health care providers and their knowledge of oral health. According to the *Surgeon General's Report on Oral Health in America*, more time should be devoted to educating non-dental healthcare providers on the importance of oral health to the whole body[7] Of several studies done in this area, one, conducted by Koerber, et. al. among dentists, nurses and nutritionists in a Latino community, found that while these professions were aware of the relationship between oral health and systemic health, they did not spend time educating their patients about it.[55] Another study discussed whether allowing physicians to perform periodontal screenings would raise public awareness of periodontal disease and increase the chances of diagnosis and treatment.[56] The study found that though materials were available to inform physicians of the rationale and procedure for periodontal screening, many did not perform the exam; it was concluded that further studies were needed in order to measure outcomes of physicians' use of these materials.

Since the study done by Offenbacher, et al.[57] discussing the prevalence of pre-term, low birth weight babies among mothers with periodontal disease, the nursing community has implemented research to determine how they can better educate their patients. In a recent article published by the American Journal of Maternal/Child Nursing, the authors discuss the addition of dental-related questions to the prenatal visit to determine the oral health of their patients and possible need for referral to a dentist.[58]

Diabetes Educators' Knowledge, Opinions and Behaviors Regarding Oral Health

Among diabetes educators, the main source of education and training for those diagnosed with diabetes[8], there is very little literature regarding their knowledge of the effects of periodontal disease on diabetes. One very recent study addresses diabetes educators and their knowledge and practices regarding oral and systemic health. Dr. Hon K. Yuen and colleagues, from the Medical University of South Carolina, mailed a 12-item questionnaire to diabetes educators practicing in South Carolina. The questionnaire was designed to determine the perceptions of diabetes educators as to how prepared they were to provide oral health information to their patients with diabetes; what barriers they felt prevented them from receiving oral health education in their curricula; and how including an oral health component in their curricula might influence their practice behaviors regarding oral health. The study found that the majority of diabetes educators in South Carolina had been practicing for a median of 8 years, worked about 25 hours a week and saw a median of 15 patients.[9] Those surveyed were asked to rate the content of their diabetes education curricula regarding its coverage of general and oral health topics. In the adequate category, responses ranged from a low of 0.8% in response to whether they allow their patients to demonstrate correct brushing and flossing techniques, to a high of 59.2% in response to whether or not they recommend frequent dental cleanings.[9] The majority responded positively to the addition of an oral health component to their curricula, while 76.9% reported that they did not have an oral health component already in place in their curricula. Diabetes educators who had an oral health component in their curricula were more likely to recommend frequent cleanings and oral hygiene homecare; emphasize the effect of uncontrolled diabetes and periodontal disease and the effect of

periodontal disease on diabetes; and monitor their patient's oral health (gum health and dry mouth). [9] Dr. Yuen concludes his study by recommending that an oral health component be added to the curriculum for diabetes educators in a more efficient and effective manner, which will greatly influence the care patients with diabetes receive.

The Purpose of this Study

The purpose of this study is to determine, on a national level, diabetes educators' knowledge, opinions and behaviors regarding periodontal disease and diabetes mellitus.

Introduction and Literature Review

The link between oral and systemic health has received much attention in medical and dental circles. Studies have shown the links between oral health and nutritional deficiencies[10], periodontal disease in relation to cardiovascular disease[11], diabetes mellitus[2], obesity[3], and pre-term low-birth weight babies.[12] Since it is now known that the mouth can reflect the effects of systemic diseases and problems, it is time for dental and other health care professionals to work together in order to promote both the general and oral health and well-being of their patients.

The *Surgeon General's Report on Oral Health in America* states the need to have an oral health infrastructure, wherein all healthcare providers have the knowledge to discuss oral health with their patients.[7] One of the major links between oral and systemic health is the relationship between periodontal disease and diabetes mellitus. Diabetes has become a world-wide epidemic[1]; periodontal disease is one of the most common infections in humans.[2,3] *Healthy People 2010* relates the importance of individual health in making a healthy society and states as two of it's objectives: "through prevention programs, to reduce the disease and economic burden of diabetes and improve the quality of life for all persons who have or are at risk for diabetes" and "prevent and control oral and craniofacial diseases, conditions and injuries and improve access to related services."[13] This is a challenge to healthcare professionals to work together to give comprehensive care to the patient in relation to oral and systemic disease and especially in the area of periodontal disease and diabetes mellitus.

Both diabetes mellitus and periodontal disease are chronic inflammatory diseases; the relationship that exists between the two is bi-directional.[2,4,5]. In fact, Loe has identified periodontal disease as the sixth complication of diabetes.[32] In patients with diabetes and poor glycemic control, the periodontium is more susceptible to infection, which increases the risk of periodontal disease, as Campus et al. found in their case-control study.[6] Periodontal disease in turn can exacerbate the glycemic control in patients with diabetes due to the inflammation of the periodontal tissues. According to Mealy and Rose, subjects with diabetes and periodontal disease have a six-fold higher risk for worsening of glycemic control over time compared to patients with diabetes and without periodontal disease.[2]

.Few reports appear in the literature that have assessed healthcare professionals' knowledge and practice behaviors regarding oral health. Of those that have been conducted, they have focused on obstetricians[59], nurse practitioners and certified nurse midwives [60] and physicians.[56] The findings from these studies have been that while knowledge of periodontal disease has been low, there is keen interest in collaboration with oral healthcare professionals and they would like more information about oral health to share with their patients.

Diabetes educators focus on seven areas when counseling their patients: healthy eating, being active, monitoring, taking medication, problem solving, healthy coping, and reducing risks.[8] However, among diabetes educators, there is little research to show their knowledge about periodontal disease and diabetes and how this affects their behaviors in counseling and referring their patients. Yuen et al recently published a study designed to determine South Carolina CDEs' perceptions regarding their preparation to provide oral

health information to their patients; what barriers they felt prevented them from including oral health education in their curricula; and how adequately the curriculum covered the topic of oral health. The study found that the majority of the diabetes educators had been practicing for a median of 8 years, worked about 25 hours a week and saw a median of 15 patients.[9] Those surveyed were asked to rate the content of their diabetes education curricula regarding its coverage of general and oral health topics. In the adequate category, responses ranged from a low of 0.8% in response to whether they allow their patients to demonstrate correct brushing and flossing techniques, to a high of 59.2% in response to whether or not they recommend frequent dental cleanings.[9] The majority responded positively to the addition of an oral health component to their curricula, while 76.9% reported that they did not have an oral health component already in place. Diabetes educators who had an oral health component in their curricula were more likely to recommend frequent cleanings and oral hygiene homecare; emphasize the effect of uncontrolled diabetes and periodontal disease and the effect of periodontal disease on diabetes; and monitor their patient's oral health (gum health and dry mouth).[9] Dr. Yuen concluded his study by recommending that an oral health component be added to the curriculum used by diabetes educators in a more efficient and effective manner, which will greatly influence the care that patients with diabetes receive.

The purpose of this study was to conduct a national study to determine diabetes educators' knowledge, opinions and practice behaviors regarding periodontal disease and diabetes mellitus. In addition, it assessed the demographics and practice settings of CDEs; their knowledge and opinions about periodontal disease and systemic health; their

role and comfort level in providing counseling to their patients about periodontal disease and diabetes; and oral health education received throughout their training.

Research Design and Methodology

Survey Instrument

The study design and instrument were approved by the University of North Carolina Biomedical Institutional Review Board (IRB). The survey instrument "Diabetes Educators' Opinions and Behaviors Regarding Periodontal Disease and Diabetes Mellitus" was developed specifically for this study and was designed by the research team and pilot tested by five CDEs who currently see patients and are practicing in North Carolina. The survey was 33 questions in length and was designed to look at the knowledge, behaviors and opinions of certified diabetes educators (CDE) regarding the relationship between periodontal disease and diabetes. In addition, it assessed the demographics and practice settings of CDEs; their knowledge and opinions about periodontal disease and systemic health; their role and comfort level in providing counseling to their patients about periodontal disease and diabetes; and oral health education received throughout their training. The questions were yes/no, open and closed ended and Liekert-scale. Revisions were incorporated prior to printing the final version of the survey instrument in Teleform format so responses could be scanned directly into an ACCESS database. No other measures of the instrument's validity or reliability were conducted

Survey Distribution

The survey sample were recruited from participants (N ≈ 3,000) attending the 36th annual American Association of Diabetes Educators' meeting in Atlanta, Georgia in August 2009. Approval for the data collection was obtained from the American Diabetes Educators Association. Participants in this meeting represented a sample of CDEs from across the nation. Recruitment took place at a booth in the Exhibition Hall of the meeting; the survey was available to all participants at the meeting who were CDEs, and who currently provided counseling to patients. An explanation of the purpose and design of the survey was provided to each potential participant. Participants were free to refuse to take the survey. As an incentive for completion, five dollars ($5) in cash was given to each participant upon completion of the survey. A total of 311 CDEs participated in the study, approximately 10% of the attendees. There were three main outcome variables: the knowledge CDEs have about the relationship between periodontal disease and diabetes; how they counsel their patients about the risk of periodontal disease and it's impact on glycemic control; and their opinions about oral-systemic research and whether they would like more oral health information for counseling their patients.

Analysis

Descriptive statistics were generated for all study variables and domains. Bivariate analysis was performed on explanatory variables including profession, previous education in oral health and personal oral health. After this, bivariate analysis was performed on each outcome to determine the level of significance ($P < .05$).

Results

Personal and Practice Demographics

A total of 311 CDEs participated in the survey, approximately 10% of the projected number of attendees at the meeting. Fifty-nine percent were nurses, 34 % were registered dietitians, 7% were pharmacists and 5% were other professionals. Due to the low number of responses in the 'pharmacist' and 'other' categories, only responses from nurses and registered dietitians are reported (N=286) (Figure 1). Demographics and practice characteristics of the survey participants who responded to this portion of the survey are illustrated in Table I (N=244). The majority (62.7%) of the participants were female and held a nursing degree; had been to the dentist in the past 6 months (75%%); and were told they did not have periodontal disease and rated themselves as having 'good' oral health (58.8%).

Knowledge

CDEs' knowledge about periodontal disease and systemic health was high. When asked about risk factors for periodontal disease, the majority recognized the important factors. However, many were confused about whether tooth decay was a factor in periodontal disease (Figure 3). Most (84%) could distinguish periodontitis from gingivitis, and realized periodontitis is the worse condition. When asked about the first clinical sign of periodontal disease, 38% answered bleeding gums, followed by 29% who thought it was bad breath. An overwhelming number recognized that people with

diabetes are at an increased risk of periodontal disease, that poor glycemic control promotes growth of oral bacteria, and that periodontal disease may worsen glycemic control.

When bivariate analysis was applied to knowledge questions regarding periodontal disease, systemic health and diabetes, nurses had a higher proportion of correct answers for questions regarding periodontal disease and gingivitis than did registered dietitians (P=<.05). Nurses also realized that tooth decay is not a factor in periodontal disease (P=.026). However, in questions regarding the link between periodontal disease and systemic health, and periodontal disease and diabetes in particular, there was no statistically significant difference between nurses and registered dietitians in their knowledge.

Attitudes and Opinions

Attitudes of CDEs regarding the link between periodontal disease and diabetes were reflected in their referral patterns. More nurses (59.2%) than registered dietitians (35.9%) said they discuss oral health when counseling their patients with diabetes. When asked the average number of patients with whom they discuss diabetes, the mean percentage was 55.7%. Sixty-four percent of CDEs say they have referred a patient with diabetes to a dental office or clinic within the past year. For those who don't refer, the main obstacles reported were their patients' lack of financial resources for dental care (57%) and their own uncertainty about when to refer (56%). CDEs' reasons for referring patients with diabetes to a dental office or clinic are reported in Figure 2.

Opinions of CDEs regarding their own knowledge about the link between periodontal disease and diabetes are included in Table II. Most (44.7%) agreed with the statement "I am knowledgeable regarding the studies linking periodontal disease and diabetes," but felt they needed more information about periodontal disease and its impact on diabetes (88.5%). The majority agreed that CDEs need to collaborate with dental professionals to reduce their patient's risk of developing periodontal disease (96.3%). A large percentage showed enthusiasm for an oral health component being added to their diabetes continuing education (83.8%).

Education and Training

Seventy-nine percent of those surveyed said they have not received any oral health education (didactic or curricular) in their training to become nurses or registered dietitians. Ninety percent reported they had not had any oral health education since receiving their CDE certification. Of the 10% who did report having had oral health education since their certification, 31% indicated this information only covered general information on healthy teeth and gums.

Bivariate analysis was performed to see if having a dental school affiliated with the university or college where they received their nursing or dietitian degree made a difference in their referral patterns. However, there was no statistically significant difference between those having a dental school affiliated with their university or college and those that did not. Bivariate analysis was also performed to see if those who have received oral health education since receiving their CDE were more knowledgeable about periodontal disease and diabetes and were more likely to refer a patient with diabetes to a

dental office or clinic. CDEs who had oral health information since their certification were more likely to refer patients anytime they expressed a concem about their mouth or gums (P=.019) and as part of the patient's health promotion and disease prevention (P=.002). However, there was no statistically significant difference in the knowledge between those who had oral health education and those who had not had oral health education since receiving their certification.

Discussion

Due to the relationship between periodontal disease and diabetes and the increasing numbers of patients diagnosed with diabetes, it is important to know about the oral health information patients with diabetes are receiving from their counselors. This study sought to determine if CDEs are knowledgeable about the link between periodontal disease and diabetes, and if they provide any oral health counseling to their patients. Results showed that CDEs have a high knowledge of periodontal disease and its impact on systemic health. However, results also showed that CDEs desire more information about periodontal disease and diabetes and they are not sure how to counsel their patients.

Knowledge about Periodontal Disease and Diabetes

CDEs appear to be very knowledgeable about periodontal disease and diabetes; in questions asking about factors influencing periodontal disease, the majority of respondents answered correctly (over 90%). Ninety-three percent agree that if a patient has periodontal disease, they are more likely to have poor glycemic control than a patient without periodontal disease (95%). They also agreed that patients with poor glycemic control are more likely to have periodontal disease. However, CDEs are not confident in screening for periodontal disease themselves. Ninety-six percent agree that there should be collaboration between dental professionals and CDEs to increase their patients' health. This interest in working with dental professionals shows potential for the oral health infrastructure discussed in the Surgeon General's Report.[7] If both CDEs and dental

professionals can collaborate interprofessionally, the patients might have the potential to receive better dental and overall care for their condition. The prediction for the future is that the numbers of patients with diabetes will vastly increase[23] so an increase in interprofessional collaboration and communication will be needed for the care of these patients. Opportunities for providing CE courses for CDEs regarding oral health and systemic complications could further the knowledge and promote working relationships between these two groups.

Counseling and Referrals Regarding Periodontal Disease and Diabetes

About half (51%) of CDEs reported counseling their patients about oral health. Specific questions about the content of this counseling were not asked, however only 31% reported receiving general information about oral health. Therefore, patients may only be receiving general information about healthy teeth and gums and not specific information about their condition and periodontal risks. This is corroborated by the Koeber et al, who identified that nurses and nutritionists considered oral health to be important but spent less time focusing on periodontal and systemic issues than on the patient's systemic condition.[53] While the CDEs in this study who reported having received oral health education do not appear more likely to counsel their patients than those who have not received any oral health education, Yuen and colleagues report that having an oral health component in the curricula does influence CDEs recommendations for frequent cleanings, and their emphasis to patients about the effect of uncontrolled diabetes on the periodontium.[9] CDEs do recognize the importance of referring their patient with diabetes to a dental office. Seventy-two percent of CDEs who are nurses

refer their patients as a part of normal disease prevention measures, while 60.4% of CDE registered dietitians do the same. This could be due to the differing roles that nurses and registered dietitians play in counseling patients with diabetes; while nurses provide general education and counseling, dietitians tend to focus on nutritional advice. Though they understand the importance of referrals, CDEs appear to be uncomfortable deciding when this referral should take place. This could be due to their beliefs concerning their scope of practice, i.e that nurses and registered dietitians do not believe this to be a part of their scope of practice, or it could be an ethical issue: they believe it is unethical to make a referral when they are being consulted. Fifty-six percent report not referring their patients because they are unsure of when to refer, and 53% say their lack of oral health training prevents them from making this decision.

Opinions Regarding Oral/Systemic Research

CDEs in this study indicated that they believe the research to be strong showing the relationship between periodontal disease and systemic health. However, less than half felt they were knowledgeable about these studies. Eighteen percent received their oral health information, in their professional journals. This finding agrees with Koerber et al who found that nurses and nutritionists reported that the best way for them to receive information about periodontal disease and diabetes would be through guidelines and protocols in their workplaces, or through their professional journals.[55] It is possible that the information about the periodontal/diabetes link may be represented more in dental literature and not in the journals read by diabetes educators, which could contribute to their uncertainty about these studies. Eighty-nine percent of CDEs in this study indicated

that they needed additional information regarding periodontal disease and its impact on diabetes. This information seems to point to a potential demand for oral health information that could easily be provided by the dental academic community or corporate entities.

While knowledge of periodontal disease and diabetes is high, CDEs welcome CE courses explaining both the research in this area and how to translate their knowledge into clinical practice. Ninety percent of those surveyed said they have not received any formal oral health education since receiving their CDE. Of those, 31% said the information they received merely focused on general information about healthy teeth and gums and did not deal with oral/systemic conditions. There is great potential for development of a course for CDEs that would provide specific and practical information about periodontal disease and diabetes and incorporate recommendations on how to educate patients with diabetes. Several corporate companies have created oral health education packets focusing on diabetes and periodontal disease; many of these companies have websites with educational information that may be downloaded. CDEs need to be alerted to the resources available to them. Also, web-based courses or traditional CE courses designed to increase inter-professional education and collaboration between nursing, dentistry and medicine might enhance the overall health of patients with diabetes.

Conclusion

Study Strengths and Limitations

The strengths of this study include (1) the survey was administered to a national sample; (2) the CDEs attending the meeting where data collection occurred represented each of the 50 states in the United States; and, (3) it was the first study of this kind to determine a wide range of issues related to diabetes and oral health. The authors are unaware of another study on this topic with national implications. Findings from this study, then, can be generalized to the population of certified diabetes educators in America. Limitations include (1) the survey design itself, which could affect the interpretation of the questions by the participants; (2) the participants, who could choose to withhold information or misunderstood the question; and, (3) the limited offering of $5 in cash to complete the survey. This may have skewed the participants towards completing the survey or not depending on whether or not they would receive the incentive. However, many of the participants commented that the study was very important and that the incentive did not influence them to complete the survey.

Clinical and Education Implications

The findings in this study reflect the need for further studies to determine the best methods to use to educate CDEs about periodontal disease and diabetes. Methods of data collection could include a CE course or focus group format to discuss the specifics of periodontal disease and diabetes, the research findings, and how to translate the

information into patient education. Results may make a difference in the confidence of CDEs in providing oral health counseling to their patients.

APPENDIX

UNC DEPARTMENT OF DENTAL ECOLOGY
Survey of Diabetes Educators' Opinions and Behaviors
Regarding Periodontal Disease and Diabetes Mellitus

ID: 1 2 0

INSTRUCTIONS: Please shade circles like this: ● Not like this: ⊗ ✓

Please print clearly and stay inside the boxes. The following is an example of how letters and numbers should be written.

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

1	2	3	4	5	6	7	8	9	0

PRACTICE SETTING

1. Are you a Certified Diabetes Educator (CDE) who currently provides care to patients with diabetes? ○ Yes ○ No

~~~~~~~ IF YES, continue to next question. IF NO, stop here. Thank you for your time! ~~~~~~~

2. What type of healthcare provider are you?

○ Nurse ○ Registered dietician ○ Physician ○ Pharmacist ○ Other (please specify) _____

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

4. Which of the following BEST describes the type of practice in which you provide care to patients with diabetes for the greatest number of hours per week? (SELECT ONLY ONE)

○ General Practice ○ Specialty Practice (specify) _____ ○ Public health / government

○ Hospital practice ○ Independent consultant ○ Other (specify) _____

5. For how many years (round up) have you been providing diabetes counseling and education? ☐☐

6. What diabetes-related services are provided at your work setting? (FILL IN YES OR NO FOR EACH ITEM)

Diabetes Self-Management Education (ADA approved)	○ Yes	○ No
Education and counseling services (not ADA-approved)	○ Yes	○ No
In-home diabetes education	○ Yes	○ No
Telephone care management	○ Yes	○ No
Medical nutrition therapy	○ Yes	○ No
Clinical (medication management)	○ Yes	○ No
Providing education to other healthcare professionals	○ Yes	○ No
Research	○ Yes	○ No
Dental Screenings/oral health information	○ Yes	○ No

7. Approximately how many hours per week do you provide care to patients with diabetes?

○ <5 hours ○ 5-10 hours ○ 11-15 hours ○ 16-20 hours ○ >20 hours

6933

Revised 07/2009


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PERIODONTAL DISEASES AND SYSTEMIC HEALTH

8. Which of the following do you believe to be associated with gum disease? (FILL IN YES OR NO FOR EACH ITEM)

Excess sugar consumption	○ Yes	○ No
Bacteria	○ Yes	○ No
Tooth decay	○ Yes	○ No
Aging	○ Yes	○ No
Genetics	○ Yes	○ No
Smoking	○ Yes	○ No
Systemic infection	○ Yes	○ No
Glycemic instability	○ Yes	○ No

9. Which condition is worse? ○ Periodontitis ○ Gingivitis

10. Which of the following describes gingivitis? (FILL IN YES OR NO FOR EACH ITEM)

Tooth decay	○ Yes	○ No
An infection of the gums	○ Yes	○ No
A reversible redness and/or inflammation of the gums	○ Yes	○ No
Lesions on the tongue	○ Yes	○ No
Bleeding gums	○ Yes	○ No
Bone loss around teeth	○ Yes	○ No

11. Which of the following describes periodontitis? (FILL IN YES OR NO FOR EACH ITEM)

Tooth decay	○ Yes	○ No
An infection of the gums	○ Yes	○ No
A reversible redness and/or inflammation of the gums	○ Yes	○ No
Lesions on the tongue	○ Yes	○ No
Bleeding gums	○ Yes	○ No
Bone loss around teeth	○ Yes	○ No

12. Which of the following is the first clinical sign of periodontal disease? (SELECT ONLY ONE):
○ Bad breath ○ Bleeding gums ○ Cavities (holes in teeth) ○ Teeth that move around (are mobile) ○ Plaque on teeth

6935

13. Please respond to the best of your ability to the following questions.

Periodontal disease is an infection of the gums.	○ True	○ False
People with diabetes are at increased risk for severe periodontal disease.	○ True	○ False
Poor diabetes control encourages growth of oral bacteria.	○ True	○ False
Periodontal disease may worsen glycemic control.	○ True	○ False
Periodontal disease is considered a complication of poor diabetes control.	○ True	○ False
Treatment of periodontal disease may improve glycemic control.	○ True	○ False

OPINIONS ABOUT PERIODONTAL DISEASES AND SYSTEMIC HEALTH

14. 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
The research is inconclusive regarding the relationship between periodontal disease and systemic health.	○	○	○	○	○
Good periodontal health is vital to overall well being.	○	○	○	○	○
If a patient brushes and flosses their teeth regularly they will reduce their chance of having periodontal disease.	○	○	○	○	○
In recent years, an association has been made between periodontal disease and diabetes.	○	○	○	○	○
If a patient has periodontal disease, they are more likely to have poor glycemic control than a patient with healthy gums.	○	○	○	○	○
Patients with poor glycemic control are more likely to have periodontal disease.	○	○	○	○	○
CDE's should be taught about periodontal health.	○	○	○	○	○
CDE's should be taught to screen for periodontal disease in their patients.	○	○	○	○	○
CDE's need to collaborate with dental professionals to reduce their patient's risk of developing periodontal disease.	○	○	○	○	○
I am confident that I can provide an oral health screening to my patients with diabetes.	○	○	○	○	○
I am interested in including an oral health component in my diabetes continuing education.	○	○	○	○	○
I am knowledgeable regarding the studies linking periodontal disease and diabetes.	○	○	○	○	○
I need additional information about periodontal disease and its impact on diabetes.	○	○	○	○	○

PRACTICE BEHAVIORS REGARDING DIABETES AND ORAL HEALTH

15. Do you discuss oral health when counseling patients with diabetes?
○ Yes ○ Occasionaly ○ No (PLEASE SKIP TO QUESTION 17)

16. For patients with diabetes, please estimate the percentage of patients with whom you discuss their oral health. ☐☐☐

17. Have you referred a patient with diabetes to a dental office or clinic within the last year?
○ No ○ Yes (PLEASE SKIP TO QUESTION 19)

18. Please indicate the reasons why you do not refer patients with diabetes to a dental office or clinic (FILL IN YES OR NO FOR EACH ITEM)

My lack of oral health training.	○ Yes	○ No
My patients lack financial resources for dental care.	○ Yes	○ No
Lack of dental providers in my area.	○ Yes	○ No
I am not associated with a dental office or clinic	○ Yes	○ No
I am not sure when to refer.	○ Yes	○ No
Other (please specify) _____	○ Yes	○ No

19. Please estimate the percentage of patients with diabetes you referred to a dental office or clinic (round up to a whole number) in the past year. ☐☐☐

20. When do you refer patients to a dental clinic? (FILL IN YES OR NO FOR EACH ITEM)

I refer anytime a patient expresses a concern about their mouth or gums.	○ Yes	○ No
I refer a patient if I see something that I think should be examined.	○ Yes	○ No
I refer as part of the patient's health promotion and disease preventive care	○ Yes	○ No
I rarely refer a patient to the dental clinic	○ Yes	○ No

DIABETES EDUCATOR ORAL HEALTH INFORMATION

21. Have you received any formal oral health education (didactic or curricular) as a nurse, registered dietician, etc?
○ Yes ○ No (PLEASE SKIP TO QUESTION 23)

22. If yes, how would you rate the formal oral health education you received?
○ Excellent ○ Good ○ Fair ○ Poor ○ Very poor

23. Was there a dental school affiliated with the university or college from which you received your professional training?
○ Yes ○ No

24. In preparing for your CDE certification, did you receive any oral health information or education through any of the following mechanisms? (FILL IN ALL THAT APPLY)
○ Preparatory seminars ○ Study guides ○ Review books
○ Other (please specify) _____ ○ Did not use any of the above

25. Since receiving your CDE, have you had any formal oral health education or training?
○ Yes ○ No (PLEASE SKIP TO QUESTION 28)

26. What type of oral health education have you received? (FILL IN ALL THAT APPLY)
○ General information about healthy mouth and gums ○ Information about link between oral and systemic health
○ Information about periodontal disease and diabetes ○ Other (please specify): _____

27. How did you receive the oral health education? (FILL IN ALL THAT APPLY)
○ CE course ○ Online course ○ Professional journal ○ Lecture
○ Other (please specify) _____

DEMOGRAPHICS

28. Select your age range: ○ <25 ○ 25-35 ○ 36-45 ○ 46-55 ○ 56-65 ○ >65

29. Gender: ○ Male ○ Female

30. Please list all states in whcih you currently provide care to patients with diabetes.

31. When was the last time you received dental care which included an assessment of your gums from a dentist or dental hygienist?
○ <= six months ○ >6 months and <= 1 year ○ > 1 year and < 2 years ○ >= 2 years ○ never

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

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

If you would like to include additional comments, please write them in the space provided below.

THANK YOU FOR YOUR PARTICIPATION!

TABLES AND FIGURES

Figure 1.

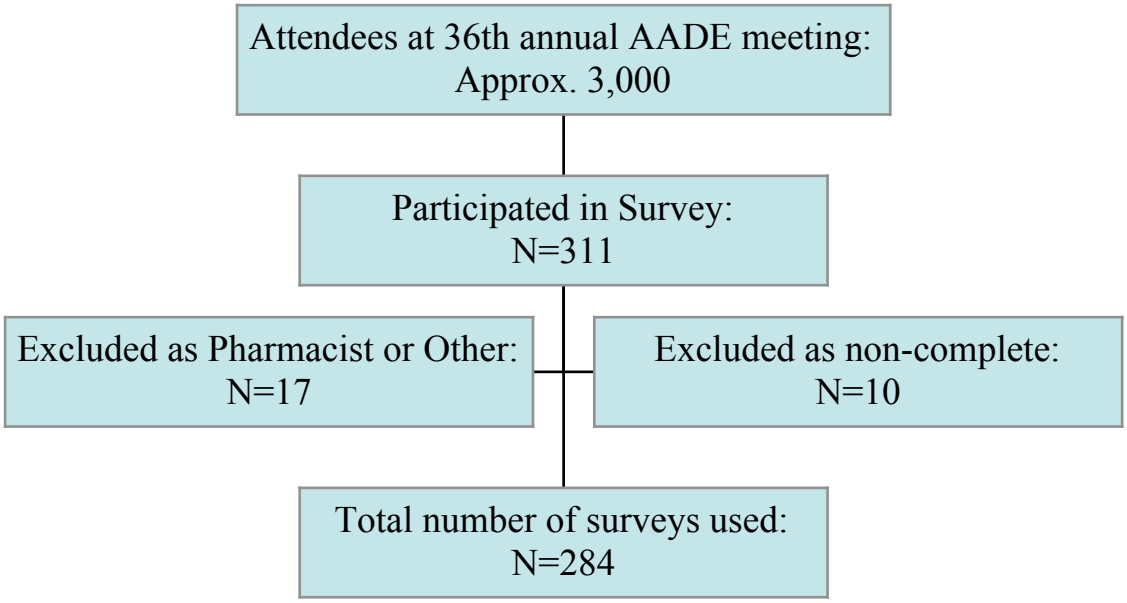


Table I. Demographics of Participants Based on Provider Type

N=244	Nurses		Registered Dietitians	
	N	%	N	%
Gender				
Male	3	1.9	0	0
Female	151	98.1	90	100
Age				
25-35 years	6	3.9	8	8.9
36-45 years	23	14.9	29	32.2
46-55 years	69	44.8	26	28.9
56-65 years	52	33.8	27	30.0
>65 years	4	2.6	0	0
How would you rate your oral health?				
Poor	1	.6	2	2.2
Fair	11	7.1	7	7.8
Good	95	61.7	46	51.1
Excellent	47	30.5	35	38.9
When was the last time you received gum assessment at a dental office?				
<6 months	111	72.1	72	80.0
>6 months and <1 year	32	20.8	8	8.9
>1 year and <2 years	7	4.5	7	7.8
>2 years	4	2.6	3	3.3
Have you ever been told you have periodontal disease?				
No	130	84.4	74	82.2
Yes	22	14.3	11	12.2
Maybe	2	1.3	5	5.6

Table II. Certified Diabetes Educators' Opinions about Periodontal Disease and Systemic Health

	Strongly Agree	Agree	Unsure/Don't know	Disagree	Strongly disagree
The research is inconclusive regarding the relationship between periodontal disease and systemic health	7% (20)	11.4% (34)	19.5% (58)	36.9% (110)	25.5% (76)
I am knowledgeable regarding the studies linking periodontal disease and diabetes	15.8% (47)	28.9% (86)	23.8% (71)	28.9% (86)	2.7% (8)
I need additional information about periodontal disease and its impact on diabetes	41.9% (125)	46.6% (139)	7.0% (21)	3.4% (10)	1.0% (3)
I am confident that I can provide an oral health screening to my patients with diabetes	19.8% (59)	19.1% (57)	30.5% (91)	24.5% (73)	6.0% 18
CDE's should be taught to screen for periodontal disease in their patients	49.7% (148)	30.9% (92)	14.1% (42)	3.7% (11)	1.7% (5)
CDE's need to collaborate with dental professionals to reduce their patients' risk of developing periodontal disease	62.1% (185)	34.2% (102)	1.7% (5)	1.0% (3)	1.0% (3)
I am interested in including an oral health component in my diabetes continuing education	37.2% (111)	46.6% (139)	12.1% (36)	2.3% (7)	1.7% (5)

Figure II. Oral Health Referral Patterns of CDE Nurses and Registered Dietitians to Dental Providers

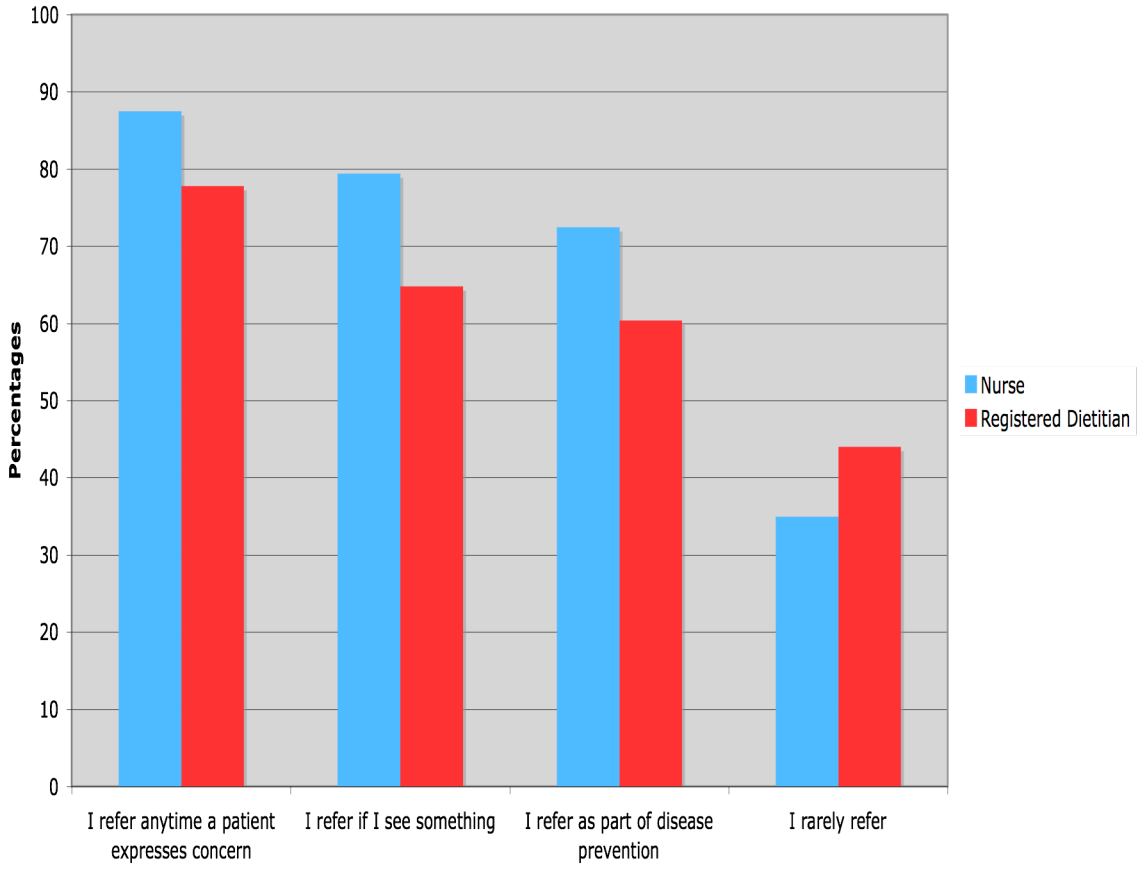
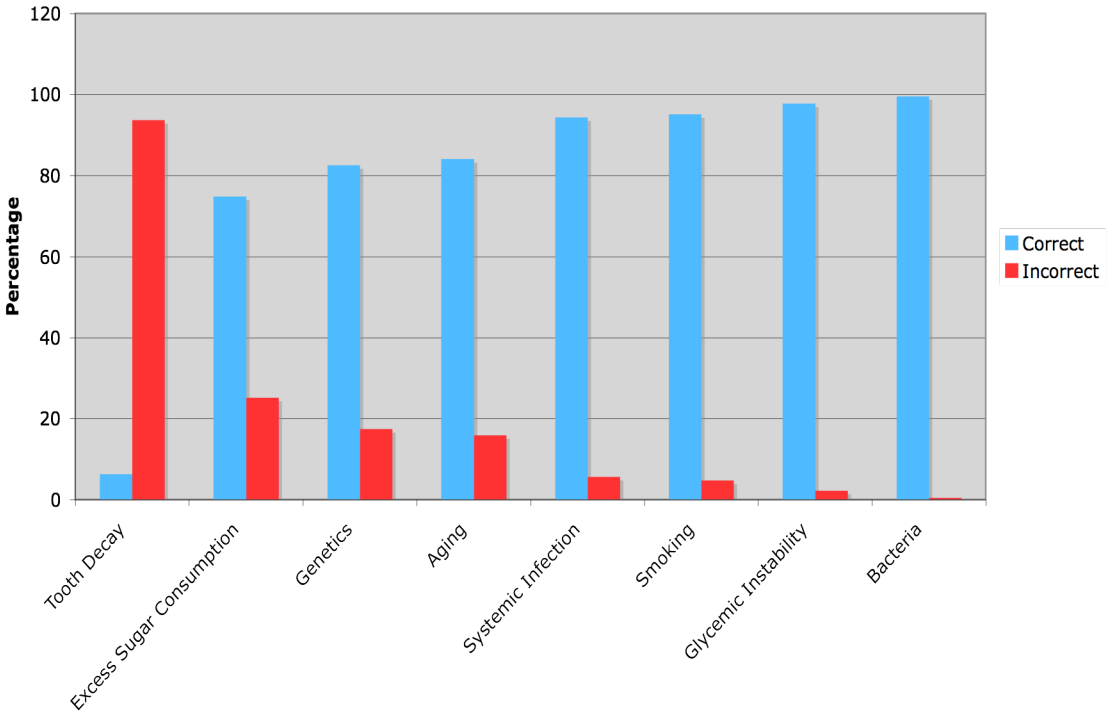


Figure III. Certified Diabetes Educators' Knowledge About Factors Influencing Periodontal Disease



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