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Determining the Need for Diabetic Risk Assessment in an Academic Dental Clinic

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Determining the Need for Diabetic Risk Assessment
in an Academic Dental Clinic

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B.A., Hunter College, 2010

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Determining the Need for Diabetic Risk Assessment in an Academic Dental Clinic

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Introduction

The health of the oral cavity may be an important indicator of overall health. Symptoms of systemic diseases, such as metabolic, gastrointestinal and immunological diseases can manifest themselves in the oral cavity.^{1,2,3,4} By conducting a thorough health history and examination, dental providers have the ability to identify potential systemic problems that patients may not be aware of, which may be of particular importance in the case of diabetes. Diabetes is a growing public health concern. As of 2010, it is the seventh leading cause of death in the United States and it is a chronic disease whose incidence has more than tripled since the 1980s.^{5,6} Since diabetes can affect oral health, it can be argued that in order for dental providers to provide comprehensive care to patients, the patient's diabetic status is important to know. Unfortunately, patients may not necessarily know their own diabetic status, which means that dental providers need to recognize the signs of a potentially diabetic patient in order to provide customized care for the patient and to counsel the patient in healthy practices. Incorporating a diabetic risk assessment as part of an initial dental examination may be beneficial for both the patient and the dental provider because a potential problem that can affect oral health can be identified.

The purpose of this study is to determine whether there is a need to incorporate a diabetic risk assessment in an academic dental clinic. The study will investigate: a) how prevalent diabetes is among patients seeking care at the University of Connecticut Health Center (UConn Health) dental clinics; b) how many patients are at increased risk for developing Type 2 diabetes; and c) whether their oral health knowledge relating to diabetes varies by their diabetic status. The patient's diabetic status will be categorized as: a) diabetic, b) non-diabetic, or c) at increased risk of developing Type 2 diabetes. The patient will be considered at increased risk if the patient is

pre-diabetic or scores a value of five or higher on the American Diabetes Association Diabetes Risk Test.⁷ By assessing the oral health knowledge related to diabetes in this specific patient population, it can be determined if there is a need to educate all or specific patients about this topic.

Background

Diabetes mellitus is a group of metabolic diseases that are characterized by high blood glucose levels, polyuria, polydipsia, and weight loss. The most common forms of diabetes are Type 1 diabetes, which accounts for 5-10% of all diagnosed cases, Type 2 diabetes, which accounts for 90-95% of all diagnosed cases in adults, and gestational diabetes, which is diagnosed in 2-10% of pregnant women.⁸ Type 1 diabetes is an autoimmune disorder that involves the destruction of the pancreatic beta cells, which leads to an absolute insulin deficiency.⁹ Both genetic and environmental factors play a role in determining whether or not a person will develop Type 1 diabetes and it most commonly manifests itself during puberty. People who have Type 1 diabetes are dependent on insulin to avoid complications from the disease.

Type 2 diabetes occurs as a result of insufficient insulin secretion as well as peripheral tissue resistance to the insulin that is present.^{9 (p1136)} The insulin resistance develops over a period of time and is typically considered to manifest itself later in life. However, the number of children and adolescents developing Type 2 diabetes has been increasing significantly overtime.¹⁰ There are strong genetic and environmental factors that predispose a person to developing Type 2 diabetes. Specific risk factors include family history of diabetes, sedentary

lifestyle, obesity, history of hypertension, history of gestational diabetes, as well as being pre-diabetic.¹¹

Gestational diabetes is a diagnosis given to a pregnant woman who has high blood glucose levels during pregnancy and was not diabetic prior to pregnancy.^{9 (1145)} Typically, the mother's blood glucose levels will return back to normal after giving birth. Normal blood glucose levels after eight hours of fasting are less than 100mg/dl.

The defined parameter of pre-diabetic means that a person's blood glucose levels are higher than normal but are not high enough to be considered a diabetic. If lifestyle modifications, such as a healthy diet and exercise are incorporated into a person's daily life, the chance of developing Type 2 diabetes decreases despite having certain risk factors. Once a person is diagnosed with Type 2 diabetes, it can be treated with diabetic medications that can lower blood glucose levels along with diet and exercise. If the person's blood glucose levels remain elevated, the person may be placed on insulin in conjunction with previous treatment. Over a span of time, diabetics, in general, can experience macro and micro-vascular complications, such as retinopathy, nephropathy, neuropathy, and cardiovascular disease.^{9 (p1137)}

Clinically, there are several ways that diabetes can be diagnosed. One method to diagnose Type 2 diabetes and pre-diabetes is utilizing the hemoglobin A1c (HbA1c) test, which measures how well controlled a person's blood glucose levels are over a consistent three month period.¹² When a person has high blood glucose levels over a period of time, the glucose in the blood builds up and combines with the hemoglobin in the red blood cells. Therefore, the higher the HbA1c percent is, the greater the number of glycosylated hemoglobin and the higher a person's blood glucose levels have been in this time frame. According to the American Diabetes Association, a HbA1c level of less than 5.7 is considered normal, a HbA1c between 5.7 and 6.5

is considered pre-diabetes, and a HbA1c level greater than or equal to 6.5 is considered diabetes. Type 1 diabetes, Type 2 diabetes, and pre-diabetes can be diagnosed by conducting the fasting plasma glucose test. After eight hours of fasting, blood glucose levels less than 100 mg/dl are considered normal, 100mg/dl to 125mg/dl are considered pre-diabetes, and levels 126mg/dl or higher are considered diabetes. Diabetes, pre-diabetes, and gestational diabetes can be diagnosed with the oral glucose tolerance test, which checks the blood glucose levels before and two hours after a person drinks a sweet drink containing 75 grams of glucose. Levels less than 140mg/dl after 2 hours are considered normal, between 140-199mg/dl are considered pre-diabetes, and levels 200mg/dl or higher are considered diabetes. Either the fasting plasma glucose test or the oral glucose tolerance test can be used to diagnosis diabetes; however, they need to be conducted on two separate days before the diagnosis of diabetes can be confirmed.

From an oral health perspective, diabetes is relevant because diabetics are at increased risk for developing tooth decay, periodontal diseases, oral fungal infections, and dry mouth.^{13,14,15,16} Periodontal disease is caused by the body's inflammatory response to the local accumulation of bacteria. Periodontal disease can be categorized based on whether or not the bone supporting the tooth is destroyed.¹⁷ The initial phase of periodontal disease is gingivitis, which involves inflammation of the gingival tissue. As a result of the inflammation, the gingiva appears to be red and swollen and may bleed when flossed or brushed. Gingivitis is considered a reversible disease because if a person brushes and flosses daily, the inflammation will stop and the gingival tissue will return to a healthy state. If the oral hygiene is not improved, then gingivitis may lead to another type of periodontal disease called chronic periodontitis, which causes the supporting structure around the tooth to be destroyed and the tooth to become mobile.

The relationship between diabetes and periodontal disease has been investigated over the past decades and the available evidence supports the idea that there is a bidirectional relationship between diabetes and periodontal health and that they can adversely affect one another.¹⁸ Furthermore, according to a systematic review that was conducted to determine the relationship between periodontal therapy and glycemic control amongst patients with Type 1 and Type 2 diabetes, the limited evidence suggests that treating a diabetic's periodontal disease may have a small but significant improvement in controlling a diabetic's blood glucose level.¹⁹

Although there is a relationship between diabetes and oral health, research has shown that diabetics' overall knowledge about the oral health complications associated with diabetes is low and that there needs to be improved patient-provider communication about the disease.^{20, 21, 22} According to a study conducted by Yuen et al. that assessed the oral health knowledge and behavior among adults with diabetes, participants who were given oral health information related to diabetes were 2.9 times more likely to possess adequate oral health knowledge as compared to those who were not informed about the relationship between oral health and diabetes.²³ Therefore, education can play a role in increasing patients' knowledge about oral health.

A potential barrier to improving diabetics' knowledge of oral health risks is the fact that patients may not be aware of their own diabetic status. In 2014, in the United States, it was estimated that 21 million people, 6.7% of the population, have been diagnosed with diabetes and an additional 8.1 million people are unaware that they have diabetes.²⁴ According to the Centers for Disease Control and Prevention, in 2012, approximately 8.4% of Connecticut adults have diagnosed diabetes and approximately 6.8% of the population has pre-diabetes.²⁵ Since dental providers interact with patients on a daily basis, they have the ability to help identify patients who are potentially diabetic and provide them with the proper resources and education to

improve their own health. According to a review of the literature to determine if screening for undiagnosed diabetes was within the dentist's scope of practice, it was concluded that dentists have an ethical obligation to protect the well-being of their patients and that screening for diabetes does not harm the patient and is in the patient's best interest.²⁶

Studies have been conducted to assess the attitudes of dental providers with regards to diabetes screening. Esmeili et al. found that 61% of general dentists believed that it was important to their role as dentists to address the issue of diabetes. However, only 47% of general dentists knew how to assess for diabetes and even fewer, 42%, felt well prepared to intervene with patients that were diagnosed with diabetes. Formal training in diabetes assessment and management corresponded with higher comfort level in managing diabetic patients.²⁷ One study conducted by Greenberg et al. showed that among a sample population of general dentists in the United States, 76.6% of the dentists felt that it was important for dentists to conduct screenings for diabetes.²⁸ However, more people were willing to refer patients for consultations to physicians as compared to collecting blood via the finger-stick method. Therefore, although dentists in the private sector acknowledge the importance of screening for diabetes in a dental setting, very few actually do so.

In terms of patient acceptance, Creanor et al. conducted a study that investigated the attitudes of patients from primary care dental clinics and general dental practices in South West England regarding the idea of chair-side screening for medical conditions. The two primary care dental clinics that were involved with the study were under the endorsement of the Peninsula Dental School.²⁹ The study found that 82% of patients from the primary care dental clinics were willing to be screened for diabetes as compared to 72% of patients from private dental practices. The study also determined that 88% of patients from the clinics and 87% of patients from private

practices felt that it was “important” to “very important” for dentists to screen for medical conditions. However, some patients did express concerns about whether or not this approach was cost effective.

Different methods of diabetic screening in the dental office have been explored. Herman et al. determined that individuals at high risk for pre-diabetes and Type 2 diabetes could be identified in a dental setting using a questionnaire that assessed gender, history of hypertension, history of dyslipidemia, history of lost teeth, and either self-reported body mass index greater than or equal to 35kg/m^2 or random capillary glucose greater than or equal to 110mg/dL .³⁰ In East London, Wright et al. conducted a study to identify high risk patients based on a validated tool from the National Institute for Health and Clinical Excellence that included age, gender, ethnicity, family history of diabetes and hypertension, as well as, body mass index.³¹ Rao et al. conducted a study to determine if gingival crevicular blood could be used to determine diabetic risk.³² In this study, participants with gingivitis and periodontitis were selected to have their gingival crevicular blood and capillary finger-prick blood analyzed. It was determined that there was a highly significant correlation between the readings from the gingival crevicular blood and capillary finger-prick blood samples and that gingival crevicular blood may be used as a potential source of screening blood glucose during periodontal examinations. Lalla et al. suggested that patients be assessed for risk factors prior to receiving periodontal examinations and blood glucose evaluations.³³ The risk factors that were included in this study were family history of diabetes, hypertension, high cholesterol, and overweight/obesity.

Since diabetic screenings in dental offices have not been standardized, there is not one specific protocol that should be utilized. However, it would make the most logical sense to have a screening protocol that is simple to use, time efficient, and practical in a dental setting. In

order to help address the issue of undiagnosed diabetes, it can be argued that clinics that treat a large number of potentially diabetic patients should consider performing some kind of screening exam or consider performing some kind of diabetic risk assessment. Since academic dental institutions are considered safety nets for low-income populations³⁴ and studies have shown that diabetes is more prevalent in low-income communities,^{35,36} conducting diabetic screenings or diabetic risk assessments in academic dental clinics may prove beneficial to patient care.

Studies have been conducted that assessed the attitudes of dental students and faculty members towards diabetes screening, monitoring, and counseling. Anders et al. assessed the attitudes of first and fourth year students attending the University of Buffalo School of Dental Medicine.³⁷ This study concluded that over half of the dental students surveyed believed that monitoring a diabetic's blood glucose level is within the scope and responsibility of the dental profession; however, only 23% believed that screening for diabetes is within the scope of the dental practice. Fischer and Koerber conducted a study that assessed the attitudes of students and faculty members from the University of Illinois at Chicago College of Dentistry towards seven clinical activities regarding diabetes education and counseling.³⁸ The seven clinical activities included providing basic information about diabetes, providing basic information about diabetes and healing, providing basic information about diabetes and oral health, providing basic information about diet control, providing basic information about diabetic medications, referring a patient to a physician for treatment, and screening patients with a finger-stick blood test for glycaemia. The authors found that although respondents were relatively comfortable screening for diabetes with a finger-stick because it was considered a standard practice in their school clinic, more participants were willing to refer patients to physicians for treatment than screen for diabetes. The willingness of students and faculty members to perform the seven clinical activities

was predicted by their perceived importance of the activity to the patient's health, their capability of performing the activity, and having little difficulty in implementing the activity. Therefore, instead of having dental providers perform the actual diabetes screening examinations, it may be more realistic to encourage dental providers to identify potentially high-risk patients, who can then be referred to physicians for further care.

The American Diabetes Association utilizes a questionnaire that assesses whether or not a person is at increased risk for developing Type 2 diabetes (Appendix: Figure1).⁷ This questionnaire was based on a study conducted by Bang et al. which looked at what factors were significant predictors of undiagnosed diabetes using the data collected from the National Health and Nutrition Examination Survey (1999-2006).³⁹ According to a study conducted by Genco et al., there is a moderate correlation between HbA1c results and the results from the American Diabetes Association Diabetes Risk Test. The study showed that the diabetes risk test performed well at predicting who would be considered at low risk for developing diabetes, with 71.9% of those in the low-risk group having a HbA1c level of less than 5.7%. However, it was noted that out of the high-risk patients who were identified, 45.7% of the patients were not considered high risk according to their HbA1c levels. Although the American Diabetes Association Diabetes Risk Test appears to have poor specificity, it can be argued that it is still a good risk assessment tool. Over identifying patients in this particular situation is not of critical concern because it is not a final diagnosis. The goal of the diabetes risk assessment is to raise awareness of a potential problem that can affect oral and systemic health.

The questions asked in the diabetes risk test are simple questions regarding a patient's medical history, which may prove beneficial to both the patient and the dental provider if incorporated into clinics with high diabetic risk patients. Patients can be made aware of a

potential problem, which can be managed by a primary care physician and the dental provider can be aware of a potential problem that may affect the patient's oral health. Incorporating a diabetic risk assessment in an academic dental setting may be especially important if a large number of patients have diabetes or have risk for developing diabetes and are not aware of the potential complications associated with the disease. Diabetic risk assessment is particularly important when it comes to Type 2 diabetes because lifestyle modifications can be made to decrease the chance of developing Type 2 diabetes or decrease the severity of the disease.

This study will attempt to determine whether or not there is a need to incorporate a diabetic risk assessment in an academic dental clinic. If the dental patient population is reflective of the population in Connecticut, approximately 8% of patients seeking care at UConn Health dental clinics will have Type 2 diabetes. However, it is believed that since UConn Health is an academic dental clinic, the patient population is not reflective of the general population in Connecticut because academic dental institutions are considered safety nets for low-income populations³⁴ and studies have shown that diabetes is more prevalent in low-income communities.^{35, 36} Therefore, it is believed that UConn Health will have a larger diabetic and at-risk population for developing Type 2 diabetes. In terms of patient knowledge, it is hypothesized that patients will have less knowledge about the oral health complications of diabetes as compared to the other systemic complications of diabetes. It is also hypothesized that diabetic patients will be more knowledgeable about diabetes and the oral health complications associated with the disease compared to non-diabetics and that there will be no significant difference in knowledge between non-diabetics and those at increased risk for diabetes.

Methods

The study was conducted at the University of Connecticut Health Center (UConn Health), an academic dental institution in Farmington, CT. The study protocol was reviewed and approved by the UConn Health Institutional Review Board (15-069-2). First, an analysis was conducted on de-identified patient data available from July 1, 2013 to October 31, 2014 in the dental clinic information management system. This system was used to obtain the number of patients, aged 18 and over, that identified themselves as being diabetic in either their medical history form or in the medical conditions field in the database. A survey was then administered to new patients of the UConn Health dental clinics over a four-month period to assess their diabetic status and risk, as well as their diabetic knowledge in relation to systemic and oral health via convenience sampling (Appendix: Figure 2). The survey took approximately five to ten minutes to complete. Study participants were approached during their screening appointment, which routinely occurs before patients are assigned to dental providers for comprehensive care. Patients who did not understand English were excluded from the study. After verbal consent was given, the investigator read the questions aloud on the survey while the participants were given the option to follow along with a written copy of the survey.

The survey instrument was designed to assess the participants' knowledge of the current evidence about diabetes and its relationship to systemic and oral health. The questions assessed if participants understood that diabetes is a disease characterized by high blood sugar levels, had an effect on eye disease, gum disease, kidney disease, tooth decay, heart disease, dry mouth, and problems healing. The questions also assessed if participants knew that having diabetes increased the risk of gum disease and that blood sugar levels may be controlled by treating gum disease. In order to assess the patient's Type 2 diabetic risk, the American Diabetes Association Diabetes

Risk Test was used (Appendix Figure 1). This tool measured the patient's age, gender, history of hypertension, history of gestational diabetes for women, weight and height, family history of diabetes, and presence of physical activity to determine diabetic risk. Additional demographic information was collected about the patient's ethnicity, race, and level of education. The participants were asked about their health status, which was accompanied by information about having a primary care doctor and regular check-up appointments. Participants who identified themselves as diabetic were asked to provide information about the type and duration of their diabetes as well as their latest HbA1c level.

The Diabetes Risk Test resulted in a score ranging between 0 to 11; the participant needed a score of five or higher to be considered at increased risk for developing Type 2 diabetes. Being male, having hypertension, being physically inactive, having a family history of diabetes, and having a history of gestational diabetes were each assigned a score of one. The number of points associated with body weight and height ranged from zero to three depending on how much the participant weighed in comparison to their height. Participants were categorized as either non-diabetic, at increased risk, or diabetic. Participants who identified themselves as pre-diabetic, as told by their physician, were also placed in the increased risk category because having blood glucose levels higher than normal increases the person's risk for developing Type 2 diabetes.⁴⁰ With regard to knowledge, each participant was able to achieve a total of three systemic points and three oral health points. Participants, who identified eye disease, kidney disease, and/or heart disease, received one point for each correct choice towards their systemic risk knowledge. Participants, who correctly identified gum disease, tooth decay, and/or dry mouth, received one point for each correct choice towards their oral health knowledge. Although

one of the choices was “problems healing”, it was considered a systemic problem and an oral health problem and therefore not included in the analysis.

The data were analyzed using SPSS software (version 21) using descriptive and inferential statistics. A paired t-test was used to determine if there was a significant difference in participants’ knowledge about the oral health complications of diabetes as compared to other systemic complications of diabetes. In order to determine if there was a difference in knowledge between the three groups (diabetic, non-diabetic, and increased risk), linear regression analysis was performed using medical knowledge as the dependent variable in one analysis and dental knowledge as the dependent variable in the second analysis.

Results

According to the data analysis of the record data that was available from July 1, 2013 to October 31, 2014, 62,398 patients were aged 18 or older and had a medical history form and/or medical conditions field completed. Among the 62,398 patients, 5,021 patients were identified as having diabetes, which accounts for 8.05% of the sample population.

For the survey portion of the study, 200 out of the 209 patients approached agreed to participate in the study, a 95.5% response rate. Five people were excluded from the study because they did not understand English and four did not want to participate in the study. Of the 200 participants who gave informed consent to participate in the study, 50.5% were female and 49.5% were male. The age of the participants ranged from 18 to 83, with a mean age of 52. One out of five participants was Hispanic or Latino, while 73.5% of the participants identified themselves as White. Approximately half (51.5%) of the participants had achieved a high school

diploma as their highest level of education. The demographic characteristics of participants can be seen in Table 1.

Table 1: Demographics of Participants

	Number of Participants (N=200)	Percentage of Participants
Gender		
Female	101	50.5
Male	99	49.5
Ethnicity		
Hispanic or Latino	39	19.5
Not Hispanic or Latino	161	80.5
Race		
White	147	73.5
African American	31	15.5
Asian	9	4.5
Other	13	6.5
Age		
<40	42	21.0
40-49	35	17.5
50-59	50	25
≥ 60	73	36.5
Level of Education		
Less Than High School	9	4.5
High School Diploma	103	51.5
Technical/ Associate Degree	32	16
Bachelor's Degree	33	16.5
Graduate	23	11.5

Among the study participants, 37.0% were non-diabetic, 17.0% self-identified as being diabetic, and 46.0% were at increased risk for developing Type 2 diabetes (Figure1). A large proportion of the participants had one or more risk factors for developing Type 2 diabetes, which included having a history of gestational diabetes (6%), having a parent or sibling with a family history of diabetes (49%), being male (49.5%), having hypertension (50.5 %), being physically inactive (56%), being overweight (69.5%), and being 40 years old and older (79%) (Figure 2). Among the survey participants, 17% identified themselves as being diabetic. Amongst the 34 participants who were diabetic, three had Type 1 diabetes, 27 had Type 2 diabetes, and four

participants did not know what type of diabetes they had. The diabetic participants ranged in age between 23-83 years old, with a mean of 60.5 years old. The average number of years that the participants had diabetes was 12.0 years, ranging between half a year to 62 years. Six out of the 34 diabetics identified themselves as having uncontrolled diabetics, while the remaining 28 diabetics identified themselves as having diabetes that is controlled with diet and medications. More than half (55.9%) of the diabetics did not know what their most recent HbA1c level was and among the 15 diabetics who did remember the value, only four had a HbA1c level lower than seven.

Figure 1

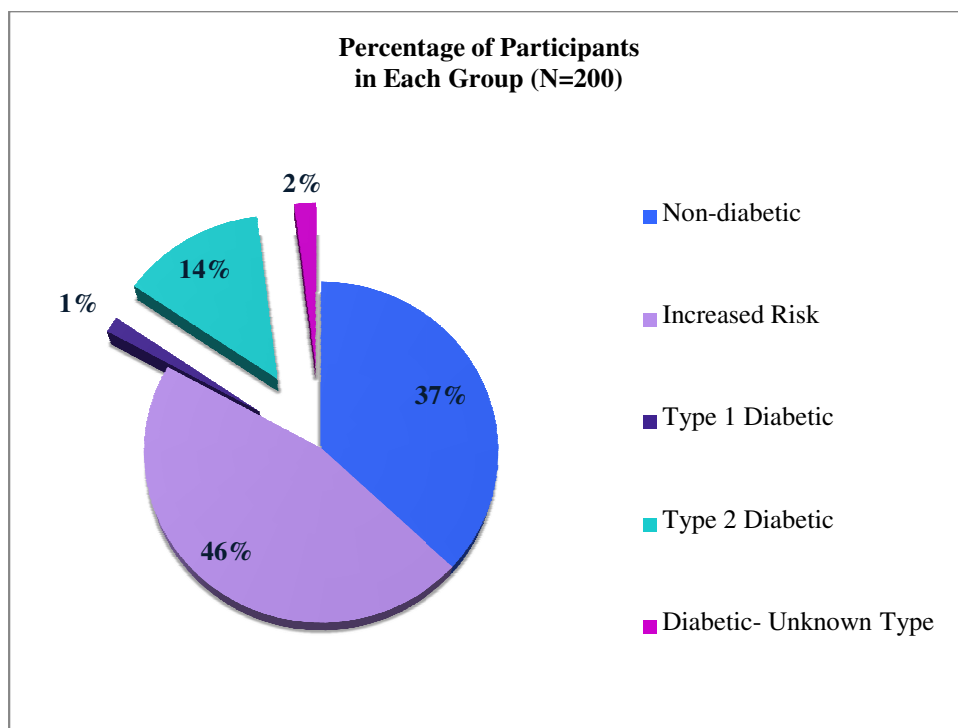
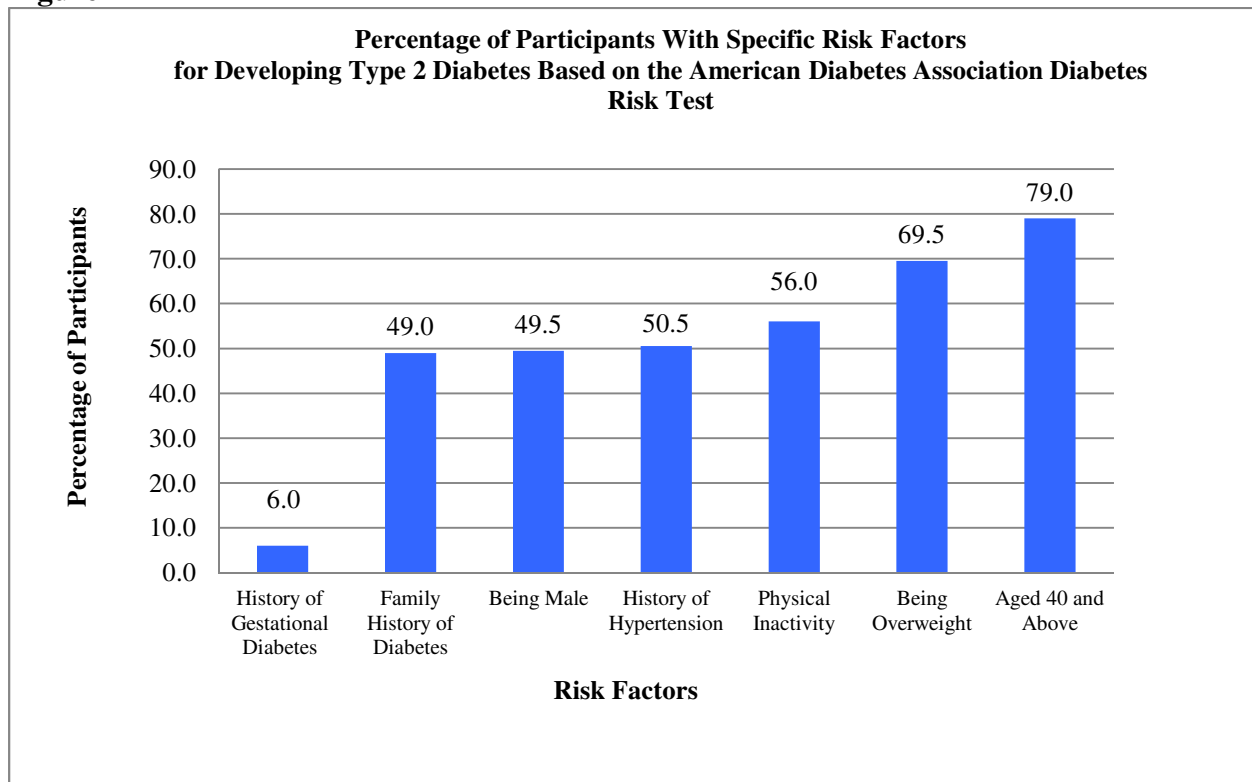


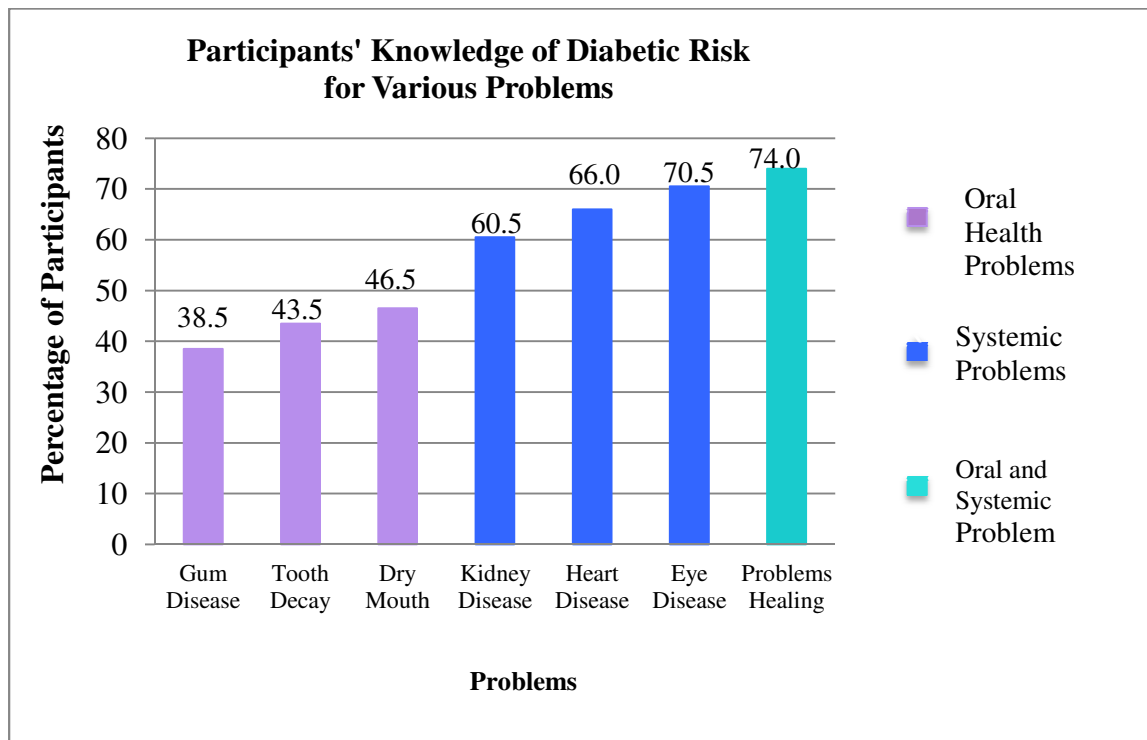
Figure 2



Overall, participants' knowledge of diabetes was lacking. The percentage of participants who thought that diabetes is a condition that happens when a person has high blood sugar levels was 44.0%, alternating high and low blood sugar levels 42.5%, low blood sugar levels 8.5%, did not know 3.5%, and normal blood sugar levels 1.5%. The percentage of participants that knew that diabetics were at increased risk for problems healing was 75%, eye disease 70.5%, heart disease 66%, and kidney disease 60.5%. Less than half of the participants knew that diabetes increased the risk for dry mouth (46.5%), tooth decay (43.5%), and gum disease (38.5%) (Figure 3). Only five percent of the participants knew that diabetes may be controlled by treating gum disease, although 60.0% of the participants knew that if diabetes is poorly controlled, the risk for gum disease is increased. Almost four out of five (78%) participants said that they were never told that oral health problems and diabetes were related. Out of the 44 participants who were told about the connection between oral health and diabetes, 31.8% learned about it from the

physician, 22.7% learned about it through reading, 15.9% learned about it from the dentist, 15.9% learned about it from friends, 6.8% learned about it from family members, and 6.8% learned about it from school.

Figure 3

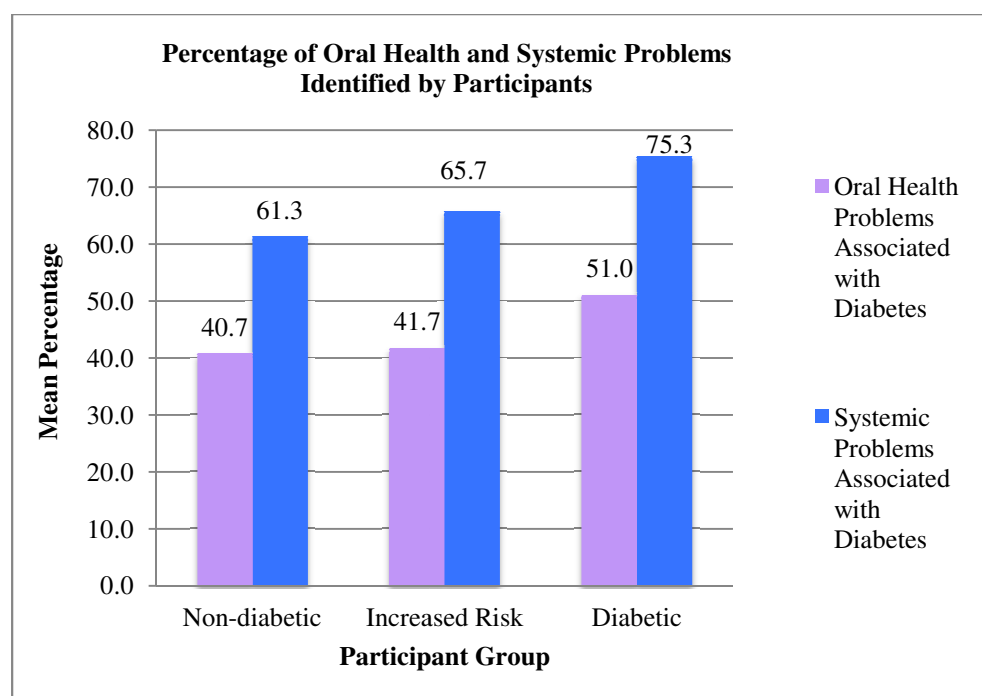


Among the participants, 88.0% reported having a primary care doctor whom they see at least once a year for a checkup.

The paired t-test showed that participants correctly identified more systemic complications associated with diabetes ($1.97 \pm .99$) as compared to the oral health complications associated with diabetes (1.29 ± 1.18), with a statistically significant difference of 0.685 (95% CI .52 to .85, $t(199) = 8.18$, $p < 0.001$). The linear regression analysis showed that diabetic patients knew significantly more about the systemic complications associated with diabetes as compared to the non-diabetics, with a significant difference of 0.427 (95% CI 0.026-.828), $SE = .203$, $p < 0.05$. There was no significant difference in oral health knowledge between diabetics and non-

diabetics. The linear regression analysis showed that there was no significant difference in systemic or oral health knowledge between non-diabetics and increased risk patients or between increased risk patients and diabetics (Figure 4).

Figure 4



Discussion

Based on the results of this study, it can be concluded that the population seeking care at UConn Health may not be representative of Connecticut's population as a whole. According to the participants' demographic characteristics, there is a higher percentage of minorities seeking care at UConn Health compared to Connecticut's population as a whole. Among the participants, 15.5% were African American and 19.5% identified themselves as being Hispanic or Latino. These percentages are higher than those of Connecticut's general population, which includes 11.3% African American and 14.7% Hispanic or Latino.⁴¹ Since UConn Health has a larger

percentage of minority groups, the prevalence of diabetes is expected to be higher because diabetes is more prevalent in minority groups.⁴² According to the information management system analysis, 8.05% of the population had diabetes, which is close to Connecticut's general diabetic population of 8.4%. However, according to the self-report of new patients surveyed in the dental clinics, 17% had diabetes. This may indicate a larger influx of diabetic patients to UConn Health's dental clinics, or it may indicate that diagnosed diabetes is not being adequately identified through the existing medical history process.

Furthermore, there appears to be a lack of diabetic understanding amongst the participants. More than half of the participants were unable to select the correct description of diabetes, with the majority believing that diabetes is a condition that happens when a person has alternating high and low blood sugar levels. This may be an indication that participants are somewhat knowledgeable about diabetic patients experiencing high blood sugar levels, however, they may have also heard about diabetics experiencing hypoglycemic episodes. Nevertheless, it appears that the majority of this population does not fully understand the exact cause of diabetes and needs to be properly educated about the disease.

In terms of the problems that are experienced by diabetic patients, it was determined that participants knew significantly more about the systemic complications associated with diabetes than they knew about the oral health complications associated with diabetes. Fifteen percent of the participants knew more about the oral health complications, 14% of the participants knew the same amount of oral health complications as systemic complications, and 71% of the participants knew more of the systemic complications. Furthermore, it was determined that diabetic participants statistically knew more about the systemic complications associated with diabetes as compared to the non-diabetic participants. Out of a possible value of 3 points, diabetics had an

average score of 2.26 points for systemic diseases, while non-diabetics had an average of 1.84 points. The difference in systemic knowledge between the two groups appears logical because it would make sense for a physician to be more inclined to inform a diabetic patient about the systemic complications associated with the disease. Although there were no statistical differences in oral health knowledge between any of the groups, this was because all groups lacked sufficient knowledge about the oral health complications associated with diabetes. This was not surprising given the fact that the majority of the participants were never educated about the connection between oral health problems and diabetes. Amongst those who knew about the connection, more participants learned about it from their physician than their dentist. This suggests that dental providers have an important role in reducing the knowledge gap and may need to be more proactive in educating patients about the oral health problems associated with diabetes.

To our knowledge, no other study has assessed the diabetic knowledge of patients from an academic dental setting. However, the results of this study are consistent with other descriptive studies that reported on this topic. Similar to our findings, participants knew more about the systemic complications associated with diabetes as compared to the oral health complications. Eldarrat conducted a study in Dubai, United Arab Emirates, which assessed diabetic patients' knowledge and awareness of their risk for systemic and oral diseases, their attitudes towards maintaining good oral health, and assessed who educated them about diabetes.⁴³ Among the 200 diabetic patients surveyed, 90% were aware of their increased risk for kidney disease, eye disease 85%, heart disease 75%, periodontal disease 60%, dental caries 54%, and oral fungal infections 42%. Allen et al. conducted a study in Ireland that assessed diabetics' attitudes, awareness and oral health-related quality of life.⁴⁴ The study found that the percentage

of participants who knew about their increased risk for circulatory problems was 99%, eye disease 98%, kidney problems 94%, heart disease 84%, and periodontal disease 33%. Therefore, in consideration of the results from the previous studies in addition to our findings, it can be argued that the population as a whole needs to be better informed about the oral health complications associated with diabetes.

Limitations

A limitation to using the information management system and the survey to determine the percentage of diabetic patients seeking care at UConn Health is that the diagnosis cannot be verified because the diagnosis was self-reported by the patients. A limitation to the survey part of the study is that because there is no standard protocol available to assess diabetic risk, the results of our diabetic risk assessment may not be replicable when another assessment tool is used. Also, since the data collected to assess risk were self-reported, the answers may not be completely accurate. It has been shown that when looking at self-reported answers, for instance, weight is more likely to be under reported and height is more likely to be over reported.⁴⁵ The participants' responses to the weight and height questions may have affected the number of points that they received for that particular risk factor. In addition, being physically active is a subjective question and depending on the participants' perspective of physical activity, the answer to this question may not accurately reflect the participants' lifestyle. It may also be possible that participants did not accurately remember their health history.

Furthermore, the results of this study are not applicable to all academic dental clinics because this study only focused on one specific dental community during a limited time period. It is also uncertain whether these results regarding patients' knowledge would be generalizable to

non-academic settings, such as dental clinics in Federally Qualified Health Centers or private dental offices.

Recommendations

Additional research is needed in different dental clinic settings in different states in order to determine if there is a larger diabetic and increased risk population seeking care at academic dental clinics in general, as well as in other dental practices. If there are more diabetics and increased risk populations seeking care at academic dental clinics, then a standard risk assessment protocol should be considered to address the issue of undiagnosed diabetes. Considering that academic dental institutions are centers for learning, it is a good environment for dental providers to educate all patients about the association between oral health and diabetes, regardless of their diabetic status. Once diabetic risk assessments are utilized in academic dental clinics, the next step would be to encourage all dental providers, no matter what practice setting, to recognize the signs of at-risk patients and provide the proper diabetic education to their patients.

Conclusion

The study suggests that there are a large percentage of patients who are at increased risk of developing Type 2 diabetes and that there are a large percentage of diabetic patients at UConn Health dental clinics. Patients' lack of understanding of the relationship between diabetes and oral health indicates that patients need to be better informed about this topic by the dental community. Performing a diabetic risk assessment and educating patients about the relationship between oral health and diabetes may be beneficial to patient care.

Figure 1

TYPE 2 DIABETES?



1 How old are you?

- Write your score
in the box.

11/11/2019

- 2** Are you a man or a woman?

- Man (1 point) Woman (0 points)

- 3** If you are a woman, have you ever been diagnosed with gestational diabetes?

- Yes (1 point) No (0 points)

- 4** Do you have a mother, father, sister, or brother with diabetes?

- Yes (1 point) No (0 points)

□

- 5** Have you ever been diagnosed with high blood pressure?

- Yes (1 point) No (0 points)

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- 6** Are you physically active?

- Yes (0 points) No (1 point)

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- 7** What is your weight status?
(see chart at right)

□ □ □ □ □

*Add up
your score.*

**For more information, visit us at
www.diabetes.org or call 1-800-DIABETES**



Visit us on Facebook
Facebook.com/AmericanDiabetesAssociation

Height	Weight (lbs.)		
4' 10"	119-142	143-190	191+
4' 11"	124-147	148-197	198+
5' 0"	128-152	153-203	204+
5' 1"	132-157	158-210	211+
5' 2"	136-163	164-217	218+
5' 3"	141-168	169-224	225+
5' 4"	145-173	174-231	232+
5' 5"	150-179	180-239	240+
5' 6"	155-185	186-246	247+
5' 7"	159-190	191-254	255+
5' 8"	164-196	197-261	262+
5' 9"	169-202	203-269	270+
5' 10"	174-208	209-277	278+
5' 11"	179-214	215-285	286+
6' 0"	184-220	221-293	294+
6' 1"	189-226	227-301	302+
6' 2"	194-232	233-310	311+
6' 3"	200-239	240-318	319+
6' 4"	205-245	246-327	328+
	(1 Point)	(2 Points)	(3 Points)

You weigh less than the amount
in the left column
(0 points)

Adapted from Bang et al., *Ann Intern Med* 151:775-783, 2009.
Original algorithm was validated without gestational diabetes as part of the model.

Lower Your Risk

The good news is that you can manage your risk for type 2 diabetes. Small steps make a big difference and can help you live a longer, healthier life.

If you are at high risk, your first step is to see your doctor to see if additional testing is needed.

Visit diabetes.org or call 1-800-DIABETES for information, tips on getting started, and ideas for simple, small steps you can take to help lower your risk.



STOP DIABETES

Figure 2

1. Diabetes is a condition that happens when you have _____. (Circle one choice)
 - a) normal blood sugar levels
 - b) low blood sugar levels
 - c) high blood sugar levels
 - d) alternating high and low blood sugar level
2. Circle any of the conditions that diabetic patients have a greater chance of getting

<input type="radio"/> Eye Disease	<input type="radio"/> Heart Disease
<input type="radio"/> Gum Disease	<input type="radio"/> Lung Disease
<input type="radio"/> Kidney Disease	<input type="radio"/> Dry Mouth
<input type="radio"/> Tooth Decay	<input type="radio"/> Problems Healing.
3. Diabetes may be controlled by treating _____. (Circle one choice)

<input type="radio"/> tooth decay	<input type="radio"/> oral fungal infection
<input type="radio"/> gum disease	<input type="radio"/> mouth cancer
4. If diabetes is poorly controlled, the risk for gum disease is _____. (Circle one choice)
 - ☐ not changed
 - ☐ increased
 - ☐ decreased
5. Has anyone told you that oral health problems and diabetes are related?
 - ☐ Yes: If so, who? _____
 - ☐ No
6. How old are you? _____ years old
7. I am _____
 - ☐ Male- Please skip question #8
 - ☐ Female
8. Females Only: Did you have high blood sugar levels during pregnancy? Circle: YES or NO
9. What is your height? _____ feet _____ inches
10. How much do you weigh? _____ pounds
11. What is your ethnicity?
 - ☐ Hispanic or Latino
 - ☐ Not Hispanic or Latino
12. What is your race? (Please circle all that apply)

<input type="radio"/> White	<input type="radio"/> Native Hawaiian or Other Pacific Islander
<input type="radio"/> African American or Black	
<input type="radio"/> Asian	<input type="radio"/> Other Race: _____
<input type="radio"/> American Indian or Alaska Native	

13. What is the highest degree or level of education you have completed?
- ☐ Less than high school
 - ☐ High school diploma
 - ☐ Associate or technical degree
 - ☐ Bachelor's degree
 - ☐ Graduate degree/ professional degree
 - ☐ Other: _____
14. Have you ever been told that you have high blood pressure?
- ☐ Yes
 - ☐ No
15. Do your parents, brothers or sisters have diabetes or a history of diabetes?
- ☐ Yes
 - ☐ No
16. Are you physically active?
- ☐ Yes
 - ☐ No
17. Do you have a primary care doctor?
- ☐ Yes
 - ☐ No
18. How many times this year did you go to your medical doctor for a check up? _____
19. When was your last visit to the medical doctor? _____
20. Circle the statement that best describes you.
- ☐ I have diabetes and it is managed with diet and/or medications
 - ☐ I have uncontrolled diabetes
 - ☐ I am a pre-diabetic- Skip remaining questions. Thank you for participating in this survey.
 - ☐ I do not have diabetes- Skip remaining questions. Thank you for participating in this survey.
21. What type of diabetes do you have?
- ☐ Type 1
 - ☐ Type 2
 - ☐ Other: _____
 - ☐ Do Not Know
22. Fill in your latest hemoglobin A1C level. If you do not know what it is, circle "Do not know"
- ☐ Hemoglobin A1C level: _____
 - ☐ Do Not Know
23. Was your latest hemoglobin A1C level taken within the past 3 months?
- ☐ Yes
 - ☐ No
24. How long have you had diabetes? _____ years

Thank you for participating in this survey!

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