

A Survey of Georgia Diabetes Educators' Knowledge and Behaviors on Oral Health
Education

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DEDICATION

This thesis is dedicated to my husband, Allen McKune, who supports me in all I do. Also, for my parents, Marla and Benjamin Flowers Jr., who are no longer with us, but encouraged me to strive for excellence.

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SECTION 1

INTRODUCTION

In 2017, according to the Centers for Disease Control (CDC), 30.3 million adults in the United States were living with diabetes and 84.1 million adults had prediabetes (1). Prediabetes is defined impaired fasting glucose or glucose tolerance (2), whereas diabetes is a metabolic disease characterized by hyperglycemia with different mechanisms (3–5). Persons living with diabetes represents 9.4% of the population and is expected to rise 42% by 2030 (6,7). Additionally, it is estimated that approximately 24% (7.2 million) of persons living with Type 1 or Type 2 diabetes mellitus (Type 2 DM) are currently undiagnosed (1,7). In 2016, 11.4% of the population in Georgia had diabetes, making the top ten list of states with the highest Type 1 or 2 DM population (1). Management of chronic disease, including diabetes has resulted in increased utilization of health care resources (8). In 2012, the American Diabetes Association completed a study to measure the added cost of health care due to Type1 and Type 2 DM (9). The results indicated that treating the health complications associated with diabetes adds \$176 billion in medical care costs and another \$69 billion in reduction in workforce/productivity (9). This greater demand for health care services and increased utilization will continue to strain Medicare and Medicaid budgets as well as the capacity of the health care workforce. Further, diabetes places many Americans at risk for additional serious health complications.

A way to maintain of diabetes is to control glycemc or blood sugar levels. This can be measured through Hemoglobin A1c (HbA1c) tests which measures the average blood sugar levels over a two to three month interval (10). It is currently recommended for patients with diabetes to have an HbA1 of less than 7% and is considered poorly

controlled if it is greater than 8% (10–13). Poor glycemic control is associated with numerous systemic complications including retinopathy, nephropathy, neuropathy, peripheral vascular disease and cardiovascular disease (14–19). In addition to the systemic complications, numerous oral complications are associated with poor blood sugar control including: gingivitis, periodontitis, oral candidiasis, burning mouth syndrome, lichen planus, abnormal wound healing, multiple carious lesions, and xerostomia (19–23). In 2012, 46% of American adults were found to have periodontitis with about 9% of those with severe periodontal disease (24). It is shown that about one-third of people living with diabetes have severe periodontal disease (19). Severe periodontal disease can also impact diabetes. Uncontrolled periodontal disease can decrease glycemic control in patients with diabetes through the increase in inflammatory cytokines (25–28). Without treatment for periodontal disease the chronic inflammation will remain present and continue to place strain systemically on the metabolic system (29). With life changing complications possible, it is important to address, treat, and prevent these conditions.

With the possibility of serious medical complications from diabetes, interprofessional communication is key. There is a lack of true comprehensive care for patients due to the deficiency of interprofessional collaboration. The dental community must be involved with patient management alongside of the medical field and can even play a vital role in identifying those patients who have undiagnosed diabetes (30). This lack of coordinated care results in increased costs (31), poor patient outcomes (30), and increased diabetes across the population (32,33). There are collaborative models of care to address these concerns.

Interprofessional collaborative practice (IPCP) has been an increasingly recognized model among all areas of health care to improve access to care and health outcomes. IPCP is when two or more providers from different health professional work as a team for patient care to provide more comprehensive and effective care (34). It has been recommended to use interprofessional care and collaboration as a standard of care in regards to managing patients with diabetes (30,35). A call to action from the World Health Organization (WHO) in 2010 suggested using IPCP and provided a framework to follow (36). This framework begins with interprofessional education (IPE) for both current and future health care workers to ensure they are ready to work in a collaborative practice. One IPE resource that may be utilized is Smiles for Life: A National Oral Health Curriculum which was created by the Society of Teachers of Family Medicine Group in Oral Health. Smiles for Life provides oral health curriculum and resources to non-oral healthcare providers and schools (37). Once IPE has been concluded, collaborative practice can be established and optimal patient care is given (36).

Collaboration focuses on prevention which is considered cost-effective in disease management and treatment (36,38–41). Research has shown that IPCP in diabetes management results in improved patient outcomes, increased practice efficiencies, improved team communication, and increased provider satisfaction (25, 26). The growing evidence on the relationship between poorly controlled diabetes and periodontal disease indicates that an interprofessional approach to diabetes management is needed to minimize co-morbidities. Yet, despite the call to action between collaborative care between oral and medical providers by the Surgeon General (35), there are few collaborative efforts that include the dental profession (39).

The Oral Health Coalition created Georgia's Oral Health Plan in 2014 in collaboration with Georgia Department of Public Health's, Oral Health Prevention Program and Maternal and Child Health Section (42). This report outlined an action plan to increase oral and systemic health knowledge and reduce oral disease in Georgia (42). Four areas of focus were prevention, public education and health promotion, surveillance and data, and access to care (42). These areas of focus include promoting oral health as a part of total health, supporting the dental and medical home concept, and increasing access and services to underserved areas (42). The need for collaboration and improvement of health care services has already been addressed, now the actions must take place.

The bi-directional relationship between diabetes and periodontal disease is an important focus for medical and dental teams when considering chronic disease management (36,39,41,43–46). This relationship requires knowledge of both diseases from all professionals interacting with patients with diabetes or periodontal disease. Certified Diabetes Educators (CDEs) are various health care and non-health care professionals with specialized training who provide support and education to patients with diabetes (47). IPCP offers a solution and a chance for patients to improve their health outcomes. Although patients with diabetes encounter a variety of health care professionals more collaboration between CDEs and dental professionals is needed (11,48,49). Since CDEs can be individuals without formal healthcare training, it is important that proper oral health education training is taught and understood (50). Before IPCP can take place, IPE must occur. It is difficult for CDEs to collaborate with dental professionals without a basic understanding of oral health education and its impact on

patient's overall health. Further, CDEs with formal healthcare training have reported inadequate training in oral health resulting in their inability to communicate the importance of oral health to their patients (48,49,51–53). In fact, Lopes et al. found that 79% of CDEs had no oral health training and only 10% had training post certification on oral health education (11). This lack of oral health training could negatively impact outcomes of patients with diabetes.

Purpose of the Study

The purpose of this study is to survey CDEs living in Georgia to determine their current knowledge and clinical practice behaviors toward oral health education. Behaviors of the CDEs surveyed include; type of interaction and time spent with patient, type of oral health questions asked and education provided, and collaboration practices.

Statement of the Problem

Since oral health is strongly linked to systemic health, especially diabetes, lack of adequate oral health awareness by CDEs represents a troubling gap in medical professional training and patient education. Diabetic patients have many resources, including diabetes self-management programs which teach disease management and prevention of co-morbidities. However, not all self-management programs are created equal. A systematic review by Poudel et al. (53) shows there is some oral health training and knowledge across various disciplines, however information regarding the oral health training given to diabetes care providers is lacking. Most CDEs in Georgia do not have formal oral health training and therefore the self-management programs they provide for patients may be deficient in this area. Given the strong relationship between oral health and systemic health, oral health should be a component of all diabetes self-management

programs. However, CDE's current behaviors, attitudes, and level of knowledge regarding oral health has not been studied in Georgia. Additionally, the extent to which oral health is addressed in diabetes self-management programs is not known.

Significance of the Study

The results may be used to inform diabetes self-management education (DSME) curricula, CDE training or continuing education requirements for CDEs. In addition, it may raise awareness of the importance of interprofessional collaboration between CDEs and dental health professionals. Increasing CDE oral health training and knowledge can provide confidence for the CDE to discuss oral health in more detail and increase referrals and/or collaboration to dental clinics. This can improve patient oral and systemic health outcomes.

Research Question

What are the clinical practice behaviors (as defined in the purpose of the study) and knowledge of CDEs regarding oral health education?

SECTION 2

REVIEW OF THE RELATED LITERATURE

A search of relevant literature was performed from 2000 to 2019. The search was conducted using PubMed, Ovid Medline, CINAHL, and Google Scholar. Key search terms were periodontal disease, diabetes, oral conditions, diabetes educators, oral health knowledge, oral health behaviors, interprofessional collaboration. Original articles and literature reviews published in English within the last nine years, with the exception of foundational sources dating back to 1998, were included. Interprofessional collaboration and education is a newer method so search parameters were broad to be more inclusive.

Periodontal Disease and Diabetes

The bidirectional relationship between diabetes mellitus and periodontal disease has been well established (36,39,41,43–46). Periodontal disease is a local inflammatory process caused by pathogenic bacteria in which the host response becomes a major factor in progression and management (5,17,27,28,54–56). Type 2 DM is a metabolic disease that is characterized by hyperglycemia with different mechanisms; RANKL/OPG axis, AGE/RAGE axis, and oxidative stress (ROS) (3–5). The local inflammation and toxins produced by bacteria associated with periodontal disease can move into the system increasing hyperglycemia and insulin resistance (5,14,27,28,33,44,57). This pathway occurs as periodontal disease is a chronic source of inflammation that moves throughout the body causing a pro-inflammatory state from the overexpression of cytokines; tumor necrosis factor- α (TNF- α), interleukin 6 (IL-6), interleukin 1 (IL-1) and increased insulin resistance (5,19). Damage from IL-6 and tumor necrosis factor- α increases production of C-reactive protein (CRP), fibrinogen, and plasminogen activator inhibitor-1 which impairs insulin signaling and resistance leading to hyperglycemia (5,19).

Additionally, diabetes increases systemic levels of inflammatory markers, including IL-6, TNF- α and CRP increasing the severity of periodontal disease. When HbA1c is >8%, which indicates poor glycemic control, there is an increase in IL-6 contributing to infection, increasing the risk of periodontal disease (11–13). Advanced glycation end-products (AGEs) are found in the blood and cause hyperglycemia and increase inflammatory mediators by expression of the signal receptor RAGE, which increases breakdown of collagen fibers, connective tissues in bone, contributing to and accelerating periodontal disease (28,29,56,58). Hyperglycemia increases oxidative stress which shifts the balance in receptor activator of nuclear factor kappa-B ligand (RANKL)/osteoprotegerin (OPG) and AGE/RAGE (5). Further, diabetes can cause both micro- and macro-vascular complications in the periodontium causing damage that can impair healing in the periodontium and inhibit renewal of periodontal tissues (5,12,29,56,59,60). For these reasons, Type 2 DM is considered as a risk factor for periodontal disease (25,29,56,60). By addressing risk factors shared by Type 2 DM and periodontitis, such as tobacco use, alcohol use and diet at medical and dental appointments, health outcomes can be improved for individuals with diabetes and periodontal diseases (61). The exaggerated inflammatory response and impaired host immune defense in diabetes can increase periodontal inflammation which in turn can impair glycemic control, demonstrating the bidirectional relationship of both diseases.

Dental Caries and Diabetes

Periodontal disease is only one oral complication of many for patients with diabetes mellitus. Dental caries can be problematic for any patient, but for patients with diabetes, contributing factors are complicated (59,62). Xerostomia, or dry mouth, is one

complication that can increase the incidence of dental caries (62,63). Xerostomia can occur naturally or may be exacerbated by systemic disease and/or medications (59,63). It begins by the reduction of saliva which leads to a decrease in antimicrobial protection and an increase in the caries process (63). Additionally, poor glycemic control can contribute to autonomic nerve dysfunction and/or microvascular changes that inhibits salivary gland function, increasing the risk of dental caries (63–65). Severe dental caries can lead to pain, infections, and tooth loss (66). Loss of teeth can further contribute to difficulty in managing diabetes through proper diet due to loss of proper mastication (67).

Oral Conditions and Diabetes

Periodontal disease and dental caries are known complications for patients with diabetes mellitus, but there are other lesser known complications that can have an impact on a patient's oral cavity. These complications include, fungal infections, oral mucosa lesions, taste and neurosensory disorders, and delayed wound healing (18,22,26,60,63). Fungal infections, in particular candidiasis, and oral mucosa lesions are attributed to poor/delayed wound healing and damage to the microvascular system found in patients with diabetes (63). It is thought and taste and neurosensory disorders are secondary complications of reduced salivary flow (62). All of these conditions can reduce the ease of managing diabetes due to poor nutritional choices (26).

Medical Professionals' Oral Health Knowledge and Behaviors

Traditional health care teams for persons with diabetes include: primary care physicians, internists, endocrinologists, nurses, dieticians, counselors, and pharmacists (68). Despite growing evidence that persons with diabetes have a higher risk for chronic periodontitis and vice versa (69), oral health lacks attention during diabetes counseling

and treatment (11,49). Since patients with chronic illnesses are more likely to visit a physician than a dentist (70), dental professionals rely on the referral of at-risk patients from the medical community, especially if a patient has no dental home or a severe dental condition. However, the literature suggests the need for oral health education in the medical community and interprofessional collaboration in the care of patients with diabetes (30).

Al-Habashneh et al., studied general practitioners, endocrinologists, internists, and other specialists' knowledge of oral health and diabetes (71). They found only half of those physicians thought oral health was a concern for diabetic patients and routinely advised their diabetic patients to visit a dental professional regularly or for a periodontal evaluation. Further, two-thirds of the physicians did not think maintaining oral health could affect glycemic control (71). However, the literature suggests an understanding of the oral-systemic link is higher among specialists, including endocrinologists and internists, than with general practitioners. Endocrinologists were found more likely to refer their patients with diabetes to a dental office (71). According to Owens et al., about half of endocrinologists and internists surveyed referred one in five patients to the dentist in the last year (64). Conversely, only five percent provided a dental screening or oral health education, alleging it was the responsibility of dental professionals to conduct oral exams, and citing uncertainty regarding the type of exam to perform (72). In a conflicting observational study by Lin et al., 50% of endocrinologists performed an oral exam for patients with diabetes, 26% advised the patient to have a dental visit, and 40% discussed the patient's increased risk for periodontal disease (73).

Diabetes Management

Currently, persons with diabetes have numerous health-related resources available to them. One of the most important is a diabetes self-management program (74–76), which focuses on disease management strategies and prevention of co-morbidities. The American Academy of Diabetes Educators (AADE) identified seven behavior needs for successful self-care management of diabetes known as AADE7™ Self-Care Behaviors which include healthy eating, being active, monitoring, taking medications, problem solving, healthy coping, and reducing risks (74,77). Oral health education and treatment fall within the “reducing risk” behavior and are considered the focus of dental care professionals (74). These behaviors are taught and monitored through a diabetic self-management education (DSME) of which there are five stages; assessment, goal setting, planning, implementation, and evaluation/monitoring (74). The DSME is adapted to the patient and by the level of CDE, which ranges from non-health care professional to advanced-level diabetes educator (74).

DSME is representative of the Chronic Care Model (CCM). CCM is a theoretic framework used to minimize health risk behaviors and their consequences related to chronic illnesses (78,79). According to CCM, six components are necessary for a health care system to be effective and provide a higher quality of care. These include: a strong support of community resources and governmental policies; a culture of organized health care systems; self-management programs; delivery of well-planned patient visits; and case management (78). Additionally, CCM stresses using evidence-based decision support and clinical information systems that organize patient information, population data and monitor efficiency of healthcare professionals (78,79). These components

facilitate a person living with diabetes to take an active role in their health to improve health outcomes. Furthermore, DSMEs provide evidence-based decision support. Without the six components of CCM, a diabetes self-management program would be unsuccessful.

Certified Diabetes Educators

Most diabetes management programs are managed by CDEs who are healthcare professionals that specialize in educating and guiding patients with diabetic conditions. CDEs can be physicians, registered nurses, occupational therapists, optometrists, pharmacists, physical therapists, dietitians, physician assistants, or other health professional with a master's degree or higher (50). While most CDEs have a strong knowledge base about classic complications of diabetes and have a higher familiarity of the oral systemic link than other health professionals, most do not have a clear understanding of the complications that poor glycemic control can have on oral health and vice versa (48,49,53,74). A study completed by Lopes et al., surveyed 298 CDEs to assess their knowledge of the connection between oral health and diabetes (11). It was found the knowledge of the bidirectional relationship between oral health and diabetes was high with 95% of the participants answering survey questions correctly (11). The results revealed CDEs are aware of the missing knowledge on periodontal disease within the medical community and its impact on diabetes control and desire more education (11). CDEs continue to show higher performance than internists and endocrinologists in dental referrals, as well as oral health educational behaviors (72). A national survey of CDEs reported they discussed oral health with 55% of their patients and referred 64% of their patients to a dental professional (11). However, despite a higher knowledge of the

oral health and diabetes link, there is a lack of communication of the knowledge to patients (11).

Effect of Diabetes Self-Management Programs

The evidence supports a positive correlation between DSME and diabetic clinical outcomes (80–83). It has been shown that persons with poor glycemic control, measured by HbA1c, who participate in DSME programs experience a statistically significant decrease in HbA1c (75,83,84). Dunning reported that most diabetic self-management classes, educational programs or initial assessments do not include information on periodontal disease (20). It should be noted the American Diabetes Association Standard of Medical Care in Diabetes recommends visiting a dentist regularly (80,85).

Educational Intervention/Curriculum

Research supports educational and behavioral interventions for patients with diabetes to improve clinical outcomes (45,76,82,83,86). Educational interventions include individual and group self-management classes that include information regarding the diabetes disease process, prevention, maintenance and complications. The most common topics covered in educational interventions are diet, exercise, medication, and blood glucose monitoring. Behavioral interventions include techniques such as motivational interviewing or health coaching aimed at helping a patient transform knowledge into behaviors and habits (84). Gary and colleagues completed a meta-analysis of randomized control trials of educational and behavioral intervention for patients with Type 2 diabetes (82). Study findings suggest most interventions are completed by nurses, dietitians and physicians, with better outcomes in glycemic control including fasting blood glucose, HbA1c, and weight, when performed by physicians (82).

This finding may be attributed to changes in treatment with regard to medications, as this can be done by physicians versus other health care professionals who may educate and then refer the patient back to the physician. Results were similar for interventions conducted in individual and group settings (82). Overall, it was shown that educational and behavioral interventions decrease HbA1c (82).

While there has been a satisfactory amount of research completed on general educational interventions and clinical outcomes, there is little research on the effect of oral health educational interventions in the diabetic population. When surveying diabetes educators and programs, Yuen et al. found over 76% of patient diabetes education curricula do not cover oral health (49). Conversely, another observational study completed by the same investigators examined oral health content in DSME programs and found 85-90% include oral health information, but do not show proper brushing and flossing (52). The only dental intervention found in the literature review followed a pilot program that eventually progressed into a full educational intervention program that lasted over four years (87). This study had many limitations, including poor study design causing difficulty in analyzing the program's effectiveness. The program developed was an interprofessional education collaboration between dental hygiene students and medical professionals in a clinical setting. The student hygienists performed plaque indexes, provided individualized oral health education and participated in a post-clinic meeting with the other healthcare professionals. The investigators found there was no change in the O'Leary plaque index score following the educational intervention.

CCM is meant to minimize health risk behaviors for chronic illness. Educational interventions have been shown to improve clinical outcomes in patients with diabetes and

supports the evidence-based criteria set by the CCM. However, oral health education is not included within the DSME curriculum. The literature supports oral disease, specifically periodontal disease, as a risk factor for diabetes. Further, the evidence shows oral health is key to diabetes management.

SECTION 3

PREFACE

Since oral health is strongly linked to systemic health, especially diabetes, understanding oral health awareness by Certified Diabetes Educators (CDEs) is important for medical professional training and patient education. The purpose of this study was to determine the oral health knowledge and practice behaviors of (CDEs). In 2017, a 31-item questionnaire was used to survey CDEs practicing in Georgia. Questions were open and closed-ended and Likert-scale modified from a previous survey used in a similar study. From a population total of 480, 78 CDEs participated in the study with a 24% response rate. Descriptive statistics were used to analyze the data. CDEs' overall knowledge of oral health was high except for tooth decay and the bidirectional relationship between diabetes and periodontal disease. Forty three percent of Georgia CDEs reported formal oral health education and 33% discussed oral health with their patients. Less than 25% of the patient population seen by CDEs were given dental referrals in the last year. The results show CDEs have a high oral health knowledge and understand the importance of oral health and collaboration, however the CDE's did not refer patients for dental care based on their perceptions of patients' financial status. These findings highlight an opportunity for CDEs and dental professionals to collaborate to further their knowledge of oral health and improve patient outcomes by increasing referrals to dental clinics and prevention of other oral conditions.

Implications for Interprofessional Practice

1. Increase interprofessional oral health education within diabetes self-management education curricula.
2. Build relationships between CDEs and dental professionals to develop

interprofessional collaborations and improve health outcomes.

Keywords: Oral health, oral disease, interprofessional practice, certified diabetes educators

MANUSCRIPT

This manuscript will be submitted to *Health and Interprofessional Practice*.

Introduction and Literature Review

In 2017, according to the Centers for Disease Control (CDC), 30.3 million adults in the United States were living with diabetes and 84.1 million adults had prediabetes (1). Prediabetes is defined impaired fasting glucose or glucose tolerance (2), whereas diabetes is a metabolic disease characterized by hyperglycemia with different mechanisms (3–5). Persons living with diabetes represents 9.4% of the population and is expected to rise 42% by 2030 (6,7). In 2016 11.4% of the population in Georgia had diabetes, making the top ten list of states with the highest Type 1 or 2 diabetes mellitus population (1).

A way to maintain of diabetes is to control glycemic or blood sugar levels. This can be measured through Hemoglobin A1c (HbA1c) tests which measures the average blood sugar levels over a two to three month interval (10). It is currently recommended for patients with diabetes to have an HbA1 of less than 7% and is considered poorly controlled if it is greater than 8% (10–13). Poor glycemic control with diabetes is associated with numerous systemic complications including retinopathy, nephropathy, neuropathy, peripheral vascular disease and cardiovascular disease (14–19). In addition to the systemic complications, numerous oral complications are associated with poor blood sugar control including: gingivitis, periodontitis, oral candidiasis, burning mouth syndrome, lichen planus, abnormal wound healing, multiple carious lesions, and xerostomia (19–23). In 2012, 46% of American adults were found to have periodontitis with about 9% of those with severe periodontal disease (24). It is shown that about one-third of people living with diabetes have severe periodontal disease (19). Severe

periodontal disease can also impact diabetes. Uncontrolled periodontal disease can decrease glycemic control in patients with diabetes through the increase in inflammatory cytokines (25–28). Without treatment for periodontal disease the chronic inflammation will remain present and continue to place strain systemically on the metabolic system (29). With life changing complications possible, it is important to address, treat, and prevent these conditions.

The dental community must be involved with patient management alongside of the medical field and can even play a vital role in identifying those patients who have undiagnosed diabetes (30) by providing chairside screenings and referrals. With the possibility of serious medical complications from diabetes, interprofessional communication is key. There is a lack of true comprehensive care for patients due to the deficiency of interprofessional collaboration. This lack of coordinated care results in increased costs (31), poor patient outcomes (30), and increase in diabetes across the population (32,33). There are collaborative models of care to address these concerns.

Interprofessional collaborative practice (IPCP) has been an increasingly recognized model among all areas of health care to improve access to care and health outcomes. The growing evidence on the relationship between poorly controlled diabetes and periodontal disease indicates that an interprofessional approach to diabetes management is needed to minimize co-morbidities. Yet, despite the call to action for collaborative care between oral and medical providers from the Surgeon General (35), there are few collaborative efforts that include the dental profession (39).

The bi-directional relationship between diabetes and periodontal disease is an important focus for medical and dental teams when considering chronic disease

management (36,39,41,43–46). This relationship requires knowledge of both diseases from all professionals interacting with patients diagnosed with diabetes or periodontal disease, including Certified Diabetes Educators (CDEs). Certified Diabetes Educators are various health care and non-health care professionals with specialized training to provide support and education to patients with diabetes (47). CDEs with formal healthcare training have reported inadequate training in oral health resulting in their inability to communicate the importance of oral health to their patients (48,49,51–53). Lopes et al. found that 79% of CDEs had no oral health training and only 10% had training post-certification on oral health education (11). This lack of oral health training negatively impacts outcomes of patients with diabetes when considering the effects of periodontal disease on diabetes control.

Periodontal Disease and Diabetes

The bidirectional relationship between diabetes mellitus and periodontal disease has been well established (36,39,41,43–46). Periodontal disease is a local inflammatory process caused by pathogenic bacteria in which the host response becomes a major factor in progression and management (5,17,27,28,54–56). Type 2 DM is a metabolic disease characterized by hyperglycemia with different mechanisms (3–5). The local inflammation and toxins produced by bacteria associated with periodontal disease can move into the system increasing hyperglycemia and insulin resistance (5,14,27,28,33,44,57).

Conversely, diabetes can cause both microvascular and macrovascular complications in the periodontium causing damage that can impair healing in the periodontium and inhibit renewal of periodontal tissues (5,12,29,56,59,60). For these

reasons, Type 2 DM is considered a risk factor for periodontal disease (25,29,56,60).

The exaggerated inflammatory response and impaired host immune defense in diabetes can increase periodontal inflammation, which in turn can impair glycemic control, demonstrating the bidirectional relationship of both diseases.

Dental Caries and Diabetes

Dental caries can be problematic for any patient, but for patients with diabetes contributing factors are complicated (59,62). Xerostomia, or dry mouth, is one complication associated with diabetes that can increase the incidence of dental caries (62,63). It begins by the reduction of saliva which leads to a decrease in antimicrobial protection and an increase in the caries process (63). Severe dental caries can lead to pain, infections, and tooth loss (66). Loss of teeth can further contribute to difficulty in managing diabetes through proper diet due to loss of proper mastication (67).

Other Oral Conditions and Diabetes

There are other lesser known complications of diabetes that can have an impact on a patient's oral cavity as well. These complications include, fungal infections, oral mucosa lesions, taste and neurosensory disorders, and delayed wound healing. All of these conditions can reduce the ease of managing diabetes due to poor nutritional choices (26).

Educational Intervention/Curriculum

Research supports educational and behavioral interventions for patients with diabetes to improve clinical outcomes (45,76,82,83,86). Educational interventions include individual and group self-management classes that include information regarding the diabetes disease process, prevention, maintenance, and complications. The most

common topics covered in educational interventions are diet, exercise, medication, and blood glucose monitoring. It has been shown that educational and behavioral interventions decrease HbA1c (82). While there has been a satisfactory amount of research completed on general educational interventions and clinical outcomes, there is little research on the effect of oral health educational interventions in the diabetic population.

Medical professionals' oral health training and knowledge

The literature suggests the need for oral health education in the medical community and interdisciplinary collaboration in the care of patients with diabetes (88). Despite growing evidence that persons with diabetes have a higher risk for chronic periodontitis and vice versa (69), oral health lacks attention during diabetes counseling and treatment (11,49). Since patients with chronic illnesses are more likely to visit a physician than a dentist (70), dental professionals rely on the referral of at-risk patients from the medical community, especially if a patient has no dental home or a severe dental condition.

It was shown by Al-Habashneh et al. that although medical providers lack the knowledge of the oral-systemic connection, (71) CDEs generally have more knowledge than other medical providers (72). Al-Habashneh et al. found only half of those physicians thought oral health was a concern for diabetic patients and routinely advised their diabetic patients to visit a dental professional regularly or for a periodontal evaluation (71). Further, two-thirds of the physicians did not think maintaining oral health could affect glycemic control (71).

Diabetes Management

Currently, persons with diabetes have numerous health-related resources available to them. One of the most important is a diabetes self-management program (74–76), which focuses on disease management strategies and prevention of co-morbidities.

Effect of Diabetes Self-Management Programs

The evidence supports a positive correlation between diabetes self-management education (DSME) and diabetic clinical health outcomes (80–83). Dunning reported that most diabetic self-management classes, educational programs or initial assessments do not include information on periodontal disease (20) despite the evidence which shows that persons with poor glycemic control who participate in DSME programs experience a statistically significant decrease in HbA1c (75,83,84). Oral health education is important in self-management of diabetes, but oral health education is not included within the DSME curriculum. The literature supports oral disease, specifically periodontal disease, as a risk factor for diabetes. Further, the evidence shows oral health is key to diabetes management and the purpose of this study is to assess the current knowledge of the oral health knowledge in CDEs.

The purpose of this study was to survey CDEs living in Georgia to determine their current knowledge and clinical practice behaviors toward oral health education. Behaviors of the CDE that were measured include the type of interaction and time spent with the patient, the type of oral health questions and education discussed, and how and where patients were sent for dental referrals.

Methods

Participants

This study used a convenience sample of registered CDEs in the State of Georgia in 2017. CDEs certified in Georgia were recruited via mail from an address list from the National Certification Board for Diabetes Educators. At the time of the study, there were 480 Georgia CDEs who were registered in Georgia. To perform a power analysis at the .05% level of significance an ideal sample size needed was 214. This study was approved by the University of Minnesota Institutional Review Board. Inclusion criteria were the ability to efficiently read and write in English and actively practicing. Exclusion criteria were any non-practicing or non-active certification.

Procedures

This study was conducted in a non-clinical setting in Georgia using electronic and paper correspondence. Georgia was chosen due to the lack of data from Georgia CDEs and being one of the top 10 states for persons with diagnosed diabetes mellitus (1,6). Supportive personnel included five CDEs from Georgia who are members of the American Association of Diabetes Educators (AADE) for the pilot survey and a statistician for data analysis. Data collection was completed by the primary investigator.

The participants were contacted via mail through mailing list from the National Certification Board for Diabetes Educators and sent an information letter, cover letter, survey, and return envelope with postage. Participation in this study was voluntary and not anonymous. Information was included in the letter for instructions to complete an online survey. A follow-up postcard was sent four weeks later to remind the participants to complete the online survey or send in the physical survey. The remaining subjects

were sent an email. Responses were not utilized in this study if received after two months. All participants were entered into a randomized drawing for one of four \$25 gift cards to Amazon.com.

Data Collection Instrument

A 31-item survey (see Appendix C) was modified from a previously developed survey by Lopes et al. (11). Permission was granted by the authors to use the survey. Lopes et al.(11), validated the content of the survey by using a multidisciplinary team to create the survey and pilot test with five practicing CDEs, similar to the study target population. Similarly, content validity was established for this study's survey by the five CDEs. Questions in the modified survey used in this study included seven questions on practice setting, five on the oral disease and systemic health relationship, seven on practice behaviors regarding diabetes and oral health, seven on diabetes educator oral health education, and five on demographics. Survey items included Likert-type questions, multiple choice, true/false, and yes/no checklists. The survey was changed and adapted once feedback was received from the pilot survey.

Data Analysis

Descriptive statistics were used to summarize the survey data. Fisher's exact tests were used to test for associations between questions of interest. T-tests or analysis of variance was used to compare mean years as an educator (q4) between question responses. P-values less than 0.05 were deemed statistically significant. SAS V9.3 (SAS Institute, Inc., Cary, NC) was used for the analysis.

Results

Personal and Practice Demographics

Of the 330 CDEs who were sent surveys, 78 responded of which 72 (92%) were practicing CDEs, for a response rate of 24% (see Table 1). All respondents (n=78) were women with 47% between the ages of 56-65 (n=33) years and 44% between 36-55 years old (n=32). Represented professions included nurses (n=33, 46%) registered dietitians (n=32, 44%), nurse practitioners (n=5, 7%), and other professions (n=2, 3%). Sixty five percent of respondents (n=50) reported spending over 16 hours a week working with patients with diabetes and had an average of 25 years of diabetes education experience.

Oral Health Knowledge

Overall the participant's knowledge of oral health was high, with the exception of identifying tooth decay as a risk factor for periodontal disease. Ninety one percent (n=65) of CDEs identified periodontitis as a worse condition than gingivitis and 66% (n=47) acknowledged bleeding gums as the first sign of periodontal disease. One percent of respondents (n=1) considered periodontal disease as a complication of poor diabetes control and 93% of participants (n=66) identified periodontitis as a complication of diabetes. Figures 1, 2, and 3 illustrate results for oral health knowledge.

Practice Behaviors

Table 2 shows results for practice behaviors. Practice behaviors reported by respondents regarding oral health and diabetes showed 33% (n=24) do not discuss oral health with their patients. Of the 49% (n=34) of CDEs who referred their patients to a dentist within the last year, 72% (n=24) sent less than 25% of their patient population. Referrals were given when there was a patient concern (n=35, 97%), clinician concern

(n=33, 94%) or as a component of a health promotion/preventative care plan (n=31, 86%). Of the CDEs who did not refer their patients, 31% (n=20) stated they had a lack of oral health training and/or 55% (n=36) stated their patients' finances were a barrier to referring them for dental care.

Education and Training

Forty three percent (n=29) of the CDEs surveyed stated they received formal oral health education and of those, 29% (n=8) had a dental school affiliated with their university or college. Sixty three percent (n=17) of CDEs rated the quality of their oral health education as good or excellent. Thirty nine percent of respondents (n=26) reported receiving additional oral health education/training post-CDE certification. The training varied from continuing education course/lecture (n=43, 47%), online course (n=4, 6%), or professional journals (n=12, 17%). Training included general oral health information (n=17, 24%), the link between oral and systemic health (n=16, 22%), and periodontal disease and diabetes (n=19, 26%). Figure 4 illustrates data on CDEs' oral health education and training. Oral health knowledge showed to be statistically significantly higher ($p = 0.0448$) with more years of performing diabetes education services when compared to formal oral health education received alone.

Discussion

The purpose of this study was to survey CDEs living in Georgia to determine their current knowledge and clinical practice behaviors toward oral health education. The strong oral systemic link present with diabetes and oral health makes it imperative to research any possible gaps in medical professional training and patient education of oral health.

Behaviors of the CDEs measured included the type of interaction and time spent with patient, type of oral health questions and education discussed, and how and where patients are sent for dental referrals. Results showed oral health knowledge was high with the exception of dental caries and periodontal disease as complications of poor diabetes control. CDEs in this study failed to identify dental caries as a complication of diabetes, but rather identified dental caries as a risk factor for periodontal disease. Severe dental caries can be devastating to the oral and overall health of a patient, causing pain and interference with mastication, leading to poor nutrition.

Understanding the causes and risk factors of periodontal disease is important for all health professionals to know to help provide patients with the best treatment. Severe periodontal disease can contribute to poor glycemic control which can worsen diabetes and increase health complications. Prevention, treatment, and maintenance of periodontal disease should be a primary focus for CDEs and dental professionals. It is important that all oral complications of diabetes are communicated during the CDE's formal educational training. Simple oral health education provided by CDEs can help in prevention and control of periodontal disease, caries, and other oral diseases for patients in all stages of diabetes disease management.

Periodontal disease is not the only area of oral health that CDEs lack in knowledge. Additional oral health education should be explored as xerostomia can be a manifestation of diabetes and a risk factor to dental caries and oral candidiasis. This lack of education of dental caries could be due to the amount of information that must be covered during appointments or sessions with the patients, as a majority of respondents from the survey stated they had a specific set of questions they ask patients during the

appointment. This finding parallels previous studies that noted time limitations as a barrier to addressing oral health issues, preventing oral health education or discussions (48,49).

Rates for dental referrals were low and the overwhelming response for reasons to not refer included the CDE's perceived lack of oral health training, their perceptions of patient's finances, and no association with a dental office/clinic. Similar to the Lopes et al. (11) study, it was found that CDEs had a high dental knowledge, but they do not feel confident in their abilities or training to refer to dentists despite rating the quality of their oral health education as good or excellent. These barriers can be perceived as either a low value placed on dental care by the CDE or assuming the patient faces financial or access barriers to dental services. A reported lack of post-certification continuing education covering oral health may be an opportunity to further CDEs' knowledge of oral disease through continuing education. Interprofessional collaborations between CDEs and dental providers may be one solution to filling the oral health knowledge gap of CDEs and lack of referrals. Dental professionals can help develop resources to educate patients and help them connect with dental providers who offer affordable dental care (35,88). Since the overall goal of DSME and CDEs is to improve the quality of life and clinical health outcomes, collaborative care with the dental profession is something that should be supported. By referring patients to the necessary dental and medical professionals, the patients are able to receive the treatment they need. Periodontal therapy can help control periodontitis and its associated inflammatory response, leading to improved glycemic control (26,89) and lower serum levels of TNF- α and CRP (90) in patients with Type 2 DM.

Most CDEs surveyed were also healthcare professionals such as nurses and registered dietitians. Forty three percent (n=29) of respondents reported receiving formal oral health education, despite 72% (n=20) of them attending a college or university associated with a dental school. Since the average length of years working with patients with diabetes was 25 years it is possible oral health education was not initially taught to the CDEs. Interprofessional education (IPE) has not been taught or required in health profession schooling until recently (91), so this participant population may have never had exposure to IPE or interprofessional collaborative practice (IPCP). H K Yuen et al. (49) showed CDEs whose programs included oral health in the curricula were more likely to discuss oral health during patient appointments. This data supports the need to incorporate more oral health education and IPE into traditional medical profession programs. Nurses and registered dietitians already work with other health care professionals (53), however adding IPE with oral health professionals into their curriculum can increase post-licensure participation in IPCP and give the future diabetes educator the confidence and skills to reach out and work with dental professionals. Poudel et al. completed a systematic review regarding diabetes educators and oral health training showing successful collaborations, however an increased presence of collaborations are needed (53). There is an opportunity to focus on integrating oral systemic health and interprofessional education in all pre-licensure health profession programs.

As Smiles for Life provides curriculum for IPE, there is an opportunity for dental professionals to create a program for IPCP. Creating a framework for how IPCP should look for CDEs and oral health professionals could help catapult collaborations. When

there is no example present it can create a barrier to implementation. Another useful resource to aid in collaboration would be creating a toolkit. The toolkit could offer education resources for patients and providers, dental and medical clinics for patients to receive services, financial support information, and other local resources available to patients. Continuing education courses provide a consistent way for health care professionals to meet and receive the most up-to-date evidenced-based data on patient care. Educational courses for the CDE could be taught by dental professionals and visa versa, this can further open the lines of communication and understanding for both professionals.

It is important to note, this study did not show statistical significance between formal oral health education training and oral health knowledge but rather a positive relationship between number of years working as a CDE and increased oral health knowledge. This could convey the thought that the longer the CDE works with patients with diabetes the more knowledge they receive through collaborations, continuing education, or clinical practice. It is difficult to correlate lack of oral health training in schools as the lack of knowledge since the average length of practice was 25 years and much has changed within IPE and oral systemic knowledge.

This study has several limitations. First, it was not asked if IPE was incorporated into the schools attended by the participants. This could lead to assuming the participants do not collaborate because they were not taught how. No question was asked regarding an existing dental professional on the diabetes management team. Other limitations of this study include the convenience sampling strategy and self-reporting. This type of strategy can be less representative of the population and can have a higher risk of bias.

Sampling of CDEs in Georgia will not represent the whole population of CDEs, thus the results of the study cannot be applied to the entire CDE population. As a survey study the results can only be used to increase information on the knowledge and behaviors of CDEs but cannot be used for causation of lack of oral health knowledge and behaviors decreasing diabetes health outcomes.

An aging population, increase in chronic diseases such as diabetes and periodontal disease, and burdened healthcare system in the United States has made IPCP more attractive. While collaborative practice is an ingenious concept, it can only be effective if all parties involved are highly trained in collaborative care. For CDEs and dental professionals this could involve dental professionals training CDEs in oral conditions, oral health education, and the importance of dental care referrals and resources for dental care and vice versa for non-CDE medical professionals. We will need CDEs willing to leave their silos and introduce and guide their patients into the dental arena. It is apparent there is a need to increase oral health education within diabetes self-management education curricula, build relationships between CDEs and dental health professionals to develop interprofessional collaborations and improve health outcomes, and provide patients and providers with resources to help aid in access to dental care.

Further research should focus on the best way to educate and support CDEs on oral health conditions. In conjunction with education, increasing confidence in CDEs to discuss oral health and provide the resources for patients. From future research, identifying what resources would be the most beneficial for CDEs can also help improve patient relations. It could vary from longer appointment times, continuing education,

collaborative sessions and partnerships with dental professionals, or referral systems with dental clinics.

Another area of research to be explored, is to conduct one-on-one interviews and focus groups to gather more in-depth detail of CDE knowledge and practice behaviors. This information can help focus which collaborative efforts would be most effective. As this study was quantitative, it would be recommended that a qualitative study be conducted focusing on patient health outcomes from CDE intervention.

Conclusion

This study assessed the knowledge and practice behaviors of oral health from CDEs in Georgia. CDEs have a high oral health knowledge and understand the importance of oral health and collaboration but limit dental referrals based on their perception of patients' ability to pay for dental care, CDE confidence levels in oral health, and the lack of association with a dental office/clinic. Limited oral health education is provided to CDE patients during DSME visits. Oral health education needs to expand to be more inclusive of CDEs and continuing education programs.

SECTION 4

TABLES

Table 1**Characteristics of the Study Sample**

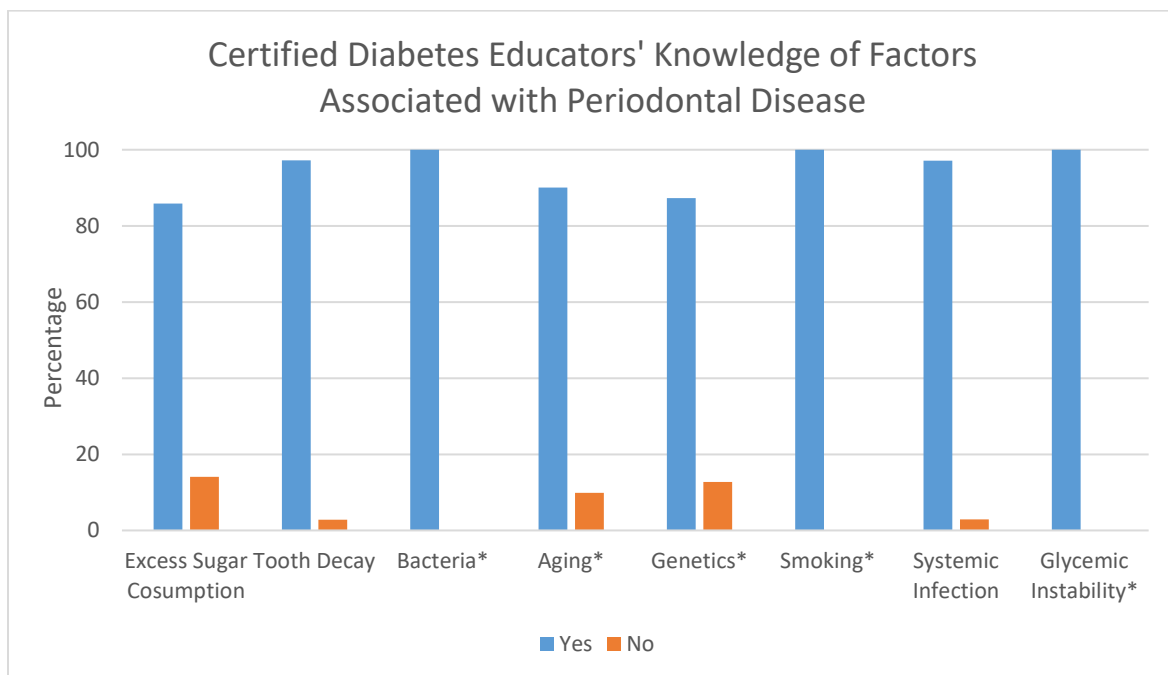
Sample (N=72)	n (%)
Provider Type	
Nurse	33 (45.8)
Registered Dietician	32 (44.4)
Pharmacist	3 (4.2)
Nurse Practitioner	5 (6.9)
Other	2 (2.8)
Age	
26-35	3 (4.3)
36-45	12 (17.1)
46-55	19 (27.1)
49-55	1 (1.4)
56-65	33 (47.14)
>65	2 (2.86)
Gender	
Male	0 (0)
Female	70 (100)
Last dental visit with periodontal evaluation	
>1 and <2 years	3 (4.3)
>6 months and <1 year	6 (8.6)
<6 months	31 (87.1)
Personal oral health	

Excellent	38 (54.3)
Good	31 (44.3)
Fair	1 (1.4)
Periodontal disease diagnosis	
Yes	12 (17.1)
No	57 (81.4)
Unsure	1 (1.4)

Table 2**Practice Behaviors of CDEs with Oral Health**

Sample (N=72)	n (%)
Oral health related questions to the patient	
Yes	27 (38)
No	24 (33.8)
Occasionally	20 (28.1)
Referral of patient to dental office in the last year	
Yes	34 (48.6)
No	36 (51.4)
Reason for referral	
Patient concern	35 (97.2)
Provider concern	33 (94.3)
Patient health promotion program	31 (86.1)
Lack of dental providers	8 (24.2)
Rarely refer	10 (28.6)
Reason for not referring	
Lack of oral health training	20 (30.8)
Patient finances	36 (55.4)
Lack of dental providers	7 (10.8)
No association with dental office	37 (56.1)
Unsure of when to refer	18 (27.7)

FIGURES

Figure 1

*** indicates correct answer**

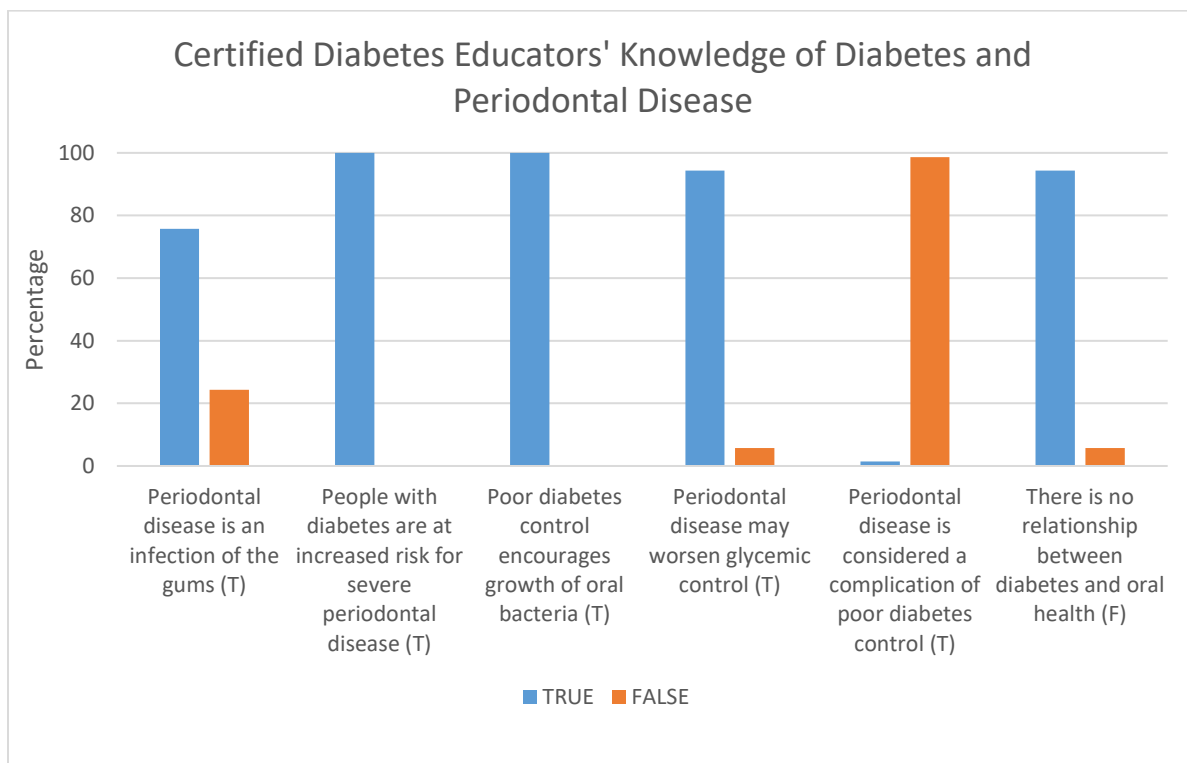
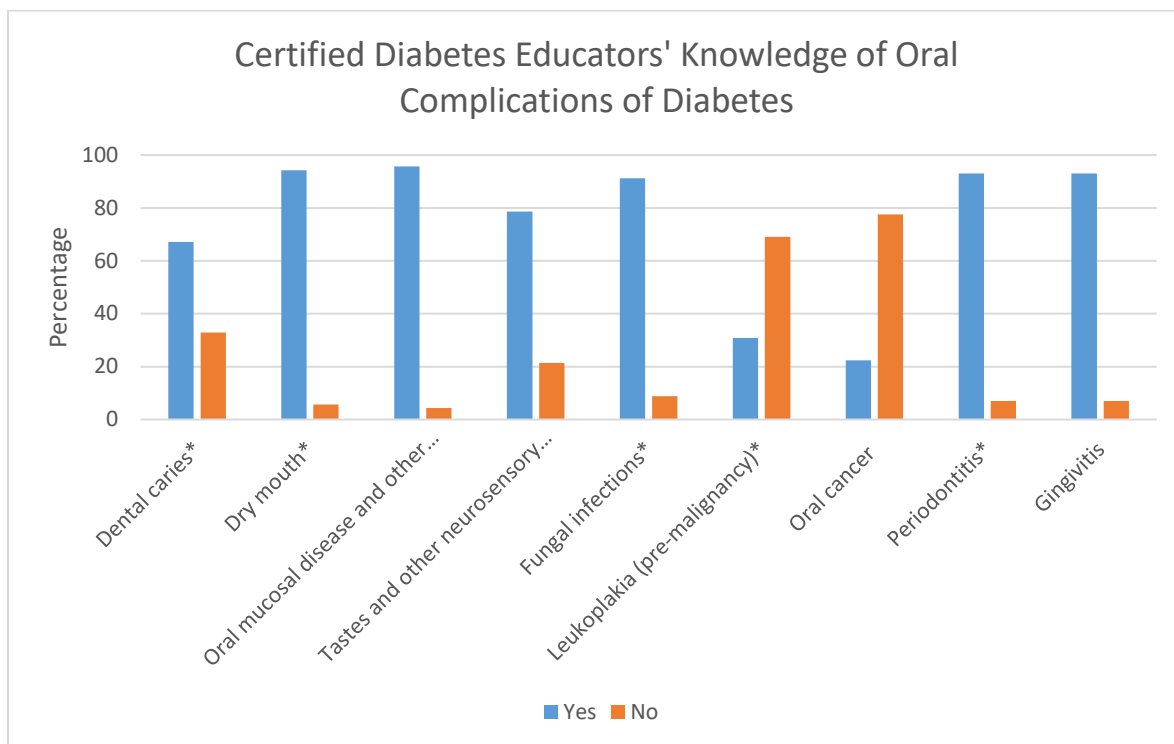
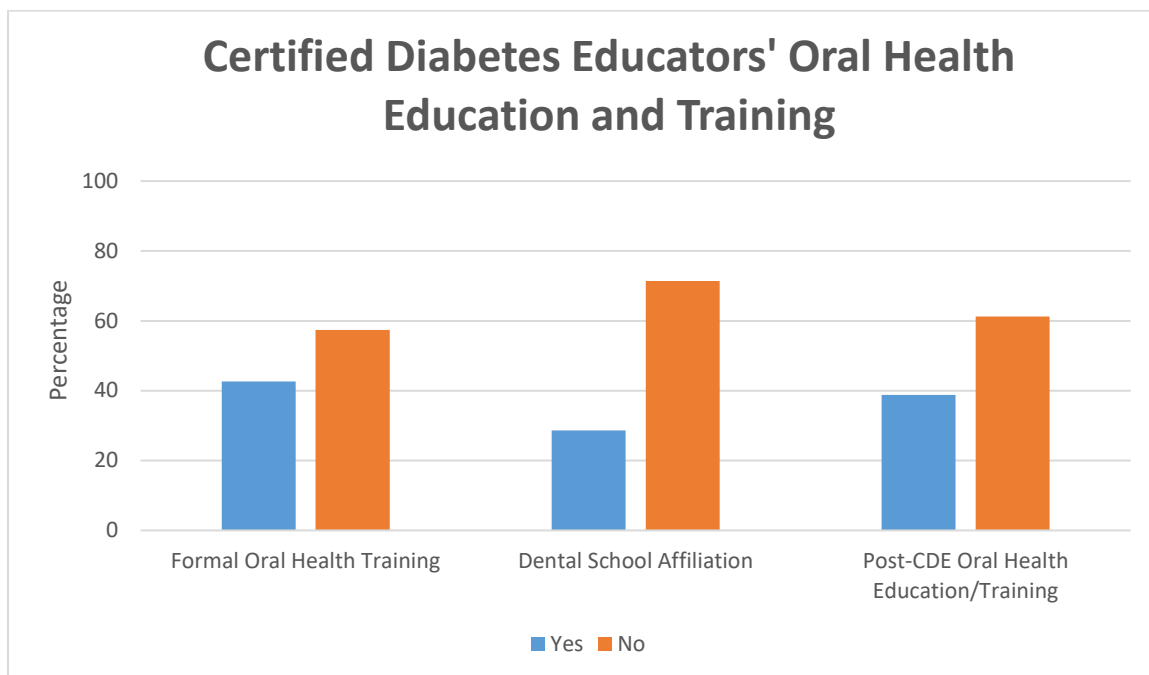
Figure 2

Figure 3

***indicates a complication**

Figure 4

SECTION 5

PRACTIAL APPLICATION

Practical application of research outcomes

The extensive research and evidence of the bi-directional link of oral health and diabetes gives dental and medical professionals a reason to seek interprofessional collaboration. CDEs and dental professionals individually have the ability to speak with patients regularly to guide them into improved health outcomes by strategically discussing the oral systemic link and providing resources for the patient. There are few professions in which this regular patient interaction is possible. Diabetes and periodontal disease mechanisms overlap making understanding each condition easier and essential to patient health. Both dental professionals and CDEs have an educator and health care provider mindset which include critical thinking and evidence-based decision-making skill sets. So, when new evidence and practices arise, the necessary changes can be disseminated to the patient. Building interprofessional relationships will only enhance the patient experience and health outcomes by creating more confidence in health care professionals to feel comfortable discussing oral health and referring patients for dental services.

IPE is already present in many health professions programs, but dental professionals need to ensure they have a seat at the table. A recommendation is to increase oral health education provided by dental professionals within diabetes self-management curricula and health profession programs. Another recommendation is to add a dental professional to every diabetes management team, since oral health education and training are limited with non-dental team members. If we allow each team member to practice what they specialize in, we can greatly improve patient care. We know patients

struggle with referrals in regards to finding a dental professional and affordable dental treatment. Just as diabetes and periodontal disease is a two-way street so is the interprofessional relationship. It is important for dental professionals to use the training provided in pre-licensure education to help in the identification and prevention of diabetes through nutritional counseling and chair-side diabetes screenings and referring to medical professionals when there is a suspicion of disease. Dental professionals can create continuing education courses and lectures to ensure vital and correct information is being received by the audience who needs it the most. This will not only help patients but can also help increase the voice of dental professionals in the medical community.

Prevention is key for any disease or condition; in the case of diabetes and oral disease management it is even more crucial. It is known that to treat disease early is not only beneficial for the patient's health but finances as well. Patient dental referrals by the CDE are deficient due to the perceived lack of patient finances and access to dental providers. Resources and partnerships with local dental offices and clinics can be developed for CDEs and their patients to help reduce those barriers. CDEs can also assist the dental community by encouraging prevention of dental diseases along with treatment as well. It is important CDEs look past financial barriers and refer all patients who need dental care by utilizing dental screenings and increasing provider oral health education.

SECTION 6

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SECTION 7

APPENDICES

APPENDIX A: Cover Letter

515 Delaware Street
S.E. Minneapolis, MN
55455

Dear Certified Diabetes Educators,

The purpose of this survey is to assess the current knowledge and practices of oral health among certified diabetes educators in Georgia. In order to examine these clinical practice topics, the University of Minnesota is asking for your cooperation in the completion of the enclosed questionnaire. **It should take no longer than 20 minutes to complete.**

The National Certification Board for Diabetes Educators has identified you as a practitioner with current certification in Georgia. We are seeking your input regarding the knowledge and experience with oral health knowledge and education you may be using with patients.

Your participation is voluntary, but please understand that your input is very important. The records of this study will be kept confidential. The code number on the survey is used for tracking purposes only. When the data is published it will include combined data only.

Thank you in advance for your cooperation. Please feel free to contact me with any questions you may have at 480-516-4247 or mckun004@umn.edu.

Sincerely,

Kendra McKune,
RDH, BS Graduate
Student
University of Minnesota, Division of Dental
Hygiene 515 Delaware Street S.E.
Minneapolis MN 55455

APPENDIX B: Consent Letter**INFORMATION SHEET FOR RESEARCH****Georgia Certified Diabetes Educators' Knowledge and Practices of
Oral Health Education**

You are invited to be in a research study of current oral health knowledge and practices used by Georgia Diabetes Educators. You were selected as a possible participant by Georgia chapter of the American Association of Diabetes Educators as a practicing Certified Diabetes Educator. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

The study is being conducted by Kendra McKune, BSDH, MSDH Candidate, University of Minnesota, School of Dentistry as part of the thesis coursework.

Procedures:

If you agree to be in this study, you would be asked to do the following:

Complete the attached survey online which should take approximately 20 minutes

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.

Voluntary Nature of the Study:

Participation of this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota or the American Association of Diabetes Educators.

Contacts and Questions

The researchers conducting this study are: Kendra McKune and Patricia Lenton. You may ask any questions you have before completion of the survey. If you have questions later, you are encouraged to contact them at:

Kendra McKune

University of Minnesota

Mckun004@umn.edu

Division of Dental Hygiene

Phone: 480-516-4247

515 Delaware St

Minneapolis, MN 55455

Patricia Lenton

Lento001@umn.edu

612-624-9669

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, MN 55455; (612-625-1650).

You will be given a copy of this information to keep for your records

APPENDIX C: Survey Questions

Practice Setting

1. Are you a Certified Diabetes Educator (CDE) who currently provides care to patients with diabetes?

- a. Yes
- b. No

IF NO, STOP HERE. Thank you for your time!

2. What type of healthcare provider are you?

- a. Nurse
- b. Registered dietician
- c. Physician
- d. Pharmacist
- e. Other (please specify):

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

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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)

- a. General Practice
- b. Specialty Practice (specify)
- c. Public health/government
- d. Hospital practice
- e. Independent consultant
- f. Other (specify)

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

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

	Yes	No
Diabetes Self-Management Education (ADA approved)		
Education and counseling services (not ADA-approved)		
In-home diabetes education		
Telephone care management		
Medical nutrition therapy		
Clinical (medication management)		

Providing education to other healthcare professionals		
Research		
Dental Screenings/oral health information		

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

- a. <5 hours
- b. 5-10 hours
- c. 11-15 hours
- d. 16-20 hours

Oral Disease and Systemic Health

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

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

9. Which condition is worse?

- a. periodontitis
- b. gingivitis

10. Which of the following is the first clinical sign of periodontal disease? (SELECT ONLY ONE):

- a. bad breath
- b. bleeding gums
- c. cavities (holes in teeth)
- d. teeth that move around (are mobile)
- e. plaque on teeth

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

	True	False
Periodontal disease is an infection of the gums.		
People with diabetes are at increased risk for severe periodontal disease.		
Poor diabetes control encourages growth of oral bacteria.		
**Periodontal disease may worsen glycemic control.		

Periodontal disease is considered a complication of poor diabetes control.		
**Treatment of periodontal disease may improve glycemic control.		

12. Which of the following do you believe to be a complication(s) and/or oral manifestation of diabetes?

(CHECK YES OR NO FOR EACH ITEM):

	Yes	No
Dental caries		
Dry mouth		
Oral mucosal disease and other oral infections		
Tastes and other neurosensory disorders		
Fungal infections		
Leucoplakia (pre malignancy)		
Oral cancer		
Periodontitis		
Gingivitis		

Practice Behaviors Regarding Diabetes and Oral Health

13. Are there a specific set of questions you ask your patients at every encounter?

- a. Yes
- b. No

14. Do you discuss oral health when counseling patients with diabetes?

- a. No (please skip to question 17).
- b. Yes
- c. Occasionally

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

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16. Have you referred a patient with diabetes to a dental office or clinic within the last year?

- a. Yes (please skip to question 19)
- b. No

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

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

Other (please specify):

18. 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.

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19. When do you refer patients to a dental clinic? (CHECK YES OR NO FOR EACH ITEM) 6

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

Diabetes Educator Oral Health Information

20. Have you received any formal oral health education (didactic or curricular) as a nurse, registered dietitian, etc.?

- a. No— (please skip to question 23)
- b. Yes

21. If yes, how would you rate the formal oral health education you received?

- a. Excellent
- b. Good
- c. Fair
- d. Poor
- e. Very poor

22. Was there a dental school affiliated with the university or college from which you received your professional training?

- a. Yes
- b. No

23. In preparing for your CDE certification, did you receive any oral health information or education through any of the following mechanisms? (CHECK ALL THAT APPLY)

- a. Preparatory seminars
- b. Study guides
- c. Review books
- d. Other (please specify):
- e. Did not use any of the above

24. Since receiving your CDE, have you had any formal oral health education or training?

- a. No—please skip to question 28
- b. Yes

25. What type of oral health education have you received? (CHECK ALL THAT APPLY).

- a. General information about healthy mouth and gums
- b. Information about link between oral and systemic health
- c. Information about periodontal disease and diabetes
- d. Other (please specify):

26. How did you receive the oral health education? (CHECK ALL THAT APPLY).

- a. CE course
- b. Online course
- c. Professional journal
- d. Lecture
- e. Other (please specify):

Demographics

27. Select your age range:

- a. <25
- b. 25-35
- c. 36-45
- d. 46-55
- e. 56-65
- f. >65

28. Gender

- a. Female
- b. Male

29. When was the last time you received dental care which included an assessment of your gums from a dentist or dental hygienist?

- a. \leq six months
- b. >6 months and <1 year
- c. >1 and <2 years
- d. ≥ 2 years
- e. never

30. Have you ever been told you have periodontal disease?

- a. yes
- b. no
- c. maybe

31. How would you rate your oral health?

- a. Excellent
- b. Good
- c. Fair
- d. Poor
- e. Very poor