INCORPORATING ORAL-SYSTEMIC EVIDENCE INTO PATIENT CARE: PRACTICE BEHAVIORS AND BARRIERS OF NORTH CAROLINA DENTAL HYGIENISTS

Kathryn P. Bell

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Approved By:
Ms. Rebecca Wilder, R.D.H., M.S.
Dr. Ceib Phillips, M.P.H., Ph.D.
Dr. Steven Offenbacher, D.D.S., Ph.D., M.M.Sc.
Dr. David Paquette, D.M.D, M.P.H., D.M.Sc.

ABSTRACT

Kathryn P. Bell
Incorporating Oral-Systemic Evidence into Patient Care: Practice Behaviors and Barriers of North Carolina Dental Hygienists
(Under the Direction of Ms. Rebecca S. Wilder)

The purpose of this survey research was to determine what practice behaviors are prevalent among North Carolina (NC) Dental Hygienists (DH) regarding the incorporation of oral-systemic evidence into practice as well as perceived barriers to implementation. A questionnaire was developed to survey 859 dental hygienists responding to mailed invitation to participate. Survey data were analyzed using descriptive statistics and Chi-square analysis. Fifty percent of DH are extremely likely to refer patients to a medical provider for follow up assessments. Conditions DH are likely to discuss with patients include tobacco use (89%), pregnancy (84%), and genetics (79%). Significant barriers to implementing oral-systemic evidence include lack of time (52%), concern over legal risks (44%), and lack of education (27%). The findings indicate that NC DH are implementing some aspects of oral-systemic evidence into practice but could take a more active role if they had more allotted time, education and training.

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LIST OF ABBREVIATIONS

ADHA	American Dental Hygienists' Association
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CDE	Certified Diabetes Educator(s)
CHD	Coronary Heart Disease
CVA	Cerebrovascular Accident
CVD	Cardiovascular Disease
DH	Dental Hygienist(s)
EBP	Evidence Based Practice
GDP	General Dental Practitioner(s)
HDL	High-Density Lipoprotein
HIV	Human Immunodeficiency Virus
IPE	Interprofessional Education
LBW	Low Birth Weight
LPS	Lipopolysaccharide
NC	North Carolina
PTB	Pre-term Birth

INTRODUCTION

Periodontal disease is a condition affecting the gingival tissues and supporting structures of the periodontium. Gingivitis and periodontitis are included under the broader term "periodontal disease," and if left untreated periodontal disease can lead to eventual tooth loss.[1] It is estimated that approximately 75% of adults in the United States have gingivitis, and about 35% have periodontitis.[2] Periodontal disease is an infection of the structures supporting the teeth, with bacterial colonization of the teeth and gums. This bacterial colonization leads to inflammatory and immunologic responses that can lead to periodontal destruction. Gram-negative, anaerobic bacteria in the sub-gingival space typically induce host response.

In recent years, there has been evidence of an association between periodontal disease and several other conditions, such as diabetes, [3-6] cardiovascular disease (CVD), [7-12] cerebrovascular accidents (CVA) such as stroke,[13,14] respiratory diseases, [15-18] and adverse pregnancy outcomes such as preeclampsia, low birth weight (LBW)and pre-term birth (PTB).[19 20 21-26] In addition to the conditions listed above, other associations are actively under investigation, including obesity, [27,28] kidney disease, [29,30] cancer, [31,32] and metabolic syndrome.[33,34] The connection between oral health and systemic health has been well established, and the evidence regarding this connection provides insight into systemic disease processes and complications.

LITERATURE REVIEW

Periodontal Disease and Systemic Health

In 2000, the report titled "Oral Health in America" reinforced the view that oral health should be included as a piece of a larger view of systemic health.[35] Periodontal disease has been linked with several systemic health issues and diseases. One of these diseases is diabetes mellitus, which demonstrates a bi-directional relationship with periodontitis.[19] There is an existing body of evidence that supports a strong relationship between diabetes and periodontal disease, indicating that diabetes is a risk factor for periodontal disease. [3-6,36,37] The level of glycemic control appears to be a key component of this relationship.[38-41] Poor glycemic control places diabetic patients at greater risk for periodontal destruction, and these patients are more likely than patients with well controlled diabetes to develop severe periodontitis.[42,43] The periodontium experiences constant exposure to bacteria in the plaque biofilms that colonize the oral cavity. This continual exposure to bacteria acts like incessant wounding.[19] Patients with diabetes mellitus have altered immune function, including changes in the function of neutrophils, monocytes, and macrophages. Neutrophil adherence, chemotaxis, and phagocytosis are often impaired and, because of this lowered immune function, bacterial infection of the periodontal pocket persists and can significantly increase the amount of periodontal destruction.[40] Also, patients with diabetes will demonstrate an increased production of pro-inflammatory cytokines and mediators, which are present in the gingival crevicular fluid, which contribute to periodontal destruction.[44]

Periodontal disease, in addition to having a systemic effect on diabetes, can also influence CVD and CVA. Several studies have demonstrated a correlation between periodontal disease and coronary heart disease (CHD) [9,10,45,46] and stroke.[13,14] Evidence has shown that individuals with periodontitis are more likely to experience a cardio vascular event, such as myocardial infarction.[11,12,47-49] Periodontal disease leads to systemic exposure of oral bacteria. Periodontal pathogens invade epithelial cells and connective tissue, and can then enter the blood stream, travelling to distant locations in the body. Oral procedures such as scaling, extraction, periodontal surgery, and even brushing can lead to bacteremia (bacterial introduction into the blood stream.)[50] Atherosclerotic plaque samples are often found to contain periodontal type pathogens such as *P. gingivalis* and *S. Sanguis*.[51]

Respiratory diseases result in significant mortality and morbidity for humans. Respiratory diseases are widespread, and increase the costs of health care due to their prevalence and toll on human health.[52] Two types of respiratory infections that are prevalent are bacterial pneumonia and chronic obstructive pulmonary disease.[53] In healthy adults, the infralaryngeal airway remains sterile by way of pulmonary defense mechanisms. Infection typically occurs as a result of a defect in the host's defense systems, challenge presented by a particularly virulent pathogen, or by an overwhelming inoculum. Lower respiratory infection occurs as a result of contamination of the lower airway epithelium by microorganisms contained in aerosolized droplets or in saliva that has been aspirated. Colonization of the oropharyngeal mucosal surfaces by respiratory pathogens and transmission of those pathogens into secretions that will contaminate the lower respiratory tree is a critical step in the process of infection.[54,55] Failure of host defense in the elimination of pathogens results in infection. It is possible to prevent lower respiratory infection by

suppressing oropharyngeal colonization of respiratory pathogens.[53] Ill patients are often unable to attend to oral hygiene and lack of attention in this area leads to increased amounts and complexity of dental plaque. There are bacterial interactions in complex plaque, and this may lead to colonization of plaque by respiratory pathogens. [56] In addition, intubated patients are at increased risk for colonization of oral bacteria in the lungs due to colonization of the endotracheal tube.[57] Multiple studies have demonstrated a correlation between periodontal infection, poor oral hygiene, and COPD.[16-18,58] Oral care has also been determined to reduce the incidence of ventilator-associated pneumonia in ICU patients.[59-61]

Pre-term delivery and/or low birth weight represent a significant cause of infant morbidity and mortality as the leading perinatal problem in the United States.[62] While some studies have shown no link between periodontal disease and adverse pregnancy outcomes,[63-65] or that periodontal therapy did not affect the rate of adverse events,[66-68] there are several studies that have demonstrated a connection.[20,69-73] Periodontal disease has been linked with PTB and LBW [22,72,74,75] as well as preeclampsia.[76,77] While the direct causal relationship remains unknown, evidence suggests that maternal infection is a key factor in adverse pregnancy outcomes.[62,78] The prevailing theory for the association between periodontal disease and PTB and LBW is that when a mother has periodontal disease, there is lipopolysaccharhide (LPS) exposure, inflammatory mediators are present, and there is cytokine production. While these chemical mediators are present at the local site (gingiva), they can be introduced into the blood stream, and target the placental membranes.[22,69,79,80] Inflammatory mediators such as TNF-α and PGE2, which are present during periodontal infection, can act as a source of fetotoxic cytokines (due to the highly vascular nature of the periodontium).[74] In response to maternal gram-negative periodontal infection, there is

production of cytokines, TNF-α, and prostaglandins. This response signals to the body that it is time for delivery, regardless of fetal age.[81]

In addition to the conditions discussed above, other oral-systemic links are being investigated to determine if an association exists with periodontitis. Some of these conditions include obesity, kidney disease, cancer and others. [27-34]

Health Care Providers Knowledge, Behaviors and Barriers Regarding Oral-Systemic Disease

Although there is growing evidence linking periodontal disease to systemic health, there is relatively little knowledge about what physicians and other health care providers are doing to incorporate this information into their patient care. Following is a review of several studies that have sought to evaluate physicians' and other health care providers' oral health knowledge.

In a study conducted by Lewis and colleagues, a national sample of pediatricians were questioned about their knowledge, current practice behaviors, and opinions on their role in promoting oral health.[82] With a response rate of 62%, two-thirds reported observing caries in their school-aged patients at least once month. Many (55%) reported having difficulty with successful referrals for their uninsured patients and 38% reported difficulty in referring their Medicaid patients. Most (90%) of the pediatricians felt that they had an important role in identifying dental problems and educating families; however, half of the physicians reported that they had no training in medical school or residency concerning oral health. Furthermore, respondents were willing to apply fluoride varnish in their practices (74%).[82]

Yellowitz et al. conducted a study to evaluate the knowledge, opinions, and practices of physicians and dentists related to the screening and detection of oral cancer.[83] There was a 78% (n=93) response rate among the physicians that were mailed surveys. They found that 63% of physicians correctly identified the importance of early detection in reducing oral cancer mortality. Only 33% of physicians believed that their oral cancer knowledge was current. Twenty one percent reported that their oral cancer knowledge was not up to date. Almost 18% of physicians provide a routine oral cancer examination for fifty percent or more of their patient population. Investigators found that there was a statistically significant relationship between physician's perceived lack of training and their infrequent completion of oral cancer examinations.[83]

More recently, Yuen and colleagues conducted a survey of South Carolina Certified Diabetes Educators (CDE) to assess their perceptions of the adequacy of their diabetes education curricula in providing oral health information.[84] The return rate was 64% (n=150), but only 130 surveys were usable. Although 94% of respondents thought that oral health should be part of the patient diabetes education curriculum, 77% responded that their curricula did not include a module on oral health. Respondents whose curricula did include a module on oral health were statistically significantly more likely to adequately address frequent dental visits, daily brushing and flossing, importance of good oral hygiene, effect of uncontrolled diabetes on periodontal disease, effect of periodontal disease on diabetes, causes and results of periodontal disease, monitoring gum health, and management of dry mouth. Among those respondents who did not include a module on oral health in their patient education curriculum, the two predominant reasons for this exclusion were insufficient time (61%) and lack of knowledge about oral health and its relationship to diabetes (37%). [84]

In an abstract published by Vinson et al, authors relay findings of a survey conducted to assess CDE knowledge, behaviors, and opinions regarding periodontal disease and diabetes. [85] The survey was distributed at the 2009 American Association of Diabetes Educators meeting. There were 314 CDE that participated. Most believed that bacteria (99%), glycemic instability (98%), systemic infection (95%), and tooth decay (94%) are associated with periodontal disease. Fifty-two percent believed that periodontitis is reversible. Bleeding gums (38%) and bad breath (29%) were reported to be the first signs of periodontal disease. Most (62%) agreed that CDE need to collaborate with dental professionals regarding disease management and 84% indicated interest in an oral health component being added to their continuing education. Only 20% reported that they felt confident providing oral health screenings to patients. Half (51%) discuss oral health with their patients. Many (64%) reported that they have referred a patient to a dentist in the last year. Most (79%) reported that they have not received formal education on oral health. [85]

Wilder et al. conducted a survey to assess obstetrician's knowledge and practice behaviors regarding periodontal health and pre-term delivery and low birth weight.[86] Surveys were mailed to 194 obstetricians in North Carolina in five centrally located counties. With a response rate of 40%, 91% reported that swelling of the gums definitely or may worsen during pregnancy and 98% reported that bleeding gums occurs or worsens during pregnancy. In regards to pregnancy risk factors and pre-term delivery and low birth weight, smoking (98%), preeclampsia (94%), periodontal disease (84%) and bacterial vaginosis (79%) were reported as the highest risk factors. Of those obstetricians who looked into patients' mouths, 22% did so at the initial prenatal visit and 48% did so only if a problem

was mentioned by the patient. About half (49%) of respondents rarely or never look into patients' mouths.[86]

In an abstract by Thomas et al, authors report on a study conducted to assess nurse practitioners', physician assistants', and nurse midwives' knowledge, behaviors, and opinions regarding periodontal disease and adverse pregnancy outcomes.[87] A survey was distributed via mail to 504 practitioners, and the response rate was 48% (n=240) after two mailings. Many (63%) reported that they examine a patient's mouth at their initial visit. Fewer (43%) reported being trained to provide an oral exam, and 20% reported that it was the responsibility of the dental professional to provide the exam. Sixty-two percent reported that their program did not address dental health in the curriculum. When asked about the level of risk for adverse pregnancy outcomes, respondents reported smoking by mother (96%), multiple gestation (82%), second hand smoke (68%), and periodontal disease (63%) as definite risk factors. More than half (55%) reported that their education was poor or very poor regarding oral health, and 55% were interested in continuing education about oral-systemic health topics. Thirty-nine percent had a dental school affiliated with the educational institution they attended. [87]

Overall, it appears that medical providers' knowledge level is fairly low regarding oral health and systemic disease. Although many medical providers indicated an interest in learning more about oral health and its relationship to systemic conditions, it currently is not being emphasized in the medical curriculum. However some institutions are beginning to include oral health content.[88-90 91] Even though medical providers are interested in obtaining additional information about oral health and some medical institutions are beginning to include more oral health content in the curriculums, it may be the responsibility of oral health

care professionals to initiate patient awareness of potential oral-systemic connections. Because dental professionals need to be able to assess and discuss risks of oral and systemic disease with their patients, as well as take a more active role in patient management, it is important to evaluate what is being included in the curricula for our future oral health professionals. There is little research that has been conducted on this issue to date, and following is a review of that literature.

Dental and Dental Hygiene Education Regarding Oral-Systemic Disease

Wilder and colleagues conducted a survey study to evaluate the periodontal-systemic disease education in United States (U.S.) and Canadian dental schools.[92] Electronic surveys (SurveyMonkey©) were emailed to the academic deans of 65 dental schools throughout the U.S. and Canada. Fifty schools responded to the survey, yielding a response rate of 77%. Reported topics covered the most (≥6 hours) were aging (56%), cardiovascular disease (53%), diabetes (53%), tobacco use (52%), and HIV 48%. Periodontal-systemic disease connections are reportedly covered in the following courses: periodontology, oral medicine, general and oral pathology, and clinical periodontics. Resources respondents used to teach this material were overwhelmingly journal articles (93%) and textbooks (89%). Journal of Periodontology (88%) and Journal of the American Dental Association (75%) were the two most utilized journals. Students were evaluated in terms of their ability to assess for risk factors concerning tobacco use (67%), HIV (63%), cardiovascular disease (62%), and diabetes. Students were evaluated regarding their ability to discuss risks for the following habits/conditions: tobacco use (86%), diabetes (77%), cardiovascular disease (71%), and HIV (70%). The majority of respondents (89%) strongly agreed or agreed that their students

were knowledgeable about the role of inflammation and its impact on periodontal-systemic conditions, and 93% reported that they believed the role of future dentists in assessing the risks of systemic complications due to oral health status was important. Authors found that only 16% of reporting schools present periodontal-systemic content to interdisciplinary groups, and only 9% of respondents agreed or strongly agreed that nurses and physicians in their area were knowledgeable about periodontal-systemic disease connections.[92]

Wilder et al conducted a similar study that evaluated the periodontal-systemic disease education of United States (U.S.) dental hygiene programs.[93] Electronic surveys (SurveyMonkey©) were distributed via email to the directors of the 286 accredited dental hygiene programs. The response rate was 63% (n=173). Topics allotted the most time (≥7hrs) were tobacco use, diabetes, and cardiovascular disease. The top two reported reference materials used to teach periodontal-systemic disease connections were journal articles (90%) and dental hygiene textbooks (87%). The two most frequently utilized journals were Journal of Dental Hygiene (87%) and Journal of Periodontology (84%). Eighty percent of respondents reported that their students receive formal training in how to discuss or communicate with their patients regarding periodontal-systemic disease connections. Students were evaluated based on their ability to assess risks most often in regards to tobacco use (94%), diabetes (90%), cardiovascular disease (87%), and adverse pregnancy outcomes (79%). The students' ability to communicate with patients in terms of periodontal-systemic disease was evaluated most frequently in regards to tobacco use (92%), diabetes (92%), cardiovascular disease (89%), and adverse pregnancy outcomes (85%). Only 6 programs teach periodontal-systemic disease topics with nursing or other allied health

students. Only 5% of program directors agreed or strongly agreed that nurses and physicians in their area are well-educated regarding oral-systemic disease.[93]

As the evidence above suggests, current dental graduates in the U.S. and Canada as well as dental hygiene graduates in the U.S. are receiving formal education regarding the periodontal-systemic health link. From this point, it is imperative to determine if and how the graduates are integrating this knowledge into their work practices and process of patient care. There have been a few investigations regarding the use of medical assessments and interventions in clinical dental practice. Following is a review of those studies.

Oral Health Care Practitioners Knowledge and Behaviors Regarding Oral-Systemic Disease

There are several risk factors for systemic diseases such as diabetes, CVD and CVA, adverse pregnancy outcomes and others that can be assessed in the dental office. Thorough review of the patient's medical history can provide insight in terms of life style, habits, medications, and existing systemic conditions. Also, assessment of blood pressure, oral cancer screening, periodontal examination, nutritional counseling, tobacco cessation counseling, and even blood glucose testing can be performed in the dental office.

Greenberg et al. conducted a survey that addressed dentists' attitudes toward, acceptance of and perceived barriers regarding screening for medical conditions in a dental setting.[94] Surveys were mailed to 7,400 U.S. practicing dentists. Completed questionnaires were returned by 1,945 respondents, yielding a response rate of 26%. Almost 90% of respondents thought that it was important for a dentist to screen for medical conditions. Respondents thought that it was important to screen for hypertension (85.8%), CVD (77%),

diabetes mellitus (77%), hepatitis (72%), and human immunodeficiency virus (HIV) (69%). The majority (83%) were willing to conduct chair-side screening that yielded immediate results, to discuss results immediately with the patient (76%), or to refer a patient for a medical consult (96%). The majority of respondents were willing to take blood pressure measurements (91%) and collect oral fluids (88%). Fewer were willing to collect blood by finger stick (56%) and measurements of height and weight (57%). In regards to perceived barriers, patient's willingness was considered most important, followed by liability, cost, time and insurance coverage.[94]

Most of the studies that have addressed dental professionals' attitudes, knowledge, and behaviors regarding oral-systemic health have been focused on one systemic disease only. The following studies are examples of these, and provide insight into practitioners' beliefs on a more specific plane.

Jontell and Glick conducted a study in which they investigated whether general private dental practitioners in Sweden could identify patients at risk of experiencing a fatal outcome of cardiovascular disease within a set time frame and to what extent those practitioners' findings would result in medical interventions. [95] Ten practitioners in Sweden participated, and enrolled 200 eligible patients. A trained member of the dental team took a blood glucose measurement and a total cholesterol measurement, in addition to a blood pressure measurement. A computerized system called HeartScore was used to calculate the risks (in percentages) of a patient dying as a result of cardiovascular disease in the next ten years. Dentists advised patients with scores of 10% or higher to seek medical consultation. After six to twelve months, the authors conducted a telephone interview to determine the results of the medical consultations. Six percent of the participants had scores of 10% or

higher (all men, n=12). Half of these at-risk individuals received prescriptions for antihypertensive medications after the medical evaluation. One of these participants also received a cholesterol-reducing drug. For three of the twelve at-risk individuals, medical providers could not confirm the dental practitioners findings, and therefore did not suggest medical intervention.[95]

Strauss and colleagues conducted a study utilizing NHANES data from 2003-2004, to determine if a larger proportion of patients with periodontal disease as compared with those without periodontitis would be appropriate to screen for diabetes according to American Diabetes Association (ADA) guidelines.[96] Data were also used to determine if at-risk individuals with periodontitis visited a dental professional recently. Data were collected from 2,923 subjects twenty years of age or older who reported that they had never been told that they had diabetes. Subject data included a periodontal exam and sufficient information to calculate body mass index (BMI). Sixty-three percent of those without periodontitis, and 93% of those with periodontitis met the ADA guidelines for diabetes screening (at–risk). Of those at-risk patients with periodontal disease, 34% had seen a dentist in the past 6 months, 50% had seen a dentist in the past year, and 60% had visited a dental professional in the past two years, suggesting that the dental visit provides a significant potential venue for this screening.[96]

Esmeili et al. conducted a survey to determine general dentists' attitudes and practices related to patients with diabetes.[97] Delta Dental, a dental insurance company, provided researchers with a list of 2,174 randomly selected Delta Dental providers in California, Pennsylvania, and West Virginia. All of these dentists were invited to participate, 271 (12%) agreed to participate, 265 of those (98%) returned the survey. Less than half (43%) of the

respondents reported that they had formal training in intervening with dental patients regarding diabetes. Less than half felt they knew how to assess patients for diabetes, and felt prepared and effective to intervene with patients. More than half believed that intervening with patients with diabetes was an important or very important part of their role as a dentist. Compared to those with no formal training, those who had formal training were more likely to feel that they knew how to assess for diabetes, to feel well prepared and effective to intervene, and to feel that they had appropriate knowledge about related pharmaceutical products. Dentists who had formal training were four times more likely to provide services to address diabetes than those who did not have any formal training. Researchers evaluated what dentists perceived to be barriers to blood glucose measurement, and lack of reimbursement was the most frequently reported barrier (53%). About half (51%) reported not being exposed to any information about blood glucose measurement in the past 12 months. Less than 30% provided written educational materials about diabetes and periodontitis and less than 2% performed in-office blood glucose measurement.[97]

Kunzel et al. conducted a survey in which they contrasted general dental practitioners (GDP) and periodontists' involvement in three areas of managing diabetic patients—assessment of health status, discussion of pertinent issues, and active management of patients.[98] The survey was mailed to random samples of general dentists and periodontists in the northeastern U.S. during the fall of 2002. Forty-six percent of GDP and 44% of periodontists were categorized as low performers with respect to assessment; 51% of GDP and 29% of periodontists were categorized as low performers with respect to discussion; and for active management, 46% of GDP and 56% of periodontists were categorized as low performers.[98] Through analysis of their results, the authors concluded that variables

pertaining to patient relations were significant predictors for general dentists' active management of diabetic patients. They also concluded that confidence, involvement with colleagues and medical experts, and professional responsibility were influential predictors for periodontists' active management of diabetic patients.[98]

Forbes and colleagues conducted a survey study polling GDP in New Zealand in regards to their attitudes, beliefs, and practices with respect to diabetic patients.[99] There was a response rate of 65%, or 437 returned surveys. Most GDP reported that they participated in the assessment and discussion phases of diabetes management, but that there was a much lower prevalence of active management (such as testing). Three-quarters of the responding dentists reported that they asked new patients about their type of diabetes. Only 3% of responding dentists had ever performed a finger-stick test. Just over two in five responding dentists believed that their management of the diabetic patient was hindered by a lack of CE opportunities, and almost one third reported that they were unwilling to perform a finger-stick test to evaluate diabetes.[99]

Huebner et al. conducted a survey of general dentists in Oregon to determine their attitudes, beliefs and practices in regards to dental care for pregnant patients. [100] Questionnaires were mailed to 1,604 dentists. Of those, 1,502 were eligible to participate and 829 surveys were completed, yielding a valid response rate of 55%. Ninety-five percent of respondents agreed that counseling about periodontal disease and premature birth was important for the health of both mother and child. The authors found that 71% of respondents said that insurance plans do not compensate adequately for time spent to counsel pregnant patients. Forty percent also perceived patients' out of pocket cost for counseling as

a barrier. Many (42%) reported being concerned about being sued if something goes wrong with a patient's pregnancy.[100]

Boyd and colleagues conducted a study to assess dental hygienists' diabetes knowledge, beliefs concerning the disease, and clinical practices to identify professional continuing education needs.[101] Invitation to participate in the study was issued electronically via a mailing list and via a newsletter to members of the American Dental Hygienists' Association (ADHA). Overall, 501 potential respondents accessed the survey, and 392 representing 48 states completed the survey (response rate=78%). The majority of respondents demonstrated knowledge regarding the following risk factors for diabetes: being overweight (99%), family history (95%), history of gestational diabetes or giving birth to a baby weighing more than eight pounds (78%), sedentary lifestyle (76%) and previous diagnosis with glucose intolerance (71%). Respondents did not know or were unsure regarding the following risk factors: polycystic ovary syndrome (73%), low high-density lipoprotein (HDL) cholesterol or high triglycerides (49%) and history of vascular disease (48%). In general respondents were familiar with the complications associated with poorly controlled diabetes, but were most likely to be unsure of sexual dysfunction (48%), autonomic neuropathy (26%), and nephropathy (19%). Major deficits in knowledge were found regarding the patient's HbA1c value and implications for diabetes control (50%). Responses to the survey also indicated confusion about the current classifications of diabetes with 70% of respondents using classifications that are no longer recognized. In addition, 75-90% of respondents were unfamiliar with the impact of various types of diabetes medications on dental care. When asked about current practices regarding diabetic patients, respondents were most likely to provide referral services (54%) and use diabetes education materials

(46%). Participants were least likely to use a glucose monitor to check a patients' blood glucose before or after treatment (83%) and have a glucose monitor in the office and know how to use it (76%).[101]

Barriers to Implementing Research Evidence into Practice

For any field to stay current, or to employ evidence-based practice (EBP), it is essential that practitioners are familiar with the research evidence and are capable of implementing it routinely. This proves challenging for many reasons. Studies in the field of nursing have illuminated some of those challenges. In a study conducted by Schoonover, registered nurses completed a survey regarding barriers to research utilization.[102] Seventy-nine nurses completed the questionnaire (21% response rate). Barriers reported among this group were lack of authority to change patient care procedures (80%), lack of time to read research (71%), and lack of awareness of research (66%).

Hutchinson et al. conducted a survey of nurses in Australia to assess barriers to, and facilitators of, research utilization in the practice setting. The response rate was 45% (n=317). The barriers reported by participants included time constraints (78%), lack of awareness of available research literature (66%), insufficient authority to change practice (65%), inadequate skills in critical appraisal (56%), and lack of support for implementation of research findings (52%).[103] In a more recent study, Chang and colleagues polled a convenience sample of 89 nurses in Taiwan regarding barriers to implementing EBP in nursing homes. The most frequently cited barriers were related to insufficient authority to change practice, difficulty understanding statistical analyses, and a perceived isolation from knowledgeable colleagues with whom to discuss the research.[104]

Hughes et al. conducted a study to assess how frequently a group of dental hygienists performed screenings for hypertension and barriers to performing the screenings. The results revealed that the majority were not performing blood pressure screenings, despite the fact that their curricula stressed the importance of this practice for all patients. The most frequently cited barriers were insufficient time in the appointment (49%) and minimal value given to the procedure by their employers (31%). [105]

The studies cited in the previous paragraphs provide insight into attitudes, beliefs, knowledge, and practice behaviors of medical, nursing, and oral health practitioners regarding some specific areas of oral-systemic health as well as challenges that may limit the incorporation of oral-systemic evidence into practice. However, there have been no published studies to date that assess dental hygienists' knowledge and practice behaviors regarding oral-systemic health and how they are incorporating evidence into clinical practice. Therefore, the purpose of this study was to assess the practice behaviors and perceived barriers of North Carolina dental hygienists in regards to the implementation of oral-systemic evidence into patient care.

INTRODUCTION AND LITERATURE REVIEW

The dental hygienist's role as an oral health care provider involves examining patients for signs of oral disease, providing treatment, and promoting home care that will help restore patients to a state of health and function. In addition, dental hygienists are often advocates for behavior or life-style changes that will promote total body health and well being. For example, dental hygienists routinely provide nutritional and smoking cessation counseling to help patients in achieving a healthier overall life-style.

Part of the dental hygienist's role as a clinician is identifying and treating periodontal disease. Periodontal disease, which encompasses gingivitis and periodontitis, is a condition affecting the gingival tissues and supporting structures of the periodontium. Periodontal disease is characterized by bacterial colonization of the teeth and gums, and destruction of the supporting tissues and bone in the case of periodontitis. Gram-negative, anaerobic bacteria in the sub-gingival space typically induce host immunologic responses, which are responsible for the destruction of supporting connective tissues and bone. If left untreated, periodontal disease can lead to eventual tooth loss.[1] It is estimated that approximately 75% of adults in the United States have gingivitis, and about 35% have periodontitis,[2] making periodontal disease a highly prevalent chronic inflammatory condition.

In recent years, there has been evidence of an association between periodontal disease and several other conditions, such as diabetes, [3-6] cardiovascular disease (CVD), [7-12] cerebrovascular accidents (CVA) such as stroke,[13,14] respiratory diseases, [15-18] and adverse pregnancy outcomes such as preeclampsia, low birth weight (LBW) and pre-term birth

(PTB).[19, 20, 21-26] In addition to the conditions listed above, other associations are actively under investigation, including obesity,[27,28] kidney disease, [29,30] cancer, [31,32] and metabolic syndrome.[33,34]

According to 2006 data from Centers for Disease Control and Prevention (CDC), approximately 70% of the population visit a dental office at least once yearly.[106] The dental hygienist is often the dental team member that provides prevention and intervention services. This may make the dental hygienist a critical health care provider to perform periodontal disease-based risk assessment and interventions to potentially prevent systemic complications and improve overall health. The purpose of this study was to assess practice behaviors and perceived barriers of North Carolina dental hygienists regarding the incorporation of oral-systemic evidence into patient care.

Health Care Providers' Knowledge, Behaviors, and Opinions Regarding Oral-Systemic Disease

In light of the growing evidence regarding oral health and systemic health connections, it is imperative that the roles of the medical provider and oral health care provider are evaluated in terms of risk assessment strategies and practices, opinions regarding the evidence of a connection, and practice behaviors concerning patient care. Research has been conducted in this area, and overall findings have indicated low knowledge levels and low levels of formal training. [82,84,85] In a study conducted by Lewis and colleagues, pediatricians reported that they felt that they had an important role in identifying dental problems and educating families (90%); however, half of the physicians reported that they had no training in medical school or residency concerning oral health. [82] Studies conducted by Yuen et al. and Vinson et al. revealed similar findings, in that the certified

diabetes educators (CDEs) polled felt that oral health was important for patient education and care, but that the education practitioners received and current knowledge levels were lacking.[84, 85]

Research investigations have also reported that medical practitioners demonstrate low rates of performing regular oral exams for patients. A study conducted by Wilder et al. indicated that if obstetricians perform oral examinations, they happen at the initial pre-natal visit only or if the patient reports a problem.[86] Thomas and colleagues found that among nurse practitioners, physician assistants, and nurse midwives, oral exams were typically performed on pregnant patients at the initial visit, if performed at all, and the majority of practitioners' (62%) educational programs did not include oral health education. [87]

Due to reported low knowledge levels and low rates of education regarding oral health in medical programs, it may be the responsibility of oral health care providers to initiate patient awareness of potential oral-systemic connections. Because the dental hygienist may treat the dental patient multiple times during a year, the dental hygienist could play a primary role in performing risk assessment for oral-systemic disease.

Oral Health Care Practitioners' Knowledge and Practices Regarding Oral-Systemic Disease

Several risk factors for systemic diseases such as diabetes, CVD and CVA, adverse pregnancy outcomes and others can be assessed in the dental office. Thorough review of the patient's medical history can provide insight in terms of life style, habits, medications, and existing systemic conditions. Assessment of blood pressure, oral cancer screening,

periodontal examination, nutritional counseling, tobacco cessation counseling, and even blood glucose testing can be performed in the dental office.

Two studies recently reported in the literature assessed the curriculum content regarding oral-systemic connections among U.S. and Canadian dental schools and U.S. dental hygiene programs. [92,93] Overall, oral-systemic connections are being formally included in the curriculum, and students are being evaluated on their abilities to assess risks and discuss these topics with their patients. Topics allotted the most time (≥7hrs) were tobacco use, diabetes, and CVD and they were the topics most emphasized in their curricula. Students in dental hygiene programs were evaluated based on their ability to assess risks most often in regards to tobacco use (94%), diabetes (90%), CVD (87%), and adverse pregnancy outcomes (79%). [93] Current graduates are being formally educated regarding oral-systemic disease, and the next logical step is to assess what dental practitioners are doing to incorporate this knowledge into practice.

Overall, it has been found that dentists are more likely to *assess* for risks and to *discuss* systemic health issues with their patients, and that they are less likely to *actively manage* their patients (e.g. perform finger stick test to assess blood glucose levels). Kunzel et al. conducted a survey in which they contrasted general dentists' (GD) and periodontists' involvement in three areas of managing diabetic patients—assessment of health status, discussion of pertinent issues, and active management of patients.[98] In terms of active management, 47% of general dentists and 56% of periodontists were categorized as low performers.[98] Forbes and colleagues observed similar findings in a 2008 study, in which most GDs polled reported that they participated in the assessment and discussion phases of diabetes management, but there was a much lower prevalence of active management. [99]

A national survey conducted by Boyd et al. focused on dental hygienists knowledge and practices regarding periodontal disease and diabetes. Participants reported that they were most likely to provide referral services (54%) and use diabetes education materials (46%). They were least likely to use a glucose monitor to check a patients' blood glucose before or after treatment (83%) or have a glucose monitor in the office and know how to use it (76%).[101]

Barriers to Implementing Research Evidence into Practice

For any field to stay current, or to employ evidence-based practice (EBP), it is essential that practitioners are familiar with the research evidence and are capable of implementing it routinely. This proves challenging for many reasons. Studies in the field of nursing have illuminated some of those challenges. In a study conducted by Schoonover, registered nurses completed a survey regarding barriers to research utilization.[102] Barriers reported among this group were lack of authority to change patient care procedures, lack of time to read research, and lack of awareness of research. Hutchinson et al. conducted a survey of nurses in Australia to assess barriers to, and facilitators of, research utilization in the practice setting. The barriers reported by participants included time constraints, lack of awareness of available research literature, insufficient authority to change practice, inadequate skills in critical appraisal, and lack of support for implementation of research findings.[103] In a more recent study, Chang and colleagues polled nurses in Taiwan regarding barriers to implementing EBP in nursing homes. The most frequently cited barriers were related to insufficient authority to change practice, difficulty understanding statistical

analyses, and a perceived isolation from knowledgeable colleagues with whom to discuss the research.[104]

Hughes et al. conducted a study to assess how frequently a group of dental hygienists performed screenings for hypertension and barriers to performing the screenings. The results revealed that the majority were not performing blood pressure screenings, despite the fact that their curricula stressed the importance of this practice for all patients. The most frequently cited barriers were insufficient time in the appointment and minimal value given to the procedure by their employers. [105]

While the studies cited in the previous paragraphs provide insight into attitudes, beliefs, knowledge, and practice behaviors of medical, nursing, and oral health practitioners regarding some specific areas of oral-systemic health, there have been no published studies to date that assess dental hygienists' knowledge, attitudes and practice behaviors regarding oral-systemic health and how they are incorporating evidence into clinical practice. Therefore, the purpose of this study was to assess the practice behaviors and perceived barriers of North Carolina dental hygienists in regards to the implementation of oral-systemic evidence into patient care.

MATERIALS AND METHODS

A cross-sectional survey of practicing North Carolina dental hygienists was conducted between October 2009 and February 2010. The survey instrument was developed by the research team and pilot tested after approval by the Biomedical Institutional Review Board of the University of North Carolina at Chapel Hill. Pilot testing occurred with ten dental hygienists, holding various dental hygiene degrees, and the survey instrument was revised using feedback from the respondents. The final survey included 39 items and focused on various systemic health issues as they relate to periodontal disease (e.g. diabetes, CVD, respiratory disease, and others). The following sections were included: demographics, practice behaviors, knowledge, attitudes and opinions, and barriers. The current paper focuses on the practice behaviors and barriers sections of the survey. The survey instrument, developed in Teleform format, contained Likert-scale questions and close-ended questions.

Names and mailing addresses of the 5,505 licensed dental hygienists in North Carolina (NC) were obtained from the NC Board of Dental Examiners. From the original sampling frame, 30% (n=1,665) were randomly selected to receive surveys. The survey instrument, cover letter explaining its purpose, and business reply envelopes for return were distributed via mail, utilizing three mailings in accordance with the Salant and Dillman methodology.[107] The mailings occurred between October 2009 and January 2010. The cover letter instructed recipients who were unwilling to participate or no longer provided patient care to return their survey blank, thusly alerting us to their status. To maintain

confidentiality, the surveys were numerically coded, and participants were not asked to include any personal information on the survey. The research assistant maintained a linkage file to prevent duplicated mailings to respondents. The linkage file was destroyed at the end of the third mailing.

The data were analyzed using SAS version 9.1 (SAS Institute Inc., Cary, North Carolina), using descriptive statistics and Chi-square analyses to assess whether the proportion of respondents who were actively engaged in evaluation of periodontal disease or who incorporated systemic health management or who perceived barriers to incorporation was associated with the respondent's age, practice type, or practice setting. Level of significance was set at 0.05.

RESULTS

There were a total of 1,030 surveys returned by recipients (yielding a total response rate of 61.9%). Of these, 859 were completed surveys (yielding a 51.6% usable response rate) and 171 were blank returned surveys. Thirty-two were "returned to sender" (not deliverable). Respondents were overwhelmingly female (99.5%), with 55% between the ages of 31 and 50. The majority (84.1%) of respondents held a two-year degree in dental hygiene (associate or certificate). The mean number of years since graduation was 17.7 with a standard deviation of 11.9 (Table 1).

Most respondents (84%) indicated that periodontal exams were performed on new patients, and a majority (69.3%) performed periodontal exams at every visit for their periodontal maintenance (D4910) patients. Overall, patients receive periodontal evaluations on a regular basis, ranging from comprehensive full mouth probing to more abbreviated exams such as periodontal screening and recording (PSR) and "spot probing" (Table 2). The most frequently evaluated indicators of oral health (Table 3) are oral cancer screenings (89.2%), plaque and calculus (91.9%) and gingival appearance (92.%).

The majority (68%) of respondents reported that the medical history was updated at every visit, and most (66%) utilized blood pressure cutoffs beyond which no treatment will be provided. Twenty percent of respondents measure blood pressure on all patients, and 62% measure blood pressure on select patients. However, very few (7.6%) record blood sugar levels of diabetic patients, and even fewer (2.8%) record HbA1c values (Table 4). The majority of respondents discuss medications (92.9%) and medical diagnoses (69.6) with all

patients. Blood pressure (62.2%) and stress (64.1%) are discussed with some patients. Bone density (58.9), physical activity (65.4), cholesterol (65%), and body mass index (BMI) (79.5%) are typically not discussed (Table 5).

Eighty-nine percent of respondents reported that they were "extremely unlikely" or "unlikely" to assess patients for diabetes using a glucometer (Table 6). However, 61.7% reported that they are "extremely likely" or "likely" to educate patients about the link between oral infection and glycemic control. Fifty percent reported that they were extremely likely to refer patients to medical providers for follow up for signs and symptoms detected during a dental hygiene appointment. The survey asked whether or not participants had a role in deciding which patients are referred to a medical doctor or dental specialist, and 79% reported that they do.

The most frequently discussed health topics (Table 7) were tobacco use (89%), pregnancy (84.1%), and genetic issues (79%). The conditions for which dental hygiene practitioners were most likely to discuss and/ or refer patients to a physician were HIV (35.7%), CVD (30.5%), and respiratory disease (28.1%). Practitioners most often ("always" + "frequently") consult with medical providers regarding need for premedication (80.2%), coagulation issues (48.5%), and treatment needs for patients with CVD (32.4%). (Table 8)

The most frequently reported "significant" barriers were patients' objection to additional fees for services (68.9%), limitations of time in practice schedule (51.5%), and lack of reimbursement from third party payers (46.4%). Lack of education was perceived by 27.4% of DH as a "significant barrier" and as "somewhat of a barrier" by 61.3% (Table 9).

The proportion of DH who actively participate in evaluating patients for periodontal disease was statistically significantly different among the age groups (Table 10). Younger

dental hygienists are more likely to be active in evaluating patients for periodontal disease as well assessing and discussing systemic health issues. Practice type was significantly associated with engagement in managing systemic health issues (Table 11) and perception of barriers (Figure 1). Practitioners in public health settings are more likely to be active in managing systemic health issues and are less likely to perceive barriers to the incorporation of systemic health management practices. Dental hygienists practicing in rural settings were least active regarding periodontal evaluation (Table 12). The proportion of DHs who perceived barriers to the incorporation of systemic health management was also statistically significantly different among the age groups (Figure 2). Overall, older respondents and those in solo private practice tend to be more likely to perceive barriers as significant.

DISCUSSION

The results from this cross-sectional survey of NC DH indicated that respondents are incorporating some aspects of oral-systemic evidence into patient care. Many respondents indicated that they update medical histories at every visit, and evaluate blood pressure prior to treatment. Hygienists are also actively and routinely providing systemic health counseling in some areas, such as tobacco cessation. They reported having a role in deciding who is referred to a medical or dental specialist, and were likely to do so. This speaks to the amount of responsibility that is delegated to dental hygienists and the breadth of care rendered in the dental practice setting. If dental hygienists provide regular periodontal exams, and have a role in referring patients, they may be a critical health care provider to assess for oral-systemic risks and manage those risks.

In contrast, the current study found that while assessment and discussion was ubiquitous among our study population, in-office active management (such as performing a finger stick test to assess for diabetes) was not prevalent. This is similar to the results of studies conducted by Kunzel [98] and Forbes.[99] In a recent study of NC DHs, regarding educating and counseling patients about obesity, respondents, overall, were willing to discuss obesity with their patients, and 65% reported that they were "highly confident" or "confident" about their abilities to discuss specific health risks associated with obesity and the importance of weight loss.[108] In contrast, data from the current study indicated that very few practitioners discuss issues like BMI and physical activity levels with their patients. Respondents more frequently consult with physicians regarding health issues that directly

affect their process of care than active management of systemic health issues—e.g. coagulation issues and premedication needs. These are more immediate issues that can influence safety of providing treatment the day the patient is scheduled rather than long-term oral-systemic health management.

Overall, younger hygienists (≤40) were more active in implementing oral-systemic evidence into practice. Also, they were statistically significantly less likely than older hygienists to consider "concern over legal risk" and "perception by board as unauthorized practice of medicine" as significant barriers. This is perhaps due to changes in dental hygiene curricula regarding the oral-systemic link. Esmeili et al. conducted a study assessing general dentists' attitudes and practices regarding patients with diabetes. They found that compared to those with no formal training, those who had formal training were more likely to feel that they knew how to assess for diabetes, to feel well prepared and effective to intervene, and to feel that they had appropriate knowledge about related pharmaceutical products. Dentists who had formal training were four times more likely to provide services to address diabetes than those who did not have any formal training. [97] A recent report on curricula in U.S. dental hygiene programs found that current graduates are receiving formal training concerning oral-systemic disease.[93] Therefore, they should generally feel more comfortable than older practitioners regarding the incorporation of oral-systemic evidence into practice.

Practitioners in public health settings were more active regarding systemic health management (e.g. asking about, recording, and discussing systemic health issues), but were least active in performing periodontal examinations when compared to practitioners in group or solo private practices. This was an interesting finding as well, and the origin of these

differences is unknown. The nature of "public health" is typically in prevention and overall health management, so it is encouraging that the data supported active management of health.

The five most frequently reported "significant" barriers to implementation of oral-systemic evidence into patient care among our respondents were patients' objection to fees (69%), lack of time in practice schedule (52%), lack of reimbursement from third party providers (46%), concern over legal risk (44%), and perception by the dental board as the unauthorized practice of medicine (39%). Interestingly, if "significant barrier" and "somewhat a barrier" were combined to get a picture of what may be perceived as any kind of barrier, lack of education emerged as the second most reported barrier. Patients' objection to fees remained the top reported barrier. These responses indicate an assumption that patients will be charged for additional services. In the study conducted by Esmeli et al., authors evaluated what dentists perceived to be barriers to blood glucose measurement. Lack of reimbursement was the most frequently reported barrier (53%). [97] The prevalence of systemic health services and counseling may increase if third party payers provide reimbursement. Another factor that influences dental hygiene care is the hygienist's philosophy of practice. Hygienists' expectations for their own level of professionalism, as well as the expectations of employers and patients shape the way in which they practice, and what responsibilities they will assume. In striving to achieve "best practices," thorough periodontal evaluation and regular risk assessment through review of patients' medical histories should be a goal for dental hygiene practitioners. Also, if the dental team can collaborate with medical professionals, patients will receive more thorough care. Expectations regarding practices may change as evidence emerges, and perhaps in the future,

patients will expect more from dental professionals. If this happens, dental care may evolve into a more comprehensive discipline.

Incorporating oral-systemic disease assessment and treatment will require a level of interprofessional collaboration and education with other healthcare professionals. Interprofessional education (IPE) is defined as an educational process that provides health professions students "with experience across professional disciplinary lines as they acquire knowledge and skills in subject areas required in their respective educational programs."[109] For example, in the "seamless care" model at Dalhousie University in Nova Scotia, Canada, teams comprised of students from medicine, nursing, pharmacy, dentistry, and dental hygiene work together to provide collaborative care to patients transitioning from acute care to the community.[110] However, the history of IPE in dentistry/dental hygiene in the United States has not been progressive except in a few instances [88-91] and may take years to achieve. Perhaps oral healthcare professionals will need to take the lead in educating other health care professionals about the implications of oral disease to systemic health. [111]

There were certain limitations to this study. Generalizability may be limited due to non-response bias. Those who took the time to complete the survey may have higher levels of interest than others, and thus may be more likely to perform in the questioned areas. If respondents were inherently more proactive, then the results may be skewed to reflect more proactive practices. However, the high response rate gives strength to the results and increases generalizability. Another consideration affecting generalizability may also be the distribution of the survey in North Carolina alone. For example, the relatively restrictive practice act in NC may create a tendency for dental hygienists to be reluctant about more active patient management, producing a lower rate of performance than the national average.

A national distribution of the survey would lend considerable insight. Conversely, North Carolina is the tenth most populous state and is growing rapidly. [112] North Carolina also ranks tenth in terms of elderly population (65 years and older) with a 2008 estimate of 1,139,052 residents in this category.[113] As the population ages, people tend to have more systemic health issues. More *active care* from oral health care providers is important for the overall health of this population. These population characteristics make North Carolina a state that is representative of the population as a whole.

CONCLUSIONS

North Carolina dental hygienists are actively and routinely incorporating some aspects of oral-systemic evidence into patient care. A more active role in patient management would necessitate more time in their practice schedules, and more education and training.

TABLES

Table 1. Demographic and practice characteristics of NC dental hygienists (N=859).

	Respondents	N	%
Age	857		
<30		151	17.6
31-40		239	27.9
41-50		235	27.4
51-59		189	22.1
≥60		43	5.0
Dental Hygiene Degree	851		
Certificate/ Associate (2 year)		716	84.1
Bachelors (4 year)		135	15.9
Primary Practice Type	856		
Group private		263	30.7
Solo private		537	62.7
Public health/Other		56	6.6
Primary Practice Setting	817		
Urban		318	38.9
Suburban		335	41.0
Rural		164	20.1
Hrs/week providing patient care	844		
1-10		56	6.6
11-20		116	13.7
21-30		217	25.7
≥31		455	64.7

*The total number of participants who completed the survey was 859, however some participants skipped questions. The total number of responses per item is indicated in the column marked "Respondents". Percentages may not add up to 100 due to rounding.

Table 2. Practice Behaviors as reported by NC dental hygienists regarding periodontal health examinations.

	Respondents	N	%
Periodontal exams performed on new patients	843		
Always		708	**84.0**
Often		69	8.2
Sometimes		45	5.3
Infrequently		21	2.5
Who performs new patient perio exams	835		
Dentist		183	21.9
Hygienist		615	**73.7**
Both		37	4.4
Frequency of periodontal exams for adult prophylaxis patients (D1110)	842		
Every visit		314	37.3
Every 6 mos		169	20.1
Every year		265	31.5
Less frequent than once yearly		94	11.2
Frequency of periodontal exams for perio maintenance patients (D4910)	820		
Every visit		568	**69.3**
Every 6 mos		119	14.5
Every Year		93	11.3
Less frequent than once yearly		40	4.9
Type of probing for adult prophy patients (D1110)	838		
Full mouth probing		433	**51.7**
PSR		161	19.2
Spot probing		244	29.1
Type of probing for perio maintenance patients (D4910)	816		
Full mouth probing		677	**83.0**
PSR		75	9.2
Spot probing		64	7.8
Is the patient informed of perio diagnosis	843		
Always		703	**83.4**
Frequently		118	14.0
Infrequently		22	2.6

Table 3. Frequency and for whom NC dental hygienists evaluate oral health indicators to determine oral health status

	All Patients		New &/or Select Patients		No Patients	
	N	%	N	%	N	%
Gingival Appearance	768	**92.8**	59	7.1	1	0.1
Plaque/Calculus	763	**91.9**	62	7.5	5	0.6
Oral Cancer Screening	746	**89.2**	82	9.8	8	1.0
Probing Depths	561	67.7	263	31.7	5	0.6
Bleeding on Probing	524	65.0	260	32.3	22	2.7
Tooth mobility	439	52.7	390	46.8	4	0.5
Furcations	388	47.3	411	50.1	21	2.6
Clinical Attachment Levels	309	39.9	408	52.6	58	7.5
Mucogingival Relationships	279	38.1	365	49.9	88	12.0

Table 4. Practice Behaviors as reported by NC dental hygienists regarding evaluation of overall/systemic health.

	Respondents	N	%
Medical History (Med Hx) Updated	853		
Every appt.		581	**68.1**
Every 3-6 mos		94	11.0
Every Year		134	15.7
No regular schedule		44	5.2
Personally Review Med Hx	852		
Always		713	**83.7**
Often		105	12.3
Sometimes		18	2.1
Infrequently		16	1.9
Blood pressure cutoffs	813		
Yes		533	**65.6**
No		280	34.4
Diabetic Patients—Blood sugar	858		
Record		65	7.6
Ask About		292	34.0
Not Done		501	**58.4**
Diabetic Patients—HbA1C	858		
Record		24	2.8
Ask About		71	8.3
Not Done		763	**88.9**

Table 5. Systemic health issues and the patients for whom NC dental hygienists assess or discuss risk.

	All patients		New &/or Select Patients		No Patients	
	N	%	N	%	N	%
Medications	777	**92.9**	57	6.8	2	0.2
Medical Diagnosis	584	69.6	238	28.4	17	2.0
Tobacco Use	336	40.2	477	**57.1**	22	2.6
Alcohol Use	144	17.3	423	**50.7**	267	32.0
Pulse	101	12.2	326	39.3	403	48.6
Stress	66	6.7	539	**64.1**	246	29.3
Physical Activity	20	2.4	270	32.3	547	**65.4**
Body Mass Index (BMI)	19	2.3	152	18.2	663	**79.5**
Cholesterol	25	3.0	268	32.0	545	**65.0**
Bone Density	9	1.1	335	40.1	492	**58.9**

Table 6. Frequency of dental hygienists who are likely to perform/offer oral-systemic services or refer to/contact a medical provider regarding a systemic health issue.

	N	Extremely Likely (%)	Likely (%)	Somewhat Likely (%)	Unlikely (%)	Extremely Unlikely (%)
Refer patients to a medical provider for follow up for signs and symptoms detected during a dental appointment	847	**49.8**	35.8	9.4	2.7	2.2
Educate patients about the link between oral infection and glycemic control	849	26.7	**35.0**	20.7	10.6	6.9
Call patient's physician to coordinate treatment	845	23.8	**29.9**	24.5	12.3	9.5
Offer nutritional counseling to patients	849	20.5	**30.5**	27.3	13.1	8.6
Offer tobacco cessation counseling	848	20.2	**32.4**	24.3	12.7	10.4
Refer patients to Quitlines or other cessation services	845	18.0	25.2	**27.8**	16.4	12.5
Discuss/Counsel obese patients about the risk of systemic disease	850	7.5	13.1	23.2	**33.1**	23.2
Refer patients to labs/physicians for fasting glucose testing	850	6.6	15.5	18.7	20.8	**38.4**
Assess patients for diabetes using a glucose monitor	849	1.6	2.6	6.8	33.3	**55.6**
Perform fasting glucose testing in your office with lab follow up	849	0.1	0.6	1.9	24.7	**72.7**

Table 7. The frequency of dental hygienists who discuss systemic or health conditions with patients and who refer patients to a medical provider for the same systemic/health condition

Condition	Discuss		Refer	
	N	%	N	%
Tobacco Use	764	**89.0**	99	11.5
Pregnancy	722	**84.1**	98	11.4
Genetics	678	**79.0**	129	15.0
Diabetes	651	**75.9**	219	25.5
Stress	569	**66.3**	95	11.1
Cardiovascular Disease (CVD)	563	65.6	262	**30.5**
Osteoporosis	448	52.2	188	21.9
Stroke	393	45.8	233	27.2
HIV	371	43.2	306	**35.7**
Respiratory Disease	267	31.1	241	**28.1**
Obesity	222	25.9	162	18.9
Other	40	4.7	23	2.7

Table 8. Frequency with which NC Dental hygienists reported consulting with medical colleagues and/or dental specialists regarding systemic health issues.

	N	Always (%)	Frequently (%)	Occasionally (%)	Rarely (%)	Never (%)
Need for premedication	849	**45.3**	34.9	16.4	2.1	1.3
Coagulation issues	830	26.0	22.5	**27.8**	13.5	10.1
Patient's medications (e.g. physical/emotional)	830	12.9	19.2	**36.5**	20.5	11.0
Treatment needs for patients with CVD	828	10.4	22.0	**34.5**	19.8	13.3
Treatment needs during pregnancy	841	10.3	12.2	25.8	**32.7**	18.9
High or low blood pressure readings	830	7.2	15.5	**32.4**	26.5	18.3
Treatment needs for patients with diabetes	828	3.4	10.4	**33.5**	32.7	20.0
Patient's risk for diabetes	818	2.4	7.2	20.5	**38.0**	**31.8**

Table 9. Frequency of NC dental hygienists who reported barriers to incorporation of oral-systemic evidence into practice

	N	Significant Barrier (%)	Somewhat a Barrier (%)	Not a Barrier (%)
Patients' objection to additional fees for services.	829	**68.9**	25.2	5.9
Lack of time in practice schedule.	842	**51.5**	34.3	14.1
Lack of reimbursement from 3rd party payers.	796	**46.4**	37.9	15.7
Concern over legal risks.	818	**44.1**	43.2	12.7
May be perceived by state board as unauthorized practice of medicine.	809	39.2	**46.0**	14.8
Lack of patient acceptance of dental professional providing counseling.	839	31.9	**54.6**	13.5
Lack of education on systemic health	840	27.4	**61.3**	11.3
Lack of patient education materials	839	21.2	**55.9**	22.9
Fear of appearing judgmental to the patient/parent.	838	21.0	**57.3**	21.7
Low level of confidence about actively managing patients with systemic health problems.	838	15.4	**61.1**	23.5
Lack of CE opportunities	836	14.5	49.2	36.4
Lack of appropriate referral options within my community.	828	12.2	**47.2**	40.6
Lack of definitive evidence to indicate oral-systemic connections.	824	7.5	**53.6**	38.8

Table 10. The effect of age on practice behaviors.

	Age				
Practice Behavior	**<30 (%)**	**31-40 (%)**	**41-50 (%)**	**>50 (%)**	**P-Value**
Ask about blood sugar	**46**	**37**	30	26	<0.001
Record Blood sugar	**12**	8	6	6	0.017
Discuss alcohol use with all patients	20	20	19	**12**	<0.001
Discuss tobacco use with all patients	45	43	42	**32**	<0.001
Perform full mouth probing for D4910 patients	88	90	78	78	<0.001
Evaluate probing depths for all patients	74	72	70	**56**	<0.001
Evaluate bleeding on probing for all patients	72	67	64	59	0.03

Table 11. Effect of practice type on practice behaviors.

	Group Private (%)	Solo Private (%)	Public Health/ Other (%)	P-Value
Ask about blood sugar	32	33	**52**	0.014
Record blood sugar	8	5	**27**	<0.001
Ask about HbA1c	6	8	**18**	0.015
Record HbA1c	4	2	**7**	0.017
Have blood pressure cutoffs	70	62	**81**	0.006
Perform full mouth probing for D1110 patients	55	51	**41**	<0.001
Perform full mouth probing for D4910 patients	84	84	**67**	0.024
Evaluate probing depths	99	99	91	<0.001
Evaluate mobility	98	98	93	0.016
Discuss pulse with all patients	9	12	28	0.003
Discuss medications with all patients	**96**	92	92	0.04
Discuss medical diagnoses with all patients	**77**	67	59	0.001
Discuss alcohol use with all patients	18	15	**34**	0.004
Discuss BMI with new/select patients	19	16	**30**	0.04
Discuss bone density with new/select patients	43	40	20	0.022

Table 12. Effect of practice setting on practice behaviors

Practice Behavior	Urban (%)	Suburban (%)	Rural (%)	P-Value
Perform periodontal exam at every visit for D1110 patients	40	41	**26**	0.022
Perform full mouth probing for D1110 patients	50	56	**43**	0.037
Evaluate probing depths for all patients	70	70	**57**	0.007
Evaluate mobility for all patients	58	48	52	0.037

FIGURES

Figure 1. Comparison of perceived "significant" barriers by practice type

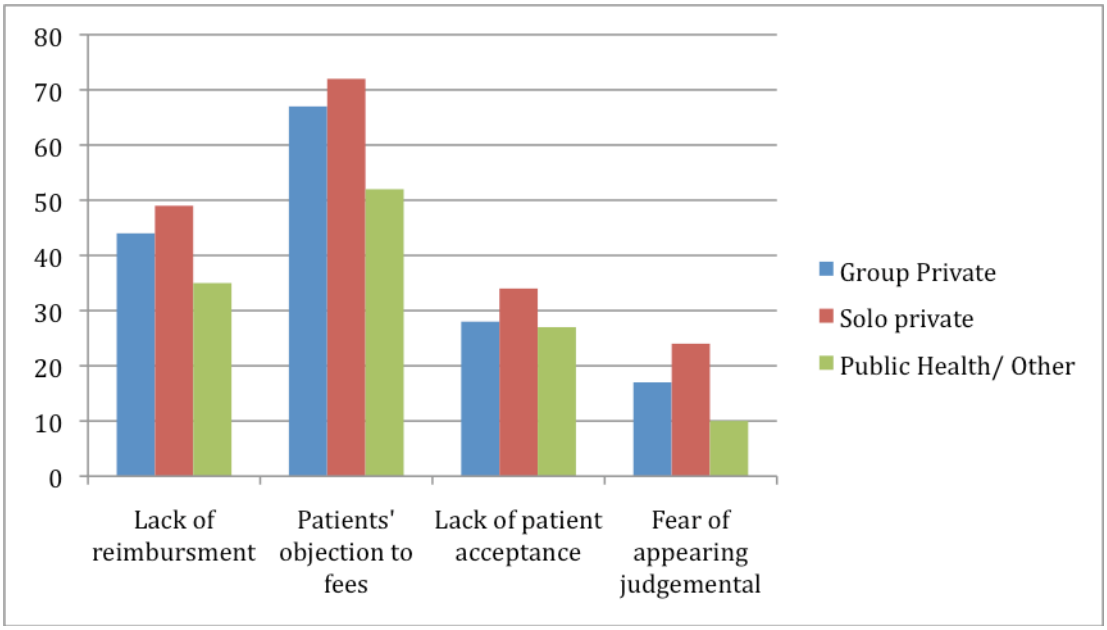
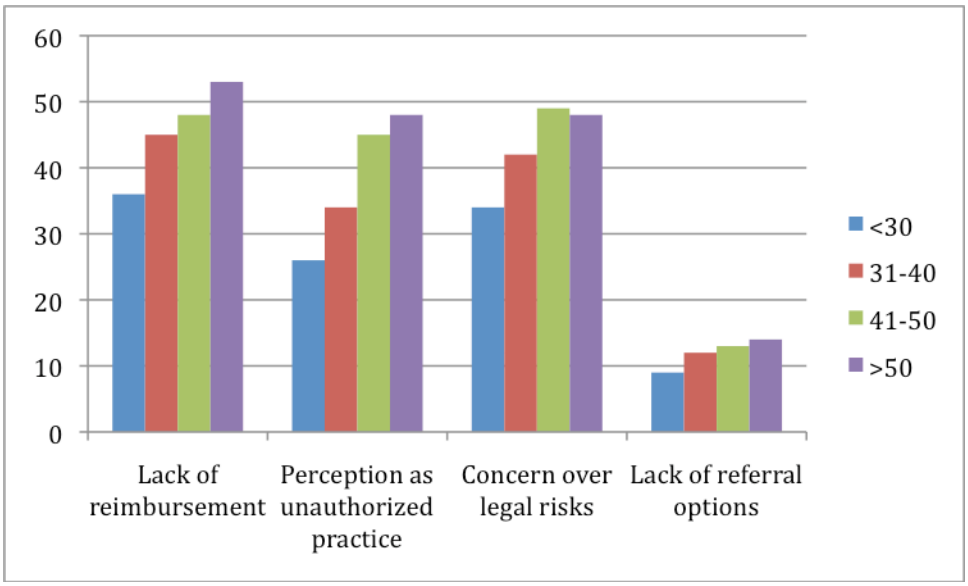


Figure 2. Comparison of perceived "significant" barriers by age



APPENDIX

October 1, 2009

Dear

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

You are one of 1,665 dental hygienists who have been randomly selected to receive this survey out of over 5,000 licensed hygienists in the state of North Carolina. **We need your help** in obtaining a good understanding of existing practices in your office and across the state regarding oral-systemic health and disease prevention. We plan to use the information you share with us to determine what is needed by North Carolina dental hygienists to provide better care for patients regarding oral disease and systemic health. Because you are one of the randomly selected hygienists, **it is important that you complete and return this survey.**

Instructions for completing the survey:

- Please answer as many questions as possible. If you choose not to answer specific questions, your answers to the other questions will still be of value to the study.
- Completion of the survey should take approximately 15 minutes.
- Please complete and return the survey by **Friday, October 23, 2009** in the enclosed business reply envelope. Late returns are accepted (and still appreciated).
- A drawing will be held of all completed surveys one month following our target date for the return of the questionnaires. **Ten randomly selected respondents will receive a $50 American Express gift card.**
- Please note that we are tracking surveys by number and will not record your name in any data files in association with this survey, except for the gift card drawing.
- Your participation is completely voluntary. **If you decide not to participate, or do not currently provide clinical care to patients, please return the blank survey in the enclosed envelope so we will know your intent.** This action will prevent you from receiving a follow-up notice.

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

research team members, the statistical analysis personnel, and me. The results will be published and shared with other dental professionals.

If you have questions about this study, please contact me at Rebecca_Wilder@dentistry.unc.edu or call (919) 966-8221. All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have any questions or concerns about your rights as a research subject you may contact, anonymously if you wish, the UNC Institutional Review Board at (919) 966-3113 or by email to IRB_subjects@unc.edu.

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

Sincerely,

Rebecca Wilder, BSDH, MS, Principal Investigator

and the other research team members:
Ceib Phillips, PhD Department of Orthodontics
David Paquette, DMD, MPH, DMSc. Department of Periodontics
Steven Offenbacher, DDS, MS, PhD Department of Periodontics
Kathryn Bell, RDH, BS MS Degree Candidate, Department of Dental Ecology

Enclosures:
Survey
Pre-addressed, business reply envelope

Rebecca Wilder's contact information:
Rebecca Wilder, BSDH, MS
Professor
Director: Graduate Dental Hygiene Education
Director of Faculty Development
UNC School of Dentistry
3280 Old Dental Bldg. CB#7450
Chapel Hill, NC 27599-7450
(919) 966-8221
Rebecca_Wilder@dentistry.unc.edu

UNC DEPARTMENT OF DENTAL ECOLOGY
North Carolina Survey of Dental Hygienists: Oral-Systemic Disease ID: ☐☐☐☐

Thank you for taking the time to complete this important survey and for providing your comments. Please write directly on the survey with a PEN. Read each question carefully and provide your most appropriate response. Fill in circles completely or fill in the boxes and blanks as needed.
When completed, do not fold the survey, but place it in the enclosed business reply envelope and mail it back to us.

IF YOU DO NOT CURRENTLY PROVIDE CLINICAL SERVICES TO PATIENTS, please return the survey in the enclosed business reply envelope. This action will help account for all surveys mailed and prevent you from receiving a follow-up notice.

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

A: DEMOGRAPHICS

1. Your age: ○ <30 ○ 31-40 ○ 41-50 ○ 51-59 ○ 60-70 ○ >70

2. Gender: ○ Male ○ Female

3. Year of graduation from dental hygiene school: ☐☐☐☐

4. Select ALL degrees that you have earned:
○ Certificate in Dental Hygiene ○ Associates in Dental Hygiene ○ Bachelors in Dental Hygiene
○ Bachelors in other area ○ Masters ○ Doctorate

B: PRACTICE SETTING

5. Which of the following *best* describes your primary practice type? ○ Group private ○ Solo private ○ Public health ○ Other

6. The setting of your practice is: ○ Urban ○ Suburban ○ Rural

7. How many hours per week do you provide direct patient care? ○ 1-10 ○ 11-20 ○ 21-30 ○ 31-40 ○ 40+

8. For dental hygienists who work in multiple practices, how many days do you provide care in the practice you work the most?
○ 1 day ○ 1.5 days ○ 2 days ○ 2.5 days ○ 3 days ○ 3.5 days ○ 4 days ○ >4 days ○ Work in only one office

9. Estimate the percentage of patients in your practice that fall into the following groups. (Percentages should total 100%)
☐☐☐ % Caucasian ☐☐☐ % Asian ☐☐☐ % Other
☐☐☐ % African American ☐☐☐ % Hispanic

10. Estimate the percentage of patients in your practice who: (Percentages should total 100%)
☐☐☐ % Have public insurance (Medicaid) ☐☐☐ % Have private dental insurance ☐☐☐ % Have no insurance / pay out of pocket for services

11. Estimate the percentage of your patients that fall into each of the following age groups: (Percentages should total 100%)
☐☐☐ % 1-18 years old ☐☐☐ % 40-64 years old
☐☐☐ % 19-39 years old ☐☐☐ % 65+ years old

12. Estimate the percentage of your adult patients that are in the following ADA codes:
☐☐☐ % D1110 (adult prophylaxis) ☐☐☐ % D4910 (periodontal maintenance)

13. Estimate the percentage of your patient population that is on a dental hygiene recall schedule shorter than 6 months.
○ 0-20% ○ 21-40% ○ 41-60% ○ > 60%

Revised 09/2009

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C: PRACTICE BEHAVIORS

14. For the majority of your patients, when is the medical history form updated?

○ At each appointment ○ Every 3-6 months ○ Every year ○ No regular schedule

15. Do you personally review the medical history with the patient?

○ Always ○ Often ○ Sometimes ○ Rarely ○ Never ○ Done by the dentist or another staff member

16. Indicate for whom you assess or discuss the following procedures with your adult patients: (*Select patients* means patients that you determine may need additional assessments due to their condition, but not performed on every patient.)

	All Patients	Select Patients	New Patients	No Patients
Blood pressure	○	○	○	○
Pulse	○	○	○	○
Medications patient is taking	○	○	○	○
Medical diagnoses as it relates to oral health status	○	○	○	○
Alcohol use	○	○	○	○
Tobacco use	○	○	○	○
Height, Weight, BMI (Body Mass Index)	○	○	○	○
Stress levels	○	○	○	○
Physical activity levels	○	○	○	○
Bone density test results	○	○	○	○
Specific High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL) cholesterol levels	○	○	○	○

17. For your patients with diabetes, which of the following do you ask about routinely and record in the record? Leave blank if not done in your practice.

	Ask about / Evaluate	Record	Not Done
Daily blood sugar reading the day of dental treatment	○	○	○
HbA1C	○	○	○

18. Do you have high and low blood pressure cut off points at which you will not treat a patient? ○ Yes ○ No

19. For a new patient visit, periodontal exams are performed: ○ Always ○ Often ○ Sometimes ○ Rarely ○ Never

20. Who performs typically the periodontal examination on new patients? ○ Dentist ○ Dental hygienist

21. Indicate the frequency with which periodontal examinations are performed for the following categories of patients.

	At every visit	Every 6 months	Once yearly	No regular schedule	Never
D1110 Adult Prophylaxis:	○	○	○	○	○
D4910 Periodontal Maintenance:	○	○	○	○	○

22. Indicate the type of probing performed for a periodontal examination with the following patient procedures:

	Full Mouth Probing	Periodontal Screening and Recording (PSR)	Spot Probing
D1110 Adult Prophylaxis:	○	○	○
D4910 Periodontal Maintenance:	○	○	○

23. Indicate if you measure / evaluate each of the following items listed on the left. Is the evaluation done for all patients or for select patients?

	Measured / Evaluated	All Patients	Select Patients	New Patients	No Patients
Oral Cancer Screening	○	○	○	○	○
Assess plaque and calculus	○	○	○	○	○
Appearance of gingiva	○	○	○	○	○
Probing depths	○	○	○	○	○
Clinical attachment levels	○	○	○	○	○
Bleeding on probing	○	○	○	○	○
Mucogingival relationships	○	○	○	○	○
Furcations	○	○	○	○	○
Tooth mobility	○	○	○	○	○

24. Do you inform the patient of his/her periodontal diagnosis?

○ Always ○ Frequently ○ Occasionally ○ Rarely ○ Never

25. For adult patients with advanced gingivitis or periodontitis, what adjunctive therapies and homecare regimens do you typically recommend? (Indicate *ALL* that apply)

○ Manual toothbrushes ○ Flossing ○ Use of antimicrobial toothpaste (e.g., Colgate Total®, Crest ProHealth®)
○ Other interdental cleaning aids (e.g., proxy brush) ○ Powered toothbrushes
○ Oral irrigation with water or an antimicrobial (e.g., Waterpik®)
○ Oral rinsing with an antimicrobial mouthrinse (e.g., Peridex™, Listerine®, Crest ProHealth®)
○ Locally delivered antibiotics (e.g., Arestin®, Atridox®, PerioChip®)
○ Systemic antibiotics ○ Other

Please answer the following questions regarding the management of patients in your practice.

26. In your practice, how likely are you to offer the following services/counseling to your patients if indicated by health history or patient assessment?

Services / Counseling	Extremely Likely	Likely	Somewhat Likely	Unlikely	Extremely Unlikely
Use a glucose monitor on patients to assess them for diabetes.	○	○	○	○	○
Perform fasting blood glucose testing in your own office with follow up from a lab.	○	○	○	○	○
Refer patients to laboratories and/or physicians to have their fasting blood glucose levels checked.	○	○	○	○	○
Call the patient's physician to coordinate the patient's dental treatment.	○	○	○	○	○
Offer tobacco cessation counseling to patients.	○	○	○	○	○
Refer patients who use tobacco to Quitlines or other cessation services.	○	○	○	○	○
Refer patients to a medical provider for follow up care for signs and symptoms detected during a dental appointment.	○	○	○	○	○
Offer nutritional counseling to patients.	○	○	○	○	○
Educate patients about the association between oral infection and glycemic control.	○	○	○	○	○
Discuss / counsel obese patients about the risks of systemic disease.	○	○	○	○	○

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27. If a patient presents with the conditions or habits listed on the left, *which are you likely* to discuss with the patient and/or recommend referral to a physician or dental specialist based on risk factors for oral-systemic complications? Leave blank if you do not perform.

	Discuss Risks	Refer to a physician or Dental Specialist
Pregnancy	○	○
Cardiovascular Disease (CVD)	○	○
Diabetes	○	○
Genetic Predisposition to Periodontal Disease	○	○
HIV	○	○
Obesity	○	○
Osteoporosis	○	○
Respiratory Disease	○	○
Stress	○	○
Stroke	○	○
Tobacco Use	○	○
Other (please specify)_____	○	○

D. WORKING WITH MEDICAL COLLEAGUES / DENTAL SPECIALISTS

28. Indicate how often you consult with a medical provider (physician, nurse practitioner, etc) for the following situations:

Topic	Always	Frequently	Occasionally	Rarely	Never
Dental treatment during pregnancy	○	○	○	○	○
High or low blood pressure readings	○	○	○	○	○
Treatment needs for a patient with diabetes	○	○	○	○	○
Patient's risk for diabetes	○	○	○	○	○
Need for pre-medication	○	○	○	○	○
Patients' medications (e.g., physical, emotional)	○	○	○	○	○
Treatment needs for a patient with cardiovascular disease (CVD)	○	○	○	○	○
Coagulation issues	○	○	○	○	○
Other (please specify)_____	○	○	○	○	○

29. Do you have a role in deciding which patients will be referred to a medical or dental specialist? ○ Yes ○ No

ID: ☐☐☐☐

E. PERIODONTAL DISEASE AND SYSTEMIC HEALTH

30. Which of the following are signs that the patient has oral inflammation? (Select TWO)

○ Gingival recession ○ Bleeding on probing ○ Increased pocket depth
○ Loss of clinical attachment ○ Supragingival plaque

31. What are the risk factors for Periodontitis? (Select ALL that apply)

○ Alcohol use	○ Diabetes	○ Diet	○ Heredity/Genetics	○ High blood pressure
○ High cholesterol	○ Increased stress	○ Overweight/obese	○ Physical inactivity	○ Poor oral hygiene (OH)
○ Post menopausal	○ Race	○ Specific oral bacteria	○ Smoking	○ Systemic inflammation

32. What are the risk factors for Cardiovascular Disease? (Select ALL that apply)

○ Alcohol use	○ Diabetes	○ Diet	○ Heredity/Genetics	○ High blood pressure
○ High cholesterol	○ Increased stress	○ Overweight/obese	○ Physical inactivity	○ Poor oral hygiene (OH)
○ Post menopausal	○ Race	○ Specific oral bacteria	○ Smoking	○ Systemic inflammation

33. What are the risk factors for Diabetes/Diabetic Complications? (Select ALL that apply)

○ Alcohol use		○ Diet	○ Heredity/Genetics	○ High blood pressure
○ High cholesterol	○ Increased stress	○ Overweight/obese	○ Physical inactivity	○ Poor oral hygiene (OH)
○ Post menopausal	○ Race	○ Specific oral bacteria	○ Smoking	○ Systemic inflammation

34. What are the risk factors for Preterm/Low Birth Weight Babies? (Select ALL that apply)

○ Alcohol use	○ Diabetes	○ Diet	○ Heredity/Genetics	○ High blood pressure
○ High cholesterol	○ Increased stress	○ Overweight/obese	○ Physical inactivity	○ Poor oral hygiene (OH)
	○ Race	○ Specific oral bacteria	○ Smoking	○ Systemic inflammation

35. What are the risk factors for Osteoporosis? (Select ALL that apply)

○ Alcohol use	○ Diabetes	○ Diet	○ Heredity/Genetics	○ High blood pressure
○ High cholesterol	○ Increased stress	○ Overweight/obese	○ Physical inactivity	○ Poor oral hygiene (OH)
○ Post menopausal	○ Race	○ Specific oral bacteria	○ Smoking	○ Systemic inflammation

36. Indicate your opinion regarding the *strength of the evidence supporting the link between the following*

	Strong	Moderate	Weak	None
Periodontal disease and **Cardiovascular disease**	○	○	○	○
Periodontal disease and **Diabetes**	○	○	○	○
Periodontal disease and **Obesity**	○	○	○	○
Periodontal disease and **Pregnancy complications like preterm delivery and low birth weight infants**	○	○	○	○
Periodontal disease and **Osteoporosis**	○	○	○	○
Periodontal disease and **Respiratory conditions like bacterial pneumonia**	○	○	○	○

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F. ATTITUDES AND OPINIONS

37. Indicate your level of agreement with the following statements:

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I feel comfortable asking patients about their alcohol habits.	○	○	○	○	○
I feel confident that I can counsel patients about the effects of alcohol on their oral-systemic health.	○	○	○	○	○
I feel comfortable asking patients about their tobacco habits.	○	○	○	○	○
I am confident that I can counsel my patients on how to quit using tobacco.	○	○	○	○	○
I am comfortable referring patients who use tobacco to a Quitline.	○	○	○	○	○
I am confident that I can discuss potential risks with pregnant patients who also have periodontal disease.	○	○	○	○	○
I am comfortable treating patients who may be at risk for adverse pregnancy outcomes (low birth weight/preterm delivery).	○	○	○	○	○
I am confident that I can discuss potential oral-systemic risks with cardiovascular patients who also have periodontal disease.	○	○	○	○	○
I am comfortable treating patients who have both cardiovascular disease and periodontal disease in my practice.	○	○	○	○	○
I am confident that I can discuss potential oral-systemic risks to patients with diabetes who also have periodontal disease.	○	○	○	○	○
I am comfortable treating patients who have both diabetes and periodontal disease.	○	○	○	○	○

38. Indicate your level of agreement with the following statements.

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I ask very thorough/detailed follow up questions to "yes" answers on the medical history form.	○	○	○	○	○
I thoroughly assess the patient's risk for systemic disease as it relates to their oral condition.	○	○	○	○	○
I adjust the frequency of dental visits as needed for patients with diabetes, CVD or other conditions that might place them at risk for oral-systemic complications.	○	○	○	○	○
Medical providers should be trained to screen patients for periodontal disease.	○	○	○	○	○
My knowledge about periodontal disease is current.	○	○	○	○	○
My employer's knowledge about periodontal disease is current.	○	○	○	○	○
I provide thorough periodontal therapies to my patients (i.e. scaling and root planing services, etc.).	○	○	○	○	○
The evidence relating periodontal disease and systemic disease is not conclusive.	○	○	○	○	○
Dentists should be trained to identify risk factors for oral-systemic disease.	○	○	○	○	○
Dental hygienists should be trained to identify risk factors for oral-systemic disease.	○	○	○	○	○
Dentists should be trained to actively manage a patient with systemic disease (ie: diabetes, respiratory disease, CVD).	○	○	○	○	○
Dental hygienists should be trained to actively manage a patient with systemic disease (i.e.: diabetes, respiratory disease, CVD).	○	○	○	○	○

38 (cont). Indicate your level of agreement with the following statements .

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
My employer encourages staff members to incorporate evidence about oral-systemic disease into clinical practice.	○	○	○	○	○
Medical colleagues would like for me to take a more active role in the management of my patients' systemic health issues (ie: diabetes, respiratory disease, CVD).	○	○	○	○	○
My patients would like for me to take a more active role in the management of their systemic health.	○	○	○	○	○
My patients appreciate it when I ask them questions about their systemic health.	○	○	○	○	○
Physicians and nurses in my area are knowledgeable about oral-systemic connections.	○	○	○	○	○
During their formal education, dental and medical professionals should be taught to practice in a more collaborative way.	○	○	○	○	○
I have experienced an increase in the number of questions patients ask me about oral-systemic relationships.	○	○	○	○	○
I am interested in expanding my practice to include the management of patients with complicated medical conditions.	○	○	○	○	○
I am interested in collaborating more with physicians and nurses to improve interprofessional care of patients.	○	○	○	○	○

G. BARRIERS

39. What obstacles do you perceive to incorporating oral-systemic evidence in caring for patients?

Issue	Significant Obstacle	Somewhat an Obstacle	Not an Obstacle
Lack of education on systemic health	○	○	○
Lack of patient education materials	○	○	○
Lack of continuing education opportunities	○	○	○
Low level of confidence about actively managing patients with systemic health problems	○	○	○
Lack of time in practice schedule	○	○	○
Limited or lack of reimbursement from 3rd party payers	○	○	○
Patients' objection to additional fees for services	○	○	○
May be perceived by state dental board as unauthorized practice of medicine	○	○	○
Concern over legal risks	○	○	○
Lack of patient acceptance of dental professional providing counseling	○	○	○
Fear of appearing judgmental to patient/parent	○	○	○
Lack of appropriate referral options within my community	○	○	○
Lack of definitive evidence to indicate oral-systemic connections.	○	○	○
Other (please specify) _____	○	○	○

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COMMENTS:

Please write any comments you have regarding the content of this survey or future plans your practice has for change regarding oral-systemic care of patients.

End of Survey.
Please do not fold the survey when placing in the return envelope.

Thank you for your participation.

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