Comparing the Risk Identification and Management Behaviors between Oral Health Providers for Patients with Diabetes

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Abstract

Purpose: Evidence supporting the link between periodontal disease and systemic disease continues to grow. To date, little is known about how dental professionals incorporate this information into managing diabetic patients. This study examines the risk identification and practice behaviors regarding diabetic patients among dentists, hygienists and specialists.

Methods: Responses were received from 383 currently practicing oral health professionals in Arkansas. The electronic survey consisted of 35 open and closed–ended or Likert–type items. Principal components factor analysis using varimax rotation was used to explore underlying dimensions of the questionnaire in order to provide a more parsimonious view of the outcomes. Logistic models were fitted to determine best practice outcome as a function of knowledge and professional and social norms.

Results: Neither knowledge about diabetes ($p<0.285$) nor provider type ($p<0.186$) was a predictor of practice behavior. Professional and social norms ($p<0.001$) identified those practitioners who felt modifying their management strategies for their patients with diabetes was a necessary component of their practice behavior.

Conclusion: In general, risk assessment was lacking, irrespective of whether a clinician was a dentist or dental hygienist. Results indicate oral health professionals in Arkansas need to improve the treatment and management of patients with diabetes and periodontal disease.

Keywords: Glycemic control, HbA1c, syndemic, insulin resistance, hypoglycemia, glycated hemoglobin, periodontitis

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Introduction

According to the most recent data from the Centers for Disease Control and Prevention, it is estimated that 23.6 million Americans, or over 7.8% of the adult population, are affected by diabetes.[1] Over the past 35 years, diabetes prevalence has increased 3–fold.[2] In 2007, 1.6 million new cases of diabetes were diagnosed in people aged 20 and older.[1] While this increase in diagnosed cases of diabetes is alarming, the estimated 5.7 million undiagnosed cases is an additional cause for concern.[1] With the increase of diabetes, dental practitioners will be treating more patients with diabetes in the future.

Recent evidence supporting the link between periodontal and systemic diseases, such as diabetes, continues to increase in the medical, nursing and dental literature. Diabetes mellitus can modify the manifestation and progression of periodontitis and is considered the most significant systemic disease risk factor for periodontitis,[3–13] while periodontitis is often considered the sixth complication of diabetes.[14,15] Additionally, several studies suggest a bi–directional relationship between periodontal inflammation and glycemic control. Patients with poor glycemic control exhibit increased attachment loss and unfavorable response to periodontal therapy.[2–13] Taylor et al provides evidence from treatment studies supporting an association between poor glycemic control in people with diabetes and increased occurrence and progression of periodontal infection or periodontitis.[2] Type 2 diabetes and periodontal disease are both chronic diseases which require considerable patient education and substantial self–management skills to achieve good outcomes. In poorly controlled diabetes, the degree of periodontal destruction is often greater and the

number of teeth affected is higher, often making the diabetic patient more difficult to treat.[16] Diabetes can exaggerate the host response to the oral microbial factors, resulting in unusually destructive periodontal breakdown. Poorly controlled diabetics have a greater risk of progressive alveolar bone loss and connective tissue attachment loss than those patients with well controlled conditions.[16–21] In addition to maintaining oral health, treating periodontal infection in people with diabetes may play an important role in establishing and maintaining glycemic control. It is important to note that an improvement in glycemic control after periodontal treatment was not reported by all investigations.[2]

Because diabetes mellitus is considered the most significant systemic disease risk factor for periodontitis,[3–13] teaching blood glucose screening to dental students has been suggested as an intervention to improve diabetes outcomes.[22] This initiative is in harmony with the 1995 Institute of Medicine's Committee on the Future of Dental Education Study, which states that "dental education has arrived at a crossroads," and the position of dental education is being questioned as is its relationship to medicine and the larger health care system.[23] The Institute of Medicine's report noted the need to broaden the knowledge about oral health care problems as they relate to systemic disease and to improve understanding among general dental practitioners in active management of systemic diseases such as diabetes.

A risk assessment (process of care indicator) in the diabetic patient that is of importance to the oral health professional is the HbA1C (glycated hemoglobin) test, or A1C test.[24] Hemoglobin, which is found in red blood cells, links with the glucose in the blood to become glycated.[25] Once glycated, the hemoglobin will stay glycated for the entire lifespan of the red blood cell, approximately 120 days. Random blood glucose testing gives only a snapshot of the glucose levels at a single moment in time and is critically dependent on the time and carbohydrate content of the previous meal.[25] The HbA1c level provides a measure of glucose management over the last 2 to 3 months. An improvement or worsening in blood glucose level will take 2 to 3 months to produce a change in the HbA1C reading. Figure 1 illustrates how blood glucose and HbA1c (glycated hemoglobin) levels compare. A 9% level means that 9% of hemoglobin molecules are glycated (sugar coated). People without diabetes have an approximately 5% reading. Research has shown that keeping the HbA1C less than 7% helps lower one's risk for the complications of diabetes.[25] An 8 to 10% HbA1c is usually considered moderate glycemic control, while >10% is considered poor control.[16,25] Physician intervention is indicated with readings >8%.[19,20] The American Diabetes Association Guidelines recommend that people with diabetes try to maintain glucose levels close to normal and to keep the HbA1C value at <7%.[25] Current evidence suggests that dental professionals need to be aware of this linkage and appropriately modify assessments and treatment plans to address the diabetic individuals' needs.

Figure 1: Correlation between HbA1c levels and mean plasma glucose levels

HbA1c (%)	Mean plasma glucose levels[a]
6	126
7	154
8	182
9	212
10	240
11	269
12	298

Normal blood glucose levels for a person without diabetes: Fasting 95 mg/dl or less, one hour post prandial 140 mg/dl or less, two hours post prandial 120mg/dl or less.

Risk assessment is now an integral component and the standard of care for assessing and managing periodontal diseases.[26–27] Type 2 diabetes, as one of the most important systemic disease risk factors for periodontitis, plays an important role in patient assessment, diagnosis, comprehensive treatment planning and health promotion and disease prevention.[9] To date, little is known about the degree to which oral health professionals have modified their practice behaviors to adapt to the emerging evidence for the bi–directional relationship between diabetes and periodontal disease.

In 2006, Kunzel et al surveyed active periodontists and general practice dentists in the Northeastern U.S. to determine the extent to which the dentists' behaviors and attitudes reflect current understanding of diabetes and smoking as important systemic disease risk factors for periodontitis.[9] This survey was the first to document the extent of dentists' behaviors with respect to the assessment and management of the diabetic or unidentified diabetic patient.[9] The survey elicited a high response rate (73% for periodontists and 80% for general practice dentists) among a relatively small sample (n=274). Results showed that there was a deficit in clinicians' behaviors, specifically in: determining type of diabetes, when first diagnosed, complications (if any), regimen utilized to control blood glucose, referring for/monitoring glucose levels, communicating with patient's physician, changing/adjusting frequency of dental visits, discussing post operative medications/infection control, discussing

level of glycemic control, oral implications and how periodontal treatment may affect glycemic control. Moreover, a greater number of clinicians reported more frequently assessing and/or advising smokers than proactively managing the diabetic patient.[9]

While these results are interesting, the sample did not include dental hygienists. Patients who see their dental hygienists on a regular basis often form relationships and establish a meaningful rapport. Dental hygienists have the potential to influence the patient's attitude and knowledge regarding the link between diabetes and periodontal disease.[28] Dental hygienists also monitor the patient's periodontal health and play a key role in detecting changes that may be related to systemic disease.[29] In support of an interdisciplinary approach, all oral health professionals should offer support in the assessment and proactive management of diabetes and periodontal disease.

The purpose of this study was to compare the risk identification and practice management behaviors between various types of oral health providers for patients with diabetes.

Methods and Materials

In April 2009, a convenience sample of 1,819 practicing general dentists, periodontists and dental hygienists with current, valid email addresses in Arkansas were surveyed using a 4 page structured electronic survey instrument (Survey Monkey). The email addresses were obtained from the Arkansas State Board of Dental Examiners. Currently in Arkansas, there are 1,341 licensed dentists (1,178 practicing in Arkansas) and 1,320 licensed hygienists (1,194 practicing in Arkansas). The survey was sent via email with a cover letter that explained the purpose of the study and invited interested subjects to participate. After the initial invitation to participate in the survey, the survey was available for 3 weeks, with follow up reminders emailed to the non–respondents after 1 week and again 2 weeks later. Professionals practicing less than 1 day per week were excluded. The Social Science Institutional Review Board for the University of Missouri–Kansas City (UMKC), Kansas City, Missouri approved this research.

A survey instrument was developed based on a modification of an existing survey instrument used by Kunzel.[9] The modified survey asked dentists, periodontists and dental hygienists to describe the extent to which they assess patients for diabetes (diagnosed and undiagnosed), as well as the manner in which they evaluate and manage patients with a history of diabetes and who present with periodontal disease. The survey contained 29 Likert–type scale questions, 3 open and closed–ended questions, as well as demographics such as training (dentist, hygienist, periodontist) and years in practice. Nine questions addressed risk identification, 8 addressed risk management, 6 addressed practice behavior and 6 addressed self–assessed knowledge and confidence in these areas. Three open–ended questions requested oral health professionals to define barriers, if any, to incorporating an interdisciplinary approach to treatment of patients with type 2 diabetes. Respondents were also asked to quantify how often they read current peer reviewed literature/research. A pilot test of the survey instrument was conducted by a panel of expert dentists, periodontists and hygienists, among the UMKC School of Dentistry faculty, to ensure that the items and response categories were appropriate for identified domains.

Data were analyzed using descriptive and inferential statistics. Results were obtained from Survey Monkey, coded and transferred to Excel and imported into SPSS. Principal components factor analysis with varimax rotation was used to explore the underlying dimensions of the questionnaire in order to provide a more parsimonious view of the outcomes. Subsequently, subscale scores were computed as mean scores and used in comparative analyses. Analyses were conducted at the group level where categorical variables, such as years in practice and type of provider, were used as grouping variables.

Additionally, clinicians were dichotomously grouped into those who employ current standards of care for managing diabetics and those who do not. Current standards of care were determined by correct responses to the following questions:

- Specify the type of diabetes
- Specify when they were diagnosed
- Specify what regimen they use to control blood glucose
- Refer for and/or monitor glucose level
- Perform medical consults with the patients physician
- Change/adjust frequency of dental visits
- Discuss postoperative medications and/or infection control
- Discuss how well controlled their diabetes is
- Discuss oral implications of diabetes
- Discuss how treatment may affect glycemic control

Never, rarely, sometimes, very often and always were the response choices, with the correct response being "always." Predictive models were tested using logistic regression to explore signifi-

cant predictors of management behavior. An alpha of 0.05 was used to determine statistical significance.

Results

Out of the 1,819 that comprised the sample, 383 participants opened the survey online, with 318 completing the survey for a response rate of 17.4%. One hundred and sixty–five (60%) were dental hygienists, 106 (38.5%) were general dentists and 5 (1.5%) identified their profession as periodontist (or other). Due to the low proportion and response rate of periodontists, only descriptive data are provided for this group. The majority of respondents had more than 20 years of experience. The majority of dental hygienists indicated reading 1 journal a week, while most dentists read 2 to 3. Table I and II show the percentages of years in practice and number of journals read for the respondents.

Overall, there were 9 survey items pertaining to risk identification. Risk identification was further characterized by dichotomizing items as general risk identification or specific diabetes risk identification. General risk identification questions addressed the frequency of patient's medical history updates, presence of diabetes, if the patient is under the care of a physician and medications taken. Specific diabetes risk identification questions consisted of: when diagnosed, type of diabetes, family history of diabetes, current HbA1c, glycated hemoglobin levels and a checklist of how frequently patients were asked about regimens used to control blood glucose. A large majority of dentists and hygienists (>89%) queried their patients regarding the following 3 risk identification items: presence of diabetes, under care of a physician and medications taken. More dentists (56.9%) than dental hygienists (35.75%) questioned their patient regarding a family history of diabetes. The responses to risk identification are presented in Table III.

Only 1.9% of total responses reported that they rarely perform a complete medical history update for their patients. Despite routine history taking, remarkably few providers (12.1%) ask for patient's HbA1c, glycated hemoglobin level. For this question, only 10.8% of dentists and 8.4% of dental hygienists question their patients about their HbA1c/glycated hemoglobin level if the patient has diabetes (Table III). There were no significant differences between dentists and hygienists with respect to general risk identification ($p<0.281$) and diabetes specific risk identification ($p=0.216$).

Table I: Years of Experience in Clinical Practice

Years Experience	General Dentists (n=106)	Dental Hygienists (n=165)
<1 year	1.0%	0.6%
1–5 years	7.8%	22.7%
6–10 years	13.7%	13.6%
11–19 years	15.7%	21.4%
>20 years	60.8%	40.9%

Table II: Journals read per week

Journals Read	General Dentist (n=106)	Dental Hygienist (n=165)
0	7.8%	15.6%
1	26.5%	53.2%
2–3	47.1%	25.3%
4–5	3.9%	0.6%
>6	14.7%	4.5%

Table III: Risk Identification

Questions 1 through 5: Percentages of respondents who answered "yes" to identification questions for new patients. This includes general and specific risk identification questions.		
Question 6: Frequency percentages of medical history updates.		
Question	DDS	Hygienists
1. Do you have diabetes	89.2%	89.0%
2. Do you have a family history of diabetes	56.9%	35.7%
3. Under physician's care	90.2%	90.9%
4. Are you taking medication	91.2%	92.9%
5. Current HbA1C (Glycated hemoglobin level) (Specific risk identification)	10.8%	8.4%
6. Frequency of Med HX Update		
Never/Rarely	0.0%	1.9%
Sometimes	13.7%	20.8%
Very Often	51.0%	37.7%
Always	35.3%	39.6

In relation to querying patients regarding regimens used to control blood glucose levels (i.e. how often do you ask your patients about the following regimens to control blood glucose) the following categories were presented: diet control, insulin control, self monitor glucose, medication control and patients' perceived level of glycemic

control. Never, rarely, sometimes, very often and always were the response choices, and the correct response was "always." Survey results revealed that 38.2% of respondents always ask about diet control, 44.5% always ask about insulin control and 46.6% always ask about medication control. Only 17.6% (very often) and 15.5% (always) question their patients regarding their perceived level of glycemic/HbA1c control. The remaining respondents (never (23.4%), rarely (21.6%) or sometimes (21.9%)) questioned the patient about their perceived level of glycemic control. No significant difference in response was noted between dentists and hygienists regarding assessment of glycemic control.

Table IV: Self–Assessed Knowledge

	Perio Abscess[a]	Glycemic[b]	Recognizing[c] 8%	Level[d]
Frequency/percent with correct answer	180 (65%)	228 (82%)	179 (64%)	52 (0.19%)

a Periodontal abscesses may be an indication of a patient with uncontrolled diabetes.
b Untreated periodontitis contributes to poor glycemic control.
c Recognizing uncontrolled diabetes is difficult because they respond to periodontal therapy similarly to non–diabetics.
d A patient reporting a glycated hemoglobin level of 8% is indicative of good glycemic control.

Utilizing factor analysis, survey items were organized and 3 sub–categories emerged: communication, medical/dental management and chair–side testing. Sub–scale scores were computed by taking a mean of responses or associated items. Communication sub–scale consisted of discussing the following: post–operative medications and/or infection control, how well controlled their diabetes is, oral implications of diabetes and how gingival/periodontal treatment may affect glycemic control. The medical/dental management sub–scale consisted of the following: attain medical consults with the patient's physician and modify the frequency of dental visits. The chair–side testing sub–scale consisted of a single item, use in office glucometer. Never, rarely, sometimes, very often and always were the response choices, and the correct response was "always." There was no significant difference between dentists and dental hygienists for the medical/dental management, communication and chair–side testing sub–scales. Dental hygienists were slightly higher than dentists in regards to chair–side testing. Less than half of all respondents (37.8 to 45.3%) reported that they sometimes or very often did all of the above (communication, medical/dental management and chair–side testing), with the exception of chair–side testing. A majority (84.9%) stated they never engaged in chair–side testing, with only 3 respondents (1%) stating that they always use an in office glucometer.

The 4 survey questions regarding self–assessed knowledge are presented in Table IV. Answer responses were strongly disagree, disagree, neither agree or disagree, agree and strongly agree.

1. Periodontal abscesses may be an indicator of a patient with uncontrolled diabetes (correct response: strongly agree)
2. Untreated periodontitis contributes to poor glycemic control (correct response: strongly agree)
3. Recognizing uncontrolled diabetes is difficult because they respond to periodontal therapy similarly to non–diabetics (correct response: strongly disagree)
4. A patient reporting a glycated hemoglobin level of 8% is indicative of good glycemic control (correct response: strongly disagree)

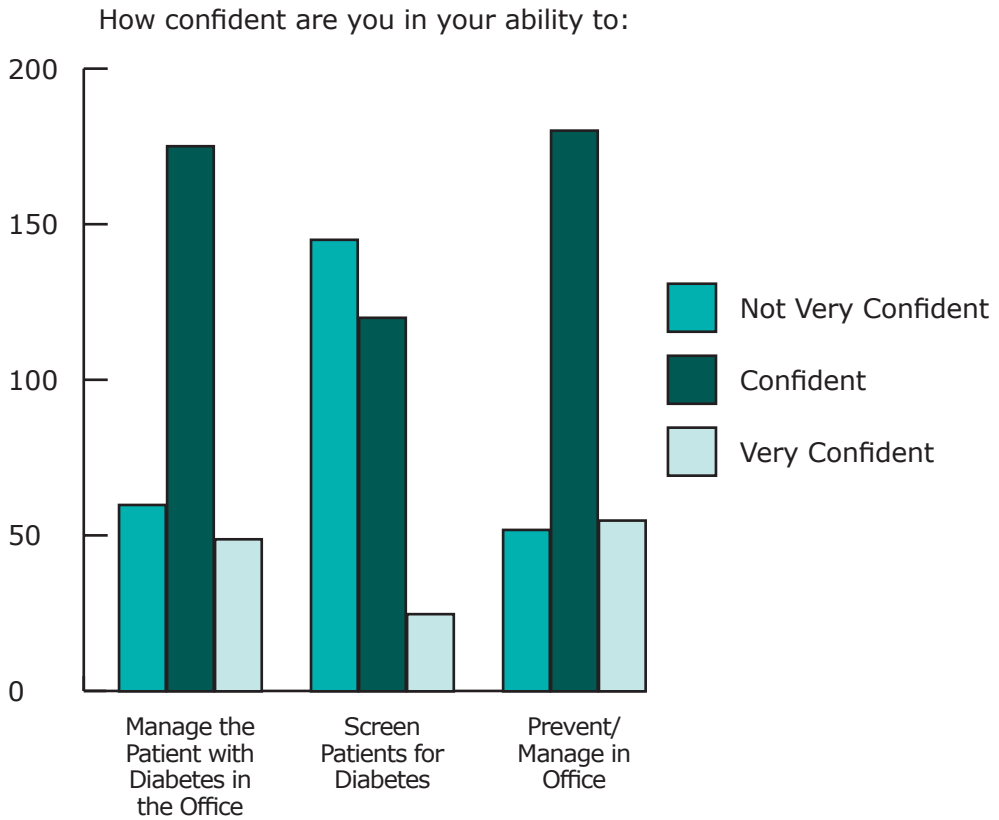
While both groups scored very low in recognizing an 8% HbA1c (glycated hemoglobin) level as an indicator of poor glycemic control, dental hygienists scored slightly better than dentists. In comparison of scores for items related to knowledge of diabetes and periodontal disease, the difference between dentists and dental hygienists was not significant (p=0.131). Most respondents (dentists and dental hygienists) agreed or strongly agreed (44.2 and 39.5%, respectively) that untreated periodontal disease contributes to poor glycemic control, while only 44% agreed and 22.5% strongly agreed that periodontal abscesses may be an indication of a patient with uncontrolled diabetes. Table IV displays the results of the self assessed knowledge items. Table answers were dichotomously grouped (0=incorrect response and 1=correct response).

A majority of all respondents (dentists and dental hygienists combined) stated they were very confident (17%) or confident (62.5%) in managing the diabetic patient in the office (Table V). When questioned about preventing in–office emergencies, 18% were not confident, 63% stated they were confident and 19% stated that they were very confident. The majority of all respondents (50.5%) responded that they are not very confident in screening patients for diabetes by using an in office glucometer.

A "professional norms" variable was created by

those responding positively to the following: my patients expect, my employer/employees expect and/or my colleagues expect me to take a more active role in diabetes management. A professional norms sub–scale score was computed by taking a mean of these 5 items. Logistic regression was used to model best practice outcome as a function of knowledge, professional/social norms or training.

Table V: Self–Assessed Confidence



In regards to professional norms (i.e. "what others expect me to do"), Likert style questions extracted the respondents' strength of professional responsibility regarding diabetes management. Answer responses were: strongly disagree, disagree, neither agree or disagree, agree and strongly agree. The preferred response for all statements was strongly agree, with the exception of "taking a more active role in diabetes management is too time consuming." For this statement, the preferred response was strongly disagree. The distribution of responses is displayed in Table VI. The responses were varied with the exception of "I feel competent taking a more active role in diabetes management." For this item, 48.8% of respondents agreed. No other items elicited a strong response. The majority of all respondents neither agreed nor disagreed with the following statements: "My patients expect me to take an active role in their diabetes management" (33%) and "My colleagues expect me to take an active role in diabetes management" (37.5%). The highest percentage (39.6%) disagreed with the statement "Taking a more active role in diabetes management is too time–consuming."

Dentists and hygienists responding positively to "My patients expect" and "My employer/employees expect." "My colleagues expect me to take a more active role in diabetes management" was a stronger indicator of pro–active practice behavior in regards to the management of the patient with diabetes. Neither knowledge of diabetes (p=0.285) nor provider type (p=0.186) was a strong indicator of practice behavior.

Discussion

While most respondents of this survey agreed that untreated periodontal disease contributes to poor glycemic control, it is surprising to find that 87.9% of respondents do not question their patients regarding their HbA1c/glycated hemoglobin level and, additionally, 70.7% remained neutral regarding their perceptions of an HbA1c level of 8%, clearly indicative of poor glycemic control. In most labs, the normal HbA1c range is 4 to 5.9%.[25] In addition, the majority of respondents stated they are not very confident in screening patients for diabetes. Monitoring the HbA1c level plays a crucial role in risk management of patients with diabetes. Hyperglycemia, hypoglycemia and/or blood glucose level are familiar terms for most practitioners. The HbA1c level is a newer term/standard used to determine a diabetic patient's level of glucose control. The HbA1c level gives a more accurate measure of the average level of glycemic control and should be collected and documented for a diabetic patient similar to the blood pressure of the hypertensive patient. The HbA1c level not only identifies potential patients at risk for a poor response to periodontal therapy, it is also an important tool for

Table VI: Professional Norms

Percentages for DDS and RDH					
	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
My patients expect me to take an active role in their diabetes management	8.6%	30.5%	33.0%	23.3%	4.7%
I feel competent taking a more active role in diabetes management	4.8%	13.8%	22.8%	48.4%	10.0%
Taking a more active role in diabetes management is too time consuming	13.9%	39.6%	33.3%	10.4%	2.8%
My colleagues expect me to take an active role in diabetes management	4.2%	21.2%	37.5%	28.8%	8.3%
My employer or employees expect me to take an active role in diabetes management	6.9%	23.4%	35.2%	25.9%	8.6%

management of the patient with diabetes in the following areas:

- Medical emergencies
- Recall interval
- Referral to the patient's physician and/or periodontist
- Possible delay of treatment

Not knowing the HbA1c level or understanding the implications of this value could have a significant impact on the control and management of the diabetic patient's periodontal condition. In addition, the level of glycemic control can have a significant impact on in–office emergencies. With a lower mean plasma glucose level, the risk for hypo–glycemia and a possible in–office emergency increases. As glycemic control moves closer to the normal range the risk for hypoglycemia increases. The patient with tight control of their glucose levels can drop into the hypoglycemic range quickly. A potential hypoglycemic episode may be influenced by one or all of the following: exercise before the dental appointment, when the patient last took their medication and if they did not eat when they took their medication. The length of the dental appointment may also be cause for concern. Monitoring the mean plasma blood glucose level before and during the appointment is important for the prevention of a hypoglycemic in–office emergency. Oral health care providers' increased knowledge and better understanding of the HbA1c level as a process of care indicator for the treatment and management of the patient with diabetes and periodontal disease is clearly an area that would benefit diabetic patients, dentists and dental hygienists in Arkansas.

While this study noted a relatively low occurrence of in office chair–side blood glucose testing, it is worth noting that in order to keep a glucometer in the dental office the practitioner must be in compliance with the Clinical Laboratory Improvement Amendments (CLIA) of 1988 and their subsequent amended provisions. Glucometer testing in the dental office is considered a CLIA–exempt procedure, but the office must register with the government and receive a registration certificate. As a result of this, testing is usually done using the patient's own glucometer. Information on the CLIA may be found at www.cms.hhs.gov/clia. To what degree compliance with the CLIA influenced practitioners' decisions regarding glucometer use is not known.

In support of evidence based care, the medical and dental professions must treat the body as a whole, realizing that interdisciplinary referrals may be necessary.[30] Syndemic, as described by Singer, is a new term used for 2 or more linked health problems acting synergistically to contribute to the excess burden of disease in a population.[31] Health care providers taking a syndemic approach will view impaired health as a cluster of chronic diseases resulting from multiple forces that bind the conditions together. The multiple forces that bind these conditions together must be addressed with a transdisciplinary approach that crosses professional boundaries.[30] As recommended by the American Academy of Periodontology Guidelines for the Management of Patient's With Periodontal Disease, only 3.5% of respondents always modify the frequency of dental visits for their patients with diabetes.[26] Nearly half of respondents (45.3%) sometimes modified the frequency, while 32.2% report they very often modified the frequency of dental visits (for the diabetic patient). The chronic nature of periodontal disease and diabetes, as well as the systemic link supported by research, warrants more frequent dental visits as well as pos-

sible co–management with a periodontist and the patient's physician for the patient with diabetes. Considering these results, one could potentially argue that dentists and hygienists in Arkansas may not be optimally assessing diabetes as a risk factor for periodontal disease and may not be considering the level of glycemic control as a factor in the treatment and management of the diabetic patient. The findings also reflect the results of the Kunzel study with respect to assessment and management of the diabetic or unidentified diabetic patient.[9] Assessing diabetes as a risk factor for periodontal disease and the patient's level of glycemic control is not only critical in patient assessment, health promotion and disease prevention – it impacts treatment planning, maintenance intervals, length of appointments, treatment outcomes and potential in–office emergencies. The attitudes and behaviors of the oral health professional must at a minimum keep pace with the evidence in treatment of patients with diabetes and periodontal disease.

The Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) both operate under the assumption that the best predictor of a behavior is behavioral intention.[33] Behavioral intention is determined by attitude toward the behavior and social normative perceptions regarding it. The foundation of TRA and TPB is "individual motivational factors are determinants of the likelihood of performing a specific behavior" (perceived control over performance of the behavior is an additional construct of TPB).[33] TRA was developed by Fishbein in an effort to understand the relationship between attitudes and behavior.[33] Both TPB and TRA focus on the constructs of attitude, subjective norm and perceived control, and have been used successfully to predict and explain a wide range of health behaviors and intentions.[33] The respondents practicing the best behavior in regards to diabetes identification and management were incorporating it as being within the scope of their professional norm/standard and had control over the behavior. Motivation to perform the behavior is also linked to what others expect, whether important referent individuals approve or disapprove of performing the behavior, weighted by the motivation to comply with those referents.[33] Attitude is also determined by the individual's belief about the outcomes or attributes of performing the behavior.[33] Those dentists and dental hygienists who hold strong beliefs that positively valued outcomes will result from performing the behavior will have a positive attitude toward the behavior, namely taking a more active role in diabetes management.

Diffusion as defined by Everett Rogers is "the process by which an innovation is communicated through certain channels over time among the members of a social system."[34] An innovation is an idea, practice or object that is perceived as new by an individual. Adopting/diffusing practice behaviors that incorporate diabetes screening and management can have a positive impact on cost, quality of care and patient health and satisfaction. Health care, dentistry included, is a very dynamic and innovative field and as such is constantly evolving. Dentists and dental hygienists can and should be proactive and play a key role in risk identification and risk management for their patients with diabetes and periodontal disease. In 2008, the ADEA House of Delegates approved The Competencies for the New General Dentist, emphasizing the need for the general dentist to go beyond the traditional practice of focusing only on oral health and being able to practice evidence–based comprehensive dentistry both independently and collaboratively to improve the health of society.[35] These competencies are also supported by the 1995 Institutes of Medicine's Committee on the Future of Dental Education, which emphasized the broadening of knowledge about oral health care problems as they relate to systemic diseases.[23] Casual blood glucose screening and understanding the significance of the HbA1c are clearly areas for improvement for dental and dental hygiene students, as well as all oral health providers.

Limitations: The potential limitations of this study are the low response rate and limited demographic area. The validity of these findings must be weighed in light of the disappointingly low response rate. This study was the first to question and compare dentists and hygienists in Arkansas regarding their risk identification and management behavior of patients with diabetes. Future studies are warranted with an increased effort to improve the response rate in order to produce a more powerful study. Despite the low response rate, these findings can be used as a basis to investigate these issues further. Although the study was also limited to oral health practitioners in Arkansas, this study could be utilized in other states or geographic areas to compare the use of diabetic health indicators in the assessment and management of patients with periodontal disease. Results from this study are also useful as evidence to enact change in dental and dental hygiene curricula in regards to risk assessment and risk management for patients with diabetes.

Limitations are inherent in self–reported data, however the socially desirable responses present in these self–reported data has not served to temper the tone of the study's results. This is evidenced by the dentists and dental hygienists relatively low

levels of self–reported patient management behavior in regard to monitoring glycemic control/HbA1c levels, modifying the frequency of dental visits and knowledge of glycated hemoglobin/HbA1c levels.

Conclusion

Although the evidence supports the need for appropriate risk assessment and risk management for the patient with diabetes and periodontal disease, these initial findings indicate that dentists and dental hygienists in Arkansas inquire and discuss more than they actively undertake measures to control or manage these risk factors. Both groups are more proactive with dental management than medical management of their patients. With an approximate estimate that 5% of all patients seen in dental offices have diabetes, and given the large number of undiagnosed cases, health professionals are in unique position to screen their patients for diabetes.[22,36,37] Oral health care providers have the potential to influence patients' periodontal health and general health outcomes, and lead the way for other health professionals by taking a syndemic approach.

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