Dental Students’ Attitudes Toward Diabetes Counseling, Monitoring, and Screening


Abstract: The main objective of this study was to examine attitudes of dental students toward chairside counseling and monitoring of and screening for diabetes. A secondary objective was to examine the psychometric properties of the survey instrument. First- and fourth-year students at one dental school completed a survey examining attitudes toward and perceived barriers to performing glucose monitoring, screening, and counseling in a dental setting. Surveys were completed by seventy-one of ninety first-year dental students (79 percent) and eighty-six fourth-year students (100 percent) for a total of 157 responses. Factor analysis of the survey instrument resulted in a three-factor solution: scope and responsibility, barriers, and glucometer use. In analyses to determine whether there were differences in attitudes by gender, level of education, or family history of diabetes, no statistically significant effects were seen. The dental students were in general agreement that glucose monitoring of patients diagnosed with diabetes is within the scope and responsibility of the dental profession; however, only a minority endorsed screening of patients who have not been diagnosed with diabetes. Psychometric analysis revealed internal reliability of the survey instrument.

Dr. Anders is Assistant Professor, Oral Diagnostic Sciences, School of Dental Medicine, University at Buffalo; Dr. Davis is Professor, Oral Diagnostic Sciences, School of Dental Medicine, University at Buffalo; and Dr. McCall is Professor and Chair, Oral Diagnostic Sciences, School of Dental Medicine, University at Buffalo. Direct correspondence and requests for reprints to Dr. Patrick L. Anders, Oral Diagnostic Sciences, School of Dental Medicine, University at Buffalo, 355 Squire Hall, Buffalo, NY 14214; 716-829-2241; planders@buffalo.edu.

Keywords: dental education, dental students, diabetes, glucose monitoring, glucometer, health promotion

Submitted for publication 5/3/13; accepted 8/1/13

Dental practice is evolving to include an increased emphasis on oral health as an integral part of systemic health and well-being.1 As focus shifts from disease treatment and prevention to health promotion,2 new models variously described as patient-centered health home,3 integrated medical/dental health care,4 and common risk approach for health promotion and disease prevention5 are emerging. In addition, interdisciplinary patient management is becoming more important as patients are living longer and with more chronic diseases than in the past.6

Diabetes mellitus is a condition of particular concern from a public health standpoint. In 2010, it was estimated that 8.3 percent of the U.S. population, or a total of 25.8 million people, have diabetes.7 In adults over age sixty-five, the percentage jumps to 27 percent.7 Global estimates project the number of people with Type 2 diabetes to be as high as 552 million by the year 2030.8 Diabetes and associated medical conditions represent an enormous burden on the health care system, with an estimated economic cost in the United States alone in 2012 of $245 billion, including $176 billion in direct medical costs and $69 billion in reduced productivity.9

Diabetes is also a condition of particular concern to dentistry because of its bidirectional relationship with oral disease.10 Twenty years ago, periodontitis was suggested as the sixth complication of diabetes.11 More recently, periodontal disease has been shown to adversely affect diabetic outcomes.12 Since oral and systemic complications of diabetes are directly related to the level of glycemic control,13 knowledge of control is necessary if the dentist is to optimize the health of the patient. However, despite recommendations for chairside monitoring of blood glucose,14-16 few dentists have ever actually used a glucometer to monitor a patient’s blood glucose levels.17,18

Evidence suggests that approximately 3 percent of the population (30 percent of diabetes cases) are undiagnosed; this increases to almost 6 percent for the population over age sixty-five.19 Because 60 percent of Americans see a dentist at least annually for routine care, the dental office has been proposed as a site for screening for undiagnosed diabetes.20 Patients have been found to be willing to have a dentist conduct screening and counseling for a variety of medical conditions including diabetes.21 The majority of dentists are also willing to do such screening.22 However, in spite of this apparent willingness, few dentists actually screen for diabetes.18

Changes to the nature of dental practice begin with changes in dental education.1 Regarding diabetes, changes have already begun. The dental curriculum at the University at Buffalo includes education in
diabetes and management of patients with diabetes in all four years. Didactically, the first-year curriculum includes glucose metabolism and introduction of the concept of treating dental patients with diabetes. In the second year, clinical implications of diabetes are presented, and diabetes management including use of a glucometer is discussed. In the third year, specifics of diabetes side effects are taught, and glucometer use is reinforced. In the fourth year, students discuss diabetes in a case-based course.

Clinically, use of a glucometer is introduced in the second year and incorporated into patient care in years three and four. Glucometer use is an integral part of the diabetes curriculum, so students have the knowledge and skill to monitor blood glucose on patients by the time of graduation. However, knowledge and skill, while necessary for the performance of a behavior, are not sufficient. Intention to perform a behavior is influenced by attitudes as well as subjective norms of social pressure.23 Relatively little is known regarding the attitudes of dental students toward glucose screening.24 Yet, if screening activities that have not historically been considered to be part of traditional dental practice are to become routine, it is necessary to understand attitudes and perceived barriers of dental students toward these activities. The primary objective of this study was therefore to examine the attitudes of the students at one dental school toward chairside monitoring, screening, and counseling for diabetes. A secondary objective was to examine the psychometric properties of the instrument.

Materials and Methods

In the spring of 2010, students in the first- and fourth-year classes at the University at Buffalo School of Dental Medicine were recruited as subjects. They were asked to participate in a survey either during regularly scheduled class time (first-year students) or as part of the exit process (fourth-year students). This study was approved by the Institutional Review Board of the University at Buffalo. Information was obtained anonymously, and voluntary completion of the questionnaire was taken as informed consent to participate in the study.

Demographic data including age, gender, and race or ethnicity were collected. Subjects were also asked about personal and family history of diabetes including diagnosis and level of control. Questions regarding attitudes toward diabetes counseling, monitoring, and screening were developed from a study by Victoroff et al.25 examining attitudes of incoming dental students toward tobacco cessation promotion. Questions regarding perceived barriers to success for diabetes counseling in a dental setting were developed from a study by Yip et al.26 that examined perceived barriers to providing tobacco cessation counseling. Each item consisted of a statement and a five-point Likert-type response scale, ranging from 1=strongly agree to 5=strongly disagree.

An exploratory factor analysis was performed to determine underlying dimensions within the attitude variables. The psychometric properties of the dimensions (sampling adequacy, internal consistency) were also established. Scale scores were calculated as a mean of the item scores within each factor. A three-way multivariate analysis of variance was conducted to determine if there were differences in these scale scores by gender, education level (first vs. fourth year), and family history of diabetes (at least one close family member has diabetes vs. no close family member has diabetes). Only two subjects reported having diabetes, so no analyses were done based on respondents’ diabetic status. All analyses were performed using SPSS (IBM SPSS Statistics, Version 20).

Results

Surveys were completed by seventy-one of ninety first-year dental students (79 percent) and eighty-six fourth-year students (100 percent) for a total of 157 responses. Over half of the respondents (56 percent) were male. The mean age was twenty-six years (SD=3.5), with a range of twenty to forty years. The most frequently reported ethnicity was white (76 percent), followed by Asian/Pacific Islander (16.4 percent).

The Kaiser-Meyer-Olkin index was 0.81 (“meritorious”) overall and between 0.65 and 0.88 for each item, indicating sampling adequacy. Bartlett’s test was significant (p<0.0001), indicating the appropriateness of proceeding with factor analysis. An exploratory factor analysis using principal axis factoring as the extraction method and an oblique rotation with Kaiser normalization was performed to identify dimensions within the response items. This analysis resulted in a three-factor solution: scope and responsibility, barriers, and glucometer use (Table 1). Kaiser’s criterion, scree test, and parallel analysis all supported our interpretation. All items but one had
Table 1. Responses to individual items within factors (n=157)

<table>
<thead>
<tr>
<th>Factor Loadings (Pattern Matrix)</th>
<th>SA</th>
<th>A</th>
<th>N</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope and Responsibility (7 items)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educate patients about the risks of diabetes to overall health and well-being.</td>
<td>22.9%</td>
<td>45.9%</td>
<td>22.9%</td>
<td>6.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Educate patients about the risks of diabetes to oral health.</td>
<td>55.4%</td>
<td>33.1%</td>
<td>7.0%</td>
<td>2.5%</td>
<td>1.9%</td>
</tr>
<tr>
<td><strong>Barriers (7 items)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The dental professional's time can be much better spent doing things other than monitoring blood glucose on a patient.</td>
<td>5.8%</td>
<td>14.8%</td>
<td>36.8%</td>
<td>33.5%</td>
<td>9.0%</td>
</tr>
<tr>
<td><strong>Glucometer Use (3 items)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take a diabetic patient's blood glucose reading using a glucometer.</td>
<td>27.3%</td>
<td>33.8%</td>
<td>26.6%</td>
<td>10.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Screen for diabetes using a glucometer on patients who are not diagnosed with diabetes.</td>
<td>7.7%</td>
<td>14.8%</td>
<td>41.9%</td>
<td>30.3%</td>
<td>5.2%</td>
</tr>
</tbody>
</table>

SA=strongly agree; A=agree; N=neutral; D=disagree; SD=strongly disagree
SB=strong barrier; SWB=somewhat a barrier; NB=not a barrier
factor loadings of 0.4 or greater on the selected factor. One item cross-loaded over 0.3. The coefficient of reliability (Cronbach’s alpha) was 0.77 overall, 0.89 for scope and responsibility, 0.84 for barriers, and 0.69 for glucometer use. These calculations support the adequacy of the data and the reliability of the instrument.

A majority of the respondents agreed or strongly agreed with all items related to scope and responsibility. The item with the lowest endorsement, but still receiving a majority of agree responses, was discussion of specific strategies for controlling diabetes. Only 59 percent agreed or strongly agreed with the statement that this is within the scope of dental practice. There was less unity in response to the barriers items, with approximately one-third indicating that these issues were barriers (19 to 35 percent agree or strongly agree), one-third indicating that the items were not barriers (27 to 49 percent disagree or somewhat disagree), and the remainder (31 to 39 percent) expressing neutrality. The item least endorsed as a barrier was related to confidence in one’s ability to obtain and discuss a patient’s blood glucose (49 percent indicated this was not a barrier).

Over half of the respondents reported feeling that monitoring glucose in a dental office can have an impact on controlling a patient’s diabetes (56 percent) and that it is within the scope of practice to take a diabetic patient’s blood glucose reading using a glucometer (61 percent). However, only a small number (23 percent) reported feeling that it is within the scope of practice to screen patients who have not been diagnosed with diabetes. Using a paired t-test, the mean difference between these last two items was found to be statistically significant at p<0.005. Generally there was much lower level of endorsement for the glucometer use items than for other items related to scope of practice or professional responsibility. This may account for its appearance as a separate factor.

Mean scale scores for the three factors by gender, level of education, and family history of diabetes appear in Table 2. Preliminary analysis indicated a violation of the equal variance assumption for barriers, despite attempts at transformation (log, square root, square, cube). Therefore, rank values for the barriers scale were used for the multivariate analysis. A three-way multivariate analysis of variance revealed no significant multivariate main effects (education, Wilks’ λ=0.965, p=0.16; gender, Wilks’ λ=0.966, p=0.18; family history of diabetes, Wilks’ λ=0.972, p=0.24) and no significant interaction effects (all p-values ≥0.29).

**Discussion**

The instrument developed for this investigation was derived from assessment tools used to examine attitudes to tobacco cessation counseling. Validity of the tobacco items is supported by multiple previous studies. Items related to glucose were constructed to parallel the tobacco items, providing face validity to our instrument.

We found no significant differences in attitude by gender, level of education, or family history of diabetes. In a study of dental students and faculty by Fischer and Koerber, educational level, student/faculty status, and having a close friend or family member who was diagnosed with diabetes all failed to predict willingness to engage in activities related to diabetes education and counseling. These authors also reported that “norms” (defined as perceiving

| Table 2. Mean (SD) scale scores by education level, gender, and family diabetes history |
|---------------------------------|-----------------|-----------------|-----------------|
|                                 | Scope and Responsibility | Barriers         | Glucometer Use  |
| **Education**                  |                      |                  |                 |
| First year (n=71)              | 4.08 (0.75)         | 2.93 (0.69)      | 3.29 (0.74)     |
| Fourth year (n=86)             | 4.07 (0.63)         | 2.66 (0.87)      | 3.57 (0.79)     |
| **Gender**                     |                      |                  |                 |
| Female (n=65)                  | 4.11 (0.68)         | 2.81 (0.71)      | 3.31 (0.72)     |
| Male (n=91)                    | 4.05 (0.70)         | 2.78 (0.87)      | 3.54 (0.80)     |
| **Family Diabetes History**    |                      |                  |                 |
| No family members have diabetes (n=101) | 4.04 (0.66) | 2.87 (0.76)      | 3.37 (0.73)     |
| At least one family member has diabetes (n=56) | 4.13 (0.72) | 2.62 (0.86)      | 3.59 (0.86)     |

*Note: Higher scores indicate greater endorsement/agreement.*
the activities to be within the role of a dentist and similar to the domain of scope and responsibility in our study) failed to predict willingness to engage in diabetes education and counseling. Regarding specific activities perceived to be within the realm of dental practice, Fischer and Koerber reported that referring a patient to a physician was ranked highest and providing information about diabetic medications was ranked lowest. This last item is similar to our item regarding discussing specific strategies for controlling diabetes, which was also least endorsed among clinical activities.

Lack of confidence in one’s ability to obtain and discuss a patient’s blood glucose was endorsed as a barrier by only 20 percent of our respondents. However, the students expressed a low level of comfort regarding clinical activities beyond obtaining and discussing a blood glucose value.

A distinction must be made between monitoring of patients diagnosed with diabetes and screening for elevated blood glucose in patients who have not been diagnosed. Patient resistance to having blood glucose taken in the dental office was perceived to be a barrier by only one-third of dental students in our study. It should be noted that our item did not specify whether this was for monitoring or screening purposes. Using a glucometer to screen patients who have not been diagnosed with diabetes was agreed to be within the scope of dental practice by only 23 percent of our respondents, whereas 61 percent agreed that using a glucometer to monitor a person diagnosed with diabetes was within the scope of dental practice. Therefore, there seems to be a difference in attitudes toward screening and monitoring activities.

In a study assessing practicing dentists’ attitudes toward chairside medical screening, 77 percent of responding dentists reported that chairside screening for diabetes was at least somewhat important, even though only 56 percent were at least somewhat willing to gather blood via finger stick as part of their practices. While practicing dentists appear willing to screen, very few actually do so. Kunzel et al. reported that 14 percent of dentists in general practice either monitored patients’ blood glucose or refer them for monitoring and only 3 percent had ever screened for diabetes using a finger stick test. Esmeili et al. reported that despite the fact that 61 percent of respondent dentists believed that addressing diabetes was important to their role as a dentist, less than 2 percent actually performed in-office blood glucose monitoring on patients with diabetes. Barasch et al. reported that less than 2 percent of dental practices have a glucometer on site. Thus, while it appears that dentists have positive attitudes toward screening for diabetes, they do not appear to actually perform screening in their practices.

We believe that there are two sequential issues related to barriers to screening for diabetes in a dental setting. The first issue is resistance to the use of a glucometer, as evidenced by the extremely low level of use in practice and supported by the lack of endorsement of glucometer use items in our study. The emergence of glucometer use as a separate factor suggests that it is not seen as a part of the standard practice of managing a dental patient with diabetes but rather from another domain beyond the scope and responsibility of dentistry. The second issue is resistance to screening for medical conditions in general. Whereas monitoring is seen as part of providing safe, appropriate dental treatment, screening is a general health service not specific to dentistry.

Screening for diabetes has been advocated for periodontal patients, dental patients with risk factors but no diagnosis, and even as an integral component of dental practice. However, screening begins with a medical history, not a glucometer test. Most dental offices routinely obtain a medical history from patients prior to treatment, and 96 percent of dentists in a recent study reported that their health history asks about a patient’s diabetic condition. However, few offices use appropriate screening questions such as a history of gestational diabetes or a history of a first-degree relative with diabetes. While a long-term goal of the dental profession might be to change the definition of practice to include medical screening, a more pragmatic approach might incorporate training to encourage the use of a glucometer for assessing peri-operative risk for hypoglycemia. Dental students become comfortable with glucometer use when it is part of a standard protocol. One study found that despite dentists’ perceptions to the contrary, patients were willing to undergo screening in a dental office. Patients in that study preferred the use of gingival crevicular blood, which has demonstrated good sensitivity (0.933) and specificity (0.900) relative to finger stick blood, suggesting that use of blood from an intraoral source might encourage both patient and dentist acceptance of the glucometer as a standard part of dental practice.

Our study has some limitations. The use of a convenience sample at one institution limits the generalizability of our findings. However, similar results have been reported elsewhere. Also, the responses to our study might be strongly influenced by the cur-
riculum and the culture of the school, although failure to detect differences by education level suggests that the influence of curriculum is not particularly strong. Self-report makes response bias possible although the high response rates and anonymous data collection should mitigate this bias. Finally, this study examined attitudes of students who by definition have not yet practiced independently and have not faced the time and financial constraints of a practice environment. Further research should follow these students into practice to determine if attitudes change with experience. This information could then be used to develop programs to encourage use of all available technologies to monitor and ultimately screen for systemic conditions that historically have been beyond the realm of dental practice.

Conclusion

The dental students in this study were in general agreement that glucose monitoring of patients diagnosed with diabetes is within the scope and responsibility of the dental profession; however, only a minority endorsed screening of patients who have not been diagnosed with diabetes. No differences in attitude were detected by gender, level of education, or family history of diabetes. Psychometric analysis revealed reliability of the survey instrument.

REFERENCES