Screening for Diabetes in a Dental School Clinic to Assess Interprofessional Communication Between Physicians and Dental Students

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Abstract: If a dental student diagnoses a patient in a dental school clinic as being at high risk of prediabetes or diabetes, the patient should be referred to his or her physician for further diagnostic evaluation, and the physician should send back the evaluation results so that the dental team can optimize treatment and health care choices if the diagnosis is confirmed. The primary aim of this study was to evaluate physicians' responses to written and oral requests for information regarding follow-up diabetes testing. A secondary aim was to evaluate patients' compliance with recommendations to seek medical care after being determined to be at high risk of prediabetes or diabetes in the dental clinic. Based on at least one positive risk factor for diabetes, 74 patients in one U.S. dental school's clinic were screened by third- and fourth-year dental students for prediabetes or diabetes and underwent point of care HbA1C (glycalated hemoglobin) blood tests between June 2014 and June 2015. Patients with an HbA1C value of 5.7% or above were referred to their physicians for follow-up testing. The physician was mailed the patient's HIPAA release and a request for updates to the student regarding the patient's diabetes status. If the physician did not provide the requested information, a dental student telephoned him or her to obtain the patient's diabetes status. Of the 74 patients, 34 (46%) tested positive with HbA1C tests and were referred to their physicians. Of those 34 referred patients, 20 (59%) saw their physicians for additional evaluations within six months of referral. None of the 20 physicians responded to the written requests for information on additional diabetes testing. After one or two telephone requests, all 20 physicians provided the test results. This study found that most of the patients (59%) followed their dental practitioner's advice to seek follow-up care with their physician, supporting the value of conducting these tests in a dental clinic. However, the results also suggested that a single written request may be insufficient to prompt physicians to return those results and that follow-up communication in a phone call may be more effective.

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Early detection of prediabetes and type 2 diabetes mellitus followed by early and effective treatment is crucial to long-term treatment success.[1] Lifestyle interventions, diet, and exercise have been found effective in reversing prediabetes or delaying onset of overt diabetes for over ten years.[2] The benefits of early improved glycemic control are important: every 1% reduction in HbA1C (glycated hemoglobin) results in a 37% reduction in microvascular complications, a 43% reduction in amputations,

a 21% reduction in death from peripheral vascular disease, and a 14% reduction in myocardial infarcts.[3]

Dentists and their staff members can aid in the early detection of diabetes and prediabetes.[4-6] Approximately 70% of U.S. adults were reported in 2005 to have seen a dentist at least once per year.[7] That study also reported that individuals tended to seek routine oral care more frequently than routine and preventive medical care. Previous research found that 71% of physicians in one study thought it valu-

able for dentists to conduct screening for diabetes mellitus[8] and that 77% of dentists in another study were willing to screen their patients for diabetes.[9] Patients' attitudes toward screening for diabetes in dental offices have also been found to be positive, with 57-83% in one study being willing to allow dentists to perform screening tests.[10]

Our search of PubMed using the terms "physician," "communication," and "dentist" identified 199 articles, but our reviews of those articles did not identify any that evaluated physicians' communications with dentists regarding their mutual patients. Well-informed health care decisions and policies require involvement of all health care professionals in the fight against chronic diseases such as diabetes.[11] Evaluating and improving the referral process are critical steps in this process, with dentists' providing cost-effective screening of patients at high risk for diabetes or prediabetes and referring those identified to their physicians for follow-up care.

To effectively screen patients and to reinforce patients' lifestyle and medication adherence, effective communications between dentists and physicians are essential. The primary aim of this study was to evaluate physicians' responses to written and oral requests for information regarding follow-up diabetes testing. A secondary aim was to evaluate patients' compliance with recommendations to seek medical care after being determined to be at high risk of prediabetes or diabetes in a dental school clinic. Standardized screenings, physician referrals, and follow-up protocols were administered by dental students at the School of Dental Medicine, Southern Illinois University.

Methods

Our study was approved by the Southern Illinois University Institutional Review Board (#13-0206-3), and the principles in the Helsinki Declaration were followed. To the greatest extent possible, the screening of patients for prediabetes or diabetes was performed according to a published protocol.[4]

Patients at the dental school are from the greater St. Louis area, with both genders, all age groups, and all socioeconomic levels represented. From June 2014 to June 2015 at the school's Screening Clinic, third- and fourth-year dental students screened the medical records of new adult dental patients. Inclusion criteria were the following: had not been told they had prediabetes or diabetes; were not pregnant;

were at least 40 years of age if non-Hispanic white; and were at least 30 years of age if Hispanic or non-white. Medical records were screened for the following risk factors: family history of diabetes, hypertension, high cholesterol, and overweight/ obesity (as determined by height and weight measurements to assess body mass index [BMI]).

If one or more of the risk factors was noted, a written informed consent to participate in the study was obtained from the patient. The patient received a complete dental examination, and a drop of blood was drawn and analyzed by a point of care HbA1C device (Bayer A1CNow+, Indianapolis, IN, USA). Patients with HbA1C values between 5.7 and 6.4 were suspected of having prediabetes, and patients with HbA1C values of 6.5 or more were suspected of having diabetes. These patients were advised by dental students and faculty members that further testing for diabetes was needed, and brochures explaining diabetes and prediabetes were given to the patients. Four faculty members were available to assist students during the screening process and in conducting fingersticks, HbA1C testing, and providing chair-side explanations of the need for patients to seek additional care from their physicians.

One of the dental students modified a standardized template to create custom referral letters that were mailed to physicians (Table 1). A copy of the letter was also mailed to the patient. The letters explained the diabetes screening methodology and the screening results and asked the physician to contact the supervising dental student with the results of diabetes testing. With the letters, HIPAA releases were also sent to the physicians. If at two, three, and five months, patients had not notified the supervising dental student that they had made an appointment with their physician for diabetes testing, the dental student called the patient or left voice messages to reinforce the need to seek additional care with his or her physician. If at six months, the physician had not provided the results of diabetes testing, the dental student called the physician's office to obtain the requested information. If after six months of having a positive HbA1C test result, a patient had not contacted his or her physician for further diabetes evaluation, the dental student made no further attempt to contact the patient.

Data distributions for patients' age and BMI were tested for normality with the Shapiro-Wilk W test. If data were normally distributed ($p \geq 0.05$), means and 95% confidence intervals were used for descriptive statistics; if data were non-normally

Table 1. Referral letter to physician

To: [physician's name and address]
Re: [patient's name]

Dear [physician's name]:

[Patient's name] was seen for a dental examination on [day/month/year]. We have asked [him or her] to contact your office because we suspect [he or she] may be prediabetic or diabetic.

Our suspicions are based on [his or her] positive responses to the following screening items:
1. A positive history of hypercholesterol
2. A positive history of hypertension
3. A positive family history of diabetes
4. A BMI of [number]

A point of care HbA1C test was performed. The value was [number].

A signed copy of [his or her] HIPAA release is attached to this letter. [He or She] is part of a research study "Screening for Diabetes and Prediabetes in a Dental School Environment." Our goal is to develop a system to allow all dentists to help with early detection and referral to physicians for prompt treatment.

We would appreciate a letter, fax, or phone call from your office with the results of your testing and diagnosis regarding the diabetic status of this patient.

Sincerely,

[student's name, address, and telephone number]

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distributed (p<0.05), medians plus 25th and 75th quantiles/quartiles were used. For proportions, 95% confidence intervals were calculated. For patients with HbA1C values ≥5.7 and <5.7, descriptive statistics were calculated for age, BMI, gender, race, family history of diabetes, history of hypertension, and history of hypercholesterol. Distributions of age and BMI data for patients with HbA1C values ≥5.7 and <5.7 were assessed for normality with the Shapiro Wilk W test, and equality of variances was assessed with the O'Brien, Brown-Forsythe, Levene, Bartlett, and F Test 2-sided. If data for age and BMI were non-normally distributed or if variances were not equal, data were log transformed for statistical analyses (and back transformed for inclusion in a table of descriptive statistics). For normally distributed data (Shapiro Wilk W test, p≥0.05) and data with equal variances (O'Brien, Brown-Forsythe, Levene, Bartlett, and F Test 2-sided, p≥0.05), differences in age and BMI for patients with HbA1C values ≥5.7 and <5.7 were assessed with the t-test. Differences for categorical variables were assessed with the Fisher's exact test. A p-value <0.05 was considered statisti-cally significant. Statistical analyses were performed with JMP Pro Statistical Software Release 12.0.1 (SAS Institute, Inc., Cary, NC, USA) and MedCalc Statistics for Biomedical Research Version 17.0.4 (MedCalc Software, Mariakerke, Belgium).

Results

Based on a positive response to at least one of the four screening risk factors, 74 patients were included in the study. Thirty-four of these patients (46% [35%-57%, 95% confidence interval]) had HbA1C values ≥5.7 and were referred to their physicians. Twenty of the 34 (59% [42%-74%]) referred patients had seen their physicians for additional evaluations by the completion of six months.

Table 2 shows patients' baseline demographics and risk factors. The age range was 38-77 years with a mean age of 59.6 years (56.3-62.9). Ages for patients with HbA1C values ≥5.7 and HbA1C values <5.7 were normally distributed (Shapiro Wilk W test, ≥0.35), and variances were equal (O'Brien, Brown-Forsythe, Levene, Bartlett, and F Test 2-sided,

Table 2. Baseline demographics and risk factors of patients in study

Demographics and Risk Factors	HbA1C ≥5.7		HbA1C <5.7	
	n	Mean (95% CI)	n	Mean (95% CI)
Age	34	59.6 (56.3-62.9)	40	59.0 (55.6-62.3)
BMI	34	31.4 (29.7-33.2)	40	29.2 (27.8-30.6)*
	n	Probability (95% CI)	n	Probability (95% CI)
Gender				
Female	22	0.65 (0.48-0.79)	24	0.60 (0.45-0.74)
Male	12	0.35 (0.21-0.52)	16	0.40 (0.26-0.55)
Race				
White	26	0.76 (0.60-0.88)	31	0.78 (0.62-0.88)
Black	5	0.15 (0.06-0.30)	8	0.20 (0.11-0.35)
Asian	3	0.09 (0.03-0.23)	1	0.03 (<0.01-0.13)
Family history of diabetes				
Yes	14	0.41 (0.26-0.58)	21	0.53 (0.37-0.67)
No	20	0.59 (0.42-0.74)	19	0.48 (0.33-0.63)
History of hypertension				
Yes	15	0.44 (0.29-0.61)	24	0.60 (0.45-0.74)
No	19	0.56 (0.39-0.71)	16	0.40 (0.26-0.55)
History of hypercholesterol				
Yes	16	0.47 (0.31-0.63)	16	0.40 (0.26-0.55)
No	18	0.53 (0.37-0.69)	24	0.60 (0.45-0.74)

Note: Values for BMI were back-transformed after logarithmic transformation. 95% CI=95% confidence interval.

*Statistically significant difference (p=0.04)

≥0.47), with no difference being found between groups (t-test, p=0.79). BMI values for patients with HbA1C values ≥5.7 and HbA1C values <5.7 were non-normally distributed (Shapiro Wilk W test, ≤0.02). However, after log transformation, they were normally distributed, and variances were equal (Shapiro Wilk W test, ≥0.06; O'Brien, Brown-Forsythe, Levene, Bartlett, and F Test 2-sided, ≥0.33), with the t-test finding a significant difference between groups (p=0.04). There were 12 males and 22 females in the test group. The racial mix was 26 white, five black, and three Asian participants. With the Fisher's exact test, no difference was found between patients with HbA1C values ≥5.7 and HbA1C values <5.7 for gender, race, family history of diabetes, history of hypertension, or history of hypercholesterol (p≥0.24).

None of the 20 physicians (0-17%) responded to the written requests for information on additional diabetes testing. After the dental student contacted the physician by telephone, all physicians (100% [83%-100%]) provided the results of their patients' follow-up examinations. Of the 20 patients, one was diagnosed as diabetic, eight were diagnosed as prediabetic, six were diagnosed as normal, and five were not retested by their physicians; thus, of these 20 patients, nine (45% [26%-66%]) were diagnosed by their physicians as diabetic or prediabetic. One of these nine patients had overt diabetes (an HbA1C value of 6.5% or greater). This patient had a screening value of 6.6 that was confirmed by the physician who diagnosed the patient as having diabetes. Of these nine patients, the age range was 47-73 years with a mean age of 62.0 (55.0-69.0), and there were three males and six females. The racial mix was seven white, one black, and one Asian participants. Two patients had family histories of diabetes, four had histories of hypertension, six had histories of hypercholesterol, three had BMIs that indicated they were overweight (BMI 25-29.9), and six had BMIs that indicated they were obese (BMI 30 or greater).

Discussion

In this study, dental students were effective in screening suspected patients with prediabetes or

diabetes and successfully communicating to a large percentage of those patients their need to follow up with their physicians. The 59% (20/34) patient compliance with referral in this study was good and similar to that found in other studies.[5,12] Based on the data we collected, we were unable to predict patients' compliance with seeking follow-up with their physicians. A previous study implied that lack of insurance and limited financial resources are factors in patient compliance.[13] Dental students in our study were willing and capable of handling all of the steps involved in assessing patients for prediabetes or diabetes: screening, obtaining fingerstick blood samples, analyzing the results with HbA1C test kits, discussing the results with patients, mailing letters to physicians that requested results of further testing for prediabetes and diabetes, following up with patients, and placing telephone calls to physicians to obtain further test results for prediabetes and diabetes. The use of a point of care HbA1C test (approximate cost of $10 per test) resulted in fewer false positive than screening criteria only.

However, the physicians' lack of response to written requests for the results of further testing can negate the potential benefits to patients since positive reinforcement by dental students and faculty members of a physician's recommendations may result in better adherence by the patient to the physician's health care advice. The reasons that the physicians did not respond to written requests are unknown and should be evaluated in a future study. A possible reason could be the protocols for modern digital health records. Written communications are scanned and filed as attachments with brief chart notes, which indicate that the patient has been referred for diabetic evaluation. Once a patient is seen by his or her physician, either the physician or a staff member would have had to remember that a referral letter requesting feedback had been received, scanned, and filed as an attachment. A number of tabs in the electronic record would have had to be accessed to find the original referral letter. Telephone calls made by the dental student to the physician were, however, not filed and resulted in compliance. Multiple times, a student's telephone call resulted in a request by a member of the physician's staff for a signed HIPAA release. In all instances, the staff member was able to find the filed HIPAA release when reminded by the student that the original communications consisted of a referral letter and a signed HIPAA release.

In 2015, after this project was completed, the American Medical Association (AMA) in conjunction with the Centers for Disease Control and Prevention (CDC) and the Diabetic Prevention Program revised its guidelines for diabetic screening. The revised guidelines are less complex than those used in this study and should make the implementation of similar studies easier to conduct.[14] The revised criteria identify elevated BMI (BMI>25kg/m^2 or BMI>23kg/m^2) and increasing age as the most important risk factors. In our study, BMI was useful in identifying patients at risk for prediabetes or diabetes.

Dentists are well suited to screen and reinforce lifestyle interventions as directed by physicians. In 2015, the New Jersey State Board of Dentistry ruled that dentists may screen for diabetes utilizing HbA1C testing in their offices, stating "such in-office blood screening is within the scope of licensure in the state of New Jersey."[15] However, for this interprofessional practice to be most useful for patients, physicians must communicate with dentists. In our study, physicians responded to telephone calls but not to written requests for information. The economic and physical burdens of treating prediabetes and diabetes are immense. Early diagnosis and effective lifestyle intervention are important in successfully treating prediabetes and diabetes. A previous study documented the benefit of expanded partnerships between physicians and non-physicians.[1] Dentists can help physicians in the management of patients with chronic diseases such as prediabetes and diabetes.

A possible limitation of our study is external validity in that we do not know whether our findings based on our dental school and dental students are generalizable to other dental schools and dental students and to practicing dentists. A second limitation is the small sample size of this pilot project. Future studies should address these limitations and also seek to identify mechanisms and motivations to increase physicians' responsiveness in providing their patients' information to dental students as well as dentists.

Conclusion

If a dental student diagnoses a patient as being at high risk of prediabetes or diabetes, the patient should be referred to the patient's physician for further diagnostic evaluation, and the physician should be sent a referral letter and the patient's HIPAA release and asked to return the evaluation results so that the dental team can help optimize treatment and health care choices if the diagnosis is confirmed.

This study found that dental students were able to carry out their part of the process and that patients generally followed the advice to follow-up with their physicians; however, extra attention was needed to ensure that the physicians provided test results back to the dental students.

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REFERENCES

1. Campbell RK. Type 2 diabetes, where are we today: an overview of disease burden, current treatments, and treatment strategies. J Am Pharm Assoc 2009;49(Suppl 1): S3-9.
2. McLellan K, Wyne K, Hsueh WV. Theraputic interventions to reduce the risk of progression from prediabetes to type 2 diabetes mellitus. Ther Clin Risk Manag 2014;10:173-88.
3. Stratton IM, Adler AI, Neil HA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35) prospective observational study. BMJ 2000;321(7258):405-12.
4. Lalla E, Kunzel C, Burkett S, et al. Identification of unrecognized diabetes and pre-diabetes in a dental setting. J Dent Res 2011;90(7):855-60.
5. Genco RJ, Schifferle RG, Dunford KL, et al. Screening for diabetes mellitus in dental practices: a field trial. J Am Dent Assoc 2014;145(1):57-64.
6. Herman WH, Taylor GW, Jacobson JJ, et al. Screening for prediabetes and type 2 diabetes in dental offices. J Public Health Dent 2015;6:10.
7. Glick M, Greenberg ML. The potential role of dentists in identifying patients' risk of experiencing coronary heart disease event. J Am Dent Assoc 2005;136(11):1541-6.
8. Greenberg BL, Thomas PA, Glick M, Kantor ML. Physicians' attitudes toward medical screening in a dental setting. J Public Health Dent 2015;11.
9. Greenbreg BL, Glick ML, Frantsve-Hawley J, Kantor ML. Dentists' attitudes toward chairside screening for medical conditions. J Am Dent Assoc 2010;141(1):52-62.
10. Greenberg BL, Kantor ML, Jiang SS, Glick M. Patients' attitudes toward screening for medical conditions in a dental setting. J Public Health Dent 2012;72(1):28.
11. Dodd AH. Treatment approach and HbA1C control among U.S. adults with type 2 diabetes: NHANES 1999-2004. Curr Med Res Opin 2009;25(7):1605-13.
12. Aleo CL, Murchison AP, Dai Y, et al. Improving eye care follow-up adherence in diabetic patients with ocular abnormalities: the effectiveness of patient contracts in a free, pharmacy-based eye screening. Public Health 2015;129(7):996-9.
13. American Diabetes Association. Strategies for improving care. Diabet Care 2016;39(Suppl 1):S6-12.
14. American Diabetic Association. Are you at risk for type 2 diabetes? 9 July 2015. At: www.diabetes.org/are-you-at-risk/diabetes-risk-test/?loc=atrisk-slabnav. Accessed 8 Jan. 2016.
15. Delta Dental of New Jersey. Delta Dental of New Jersey dentists to offer A1C diabetic testing: dentists first line of defense against diabetes. 1 June 2015. At: www.deltadentalnj.com/press/150601_Dentists_to_Offer_A1c_Diabetes_Testing.html. Accessed 8 Jan. 2016.