Abstract

Dentists' attitudes toward chairside screening for medical conditions

Background - Results of previous studies demonstrated the effectiveness of chairside medical screening by dentists to identify patients at increased risk of experiencing cardiovascular-associated events. In this study, the authors assessed dentists' attitudes, willingness and perceived barriers regarding chairside medical screening in the dental office.

Methods - A national, random sample of U.S. general dentists was surveyed by mail by means of an anonymous questionnaire that involved a five-point Likert scale (1 = very important/very willing; 5 = very unimportant/very unwilling). Friedman nonparametric analysis of variance was used to compare response items within each question.

Results - Of 1,945 respondents, most were male (82.3 percent), white (85.7 percent) and 40 to 60 years old (59.4 percent) and had practiced for more than 10 years (84.5 percent). The majority thought it was important for dentists to conduct screening for hypertension (85.8 percent), cardiovascular disease (76.8 percent), diabetes mellitus (76.6 percent), hepatitis (71.5 percent) and human immunodeficiency virus infection (68.8 percent). Respondents were willing to refer patients for consultation with physicians (96.4 percent), collect oral fluids for salivary diagnostics (87.7 percent), conduct medical screenings that yield immediate results (83.4 percent) and collect blood via finger stick (55.9 percent). Respondents were significantly more willing ($P < 0.001$) to collect saliva than height and weight measurements or blood via finger stick (mean ranks: 2.05, 2.96 and 3.05, respectively). Insurance was significantly less important ($P < 0.001$) than time, cost, liability or patients' willingness (mean ranks: 3.51, 2.96, 2.94, 2.83 and 2.77, respectively).

Conclusions - Dentists considered medical screening important and were willing to incorporate it into their practices. Additional education and practical implementation strategies are necessary to address perceived barriers.

Emneord:
Cardiovascular diseases; diabetes mellitus; surveys.

Dentists' attitudes toward chairside screening for medical conditions

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Screening for diseases is meant to identify those who have an increased likelihood of developing a disease or experiencing an increase in disease severity as a first step in disease prevention and control. Effective disease prevention is predicated on several underlying tenets, the primary one being the need for an integrated approach that involves health care professionals across multiple disciplines. In addition, the disease must have well-recognized, modifiable risk factors, and simple, safe, effective screening tools must be available. Finally, people who could benefit from screening need to be identified and provided access to a screening and prevention program.

Cardiovascular disease (CVD) and diabetes mellitus (DM) are increasingly important public health concerns that meet the fundamental criteria for effective screening. As life expectancy and obesity rate increase in the U.S. population, CVD and DM are becoming increasingly more prevalent, with 80 million people recognized as having some type of CVD and 23 million as having DM (1,2). More importantly, a significant proportion of people are unaware of their disease. The prevalence of undiagnosed disease is 29 to 71 percent for CVD (depending on the specific risk factor) and 27 to 53 percent for DM and prediabetes (1-5). Associated with the increasing disease prevalence are increasing health care expenditures for these conditions (1,2).

Primary prevention activities aimed at modifying well-recognized risk factors associated with these diseases (for example, high blood pressure, high cholesterol, obesity) have resulted in substantial reductions in disease-specific incidence and mortality. Dietary modifications and increased physical activity are associated with a 35 to 77 percent reduction in the incidence of hypertension (6-9), a 4 to 10 percent reduction in high cholesterol (10), an 11 to 15 percent reduction in incidence of CVD (11) and a 27 percent reduction in CVD-related mortality (12). Results of longitudinal studies of lifestyle interventions to prevent DM indicate a striking decrease of 50 percent in the incidence of DM during the time of the intervention and a sustained decrease of 41 percent across a 20-year follow-up (13).

Simple, safe, effective screening tools exist for CVD and DM. Among the numerous screening tools for cardiovascular events, the well-validated Framingham risk score, which is based on demographic and clinical measurements, is among the most widely used in the United States (14-17). A recent expert panel endorsed the use of the hemoglobin A1c test as a screening tool for DM, given the development of well-standardized, reliable laboratory methods (18). Subsequently, a recent global study demonstrated that hemoglobin A_{1c} levels can be used to estimate average glucose levels for the majority of patients with DM (19). This is a significant step forward in the screening for DM given that prior to this, the accepted screening test for DM required the determination of fasting plasma blood glucose levels.

In previous studies, our research group (20,21) demonstrated that oral health care professionals could use chairside screening to identify patients who are at an increased risk of experiencing CVD-associated events. Among men aged 40 years or older who had no reported cardiovascular risk factors and who had not seen a physician in the previous 12 months but had seen a dentist, 17 to 18 percent were at an increased risk of experiencing a CVD event (20,21).

Human immunodeficiency virus (HIV) disease/AIDS, another disease of public health significance, also meets the fundamental criteria as a candidate for effective disease prevention involving oral health care professionals. Since the advent of highly active antiretroviral therapy in 1997, the prevalence of people living with HIV has increased; the most recent data, from 2003 to 2006, indicate an 11 percent increase (22). Although mortality associated with HIV/AIDS has decreased dramatically since 1997, that decrease has slowed in recent years, and HIV/AIDS remains an important cause of death among young men (22). Study results have shown that the transmission rates are 3.5 times greater among those who are unaware of their infection status than among those who know they are HIV positive (23). These data suggest that early identification of infectious status could affect disease incidence. Unfortunately, a significant percentage of people – 21 to 25 percent – are unaware of their infectious status (22), even though the U.S. Food and Drug Administration approved a rapid, simple, safe HIV oral screening test in 2004 (24,25).

In conjunction with the development of the oral HIV screening test, the Centers for Disease Control and Prevention changed the national HIV testing guidelines in 2006. These revised guidelines eliminated the need for written informed consent and prevention counseling as part of HIV screening (26) and, thus, substantially expanded the possibilities for HIV screening in a variety of settings, including dental settings. Efficacy studies have been conducted regarding the use of rapid HIV testing in outpatient clinics and hospitals (27,28), although no studies have been published evaluating the efficacy of rapid HIV testing in the dental setting. Point-of-care HIV testing in a dental setting has the advantage of increasing the likelihood that the patient will receive the test results, compared with a traditional laboratory setting or walk-in clinic, in which the results are not immediately available and patients may not return for the required follow-up visit to retrieve their test results.

Given the existence of simple, safe, effective and relatively inexpensive screening methods, the availability of effective means of identifying patients at risk and the documented benefit of primary prevention, chairside screening for medical conditions should be an integral component of dental practice. How do we encourage this practice among dentists? In the behavioral research literature, the theories of planned behavior and reasoned action are the most widely researched principles of behavior change (29). Fundamental to the theories is the premise that intentions predict behaviors (29-31). Studies among a variety of health care providers – including physicians, nurses and mental health care providers – show that attitudes are among the strongest predictors of intentions (30-35). Therefore, to effectively promote chairside medical screening by dentists, one of the necessary elements is an understanding of their attitudes toward, acceptance of and perceived barriers regarding this strategy.

Results of a preliminary survey conducted among participants attending the Health Screening Program (HSP) at the 2007 annual meeting of the American Dental Association (ADA) suggest that dentists believe screening for medical conditions is important and that they generally are willing to do it (36). However, HSP participants may not be representative of the entire population of practicing general dentists. Therefore, we conducted a follow-up survey of a national random sample of U.S. practicing general dentists.

Materials, methods and participants

We mailed a self-administered questionnaire to 7,400 U.S.-based practicing dentists. The questionnaire included five Likert scale questions, each consisting of a series of items that addressed dentists' attitudes toward, acceptance of and perceived barriers regarding screening for medical conditions in a dental setting. The five-point response scale was as follows: 1 = very important/very willing, 2 = somewhat important/somewhat willing, 3 = not sure, 4 = somewhat unimportant/somewhat unwilling and 5 = very unimportant/very unwilling. Demographic information included sex, age, race/ethnicity, location of practice and years in

Table 1

Demographic characteristics of study sample and of total sampling frame

Demograhic characteristics	Study sample no. (%)[3]	Total sampling frame no. (%)[3]
Sex[1]	N = 1,875	N = 132,713
Male	1,544 (82.3)	104,519 (78.8)
Female	331 (17.1)	28,194 (21.2)
Age (Years)[1]	N = 1,925	N = 126,525
20-29	28 (1.5)	1,668 (1.3)
30-39	264 (13.7)	22,035 (17.4)
40-49	419 (21.8)	30,490 (24.1)
50-59	723 (37.6)	40,703 (32.2)
60-69	413 (21.5)	22,946 (18.1)
70 or older	78 (4.1)	8,683 (6.9)
Race[1]	N = 1,897	N = 101,371
Asian	124 (6.5)	12,851 (12.7)
African American	49 (2.6)	4,813 (4.7)
White	1,626 (85.7)	83,279 (82.2)
Other	98 (5.2)	428 (0.4)
Ethnicity	N = 1,906	N = 101,371
Hispanic og Latino	95 (5.0)	5,394 (5.3)
Not Hispanic or Latino	1,811 (95.0)	95,977 (94.7)
Locale	N = 1,911	NA
Urban	547 (28.6)	NA[4]
Suburban	1,073 (56.1)	NA
Rural	291 (15.2)	NA
Years in Practice	N = 1,920	N = 134,082
≤ 10 years	297 (15.5)	22,104 (16.5)
> 10 years	1,623 (84.5)	111,978 (83.5)
Participation in ADA[2] **Health Screening Program**	N = 1,906	–[5]
Yes	118 (6.2)	NA
No	1,788 (93.8)	NA

[1] Significantly different between the two groups; $P < 0.05$.
[2] ADA: American Dental Association
[3] Percentages are based on nonmissing frequencies and may not add to 100 percent because of rounding.
[4] NA: Not available.
[5] Data not collected.

practice. We pilot tested the survey among a convenience sample of practitioners for readability, clarity and consistency.

On the basis of experience of the ADA Survey Center, an anticipated response rate of 25 to 30 percent with anonymous mailings and the desired margin of error of less than 3 percent, the ADA generated a random sample of 7,400 U.S.-based practicing general dentists from its master file of all dentists in the United States (ADA members and nonmembers) (37). Each practitioner received a survey package that included a cover letter, a stamped addressed return envelope and the anonymous questionnaire. Respondents were instructed to return the completed survey in the addressed envelope; we made no effort to monitor practitioners who returned the survey. One month after the first mailing, a second mailing was sent to all 7,400 dental practitioners inviting those who had not yet responded to complete the survey; both mailings took place in the spring and summer of 2008.

The distribution of responses and mean ranks was calculated. Response rates to each question varied owing to missing responses. The demographics of the study sample were compared with those of the total ADA sampling frame of practicing U.S.-based general dentists; all percentages are based on the total number of respondents for each particular item. A Friedman two-way nonparametric analysis of variance (ANOVA) was conducted to test whether the distribution of ranks for each of the related items in a given question was different than would be expected by chance (38). The question of interest was whether there was a significant difference in the distribution of ranks of importance or willingness among the items of a given question. If the ANOVA

revealed a significant difference, we conducted appropriate post hoc pairwise comparisons to identify the specific differences according to the method of Siegel and Castellan (38). The higher the mean rank sum, the less willing the respondents were to conduct the activity or the less important they deemed the item.

We conducted additional analyses comparing men and women and comparing participants who had been in practice for 10 years or less versus those who had practiced for more than 10 years. Wilcoxon-Mann-Whitney rank sum tests were conducted for each item (per question) for the subanalyses according to sex and to years of practice. A Bonferroni correction factor was applied to account for the multiple numbers of tests done for each question. Analyses were conducted by using statistical software (SAS Version 9.0, SAS Institute, Cary, N.C.). Friedman pairwise comparisons were calculated by hand. We set significance at $P < 0.05$.

This collaborative study involved the University of Medicine and Dentistry of New Jersey, New Jersey Dental School, Newark; the ADA, Chicago; and A.T. Still University, Arizona School of Dentistry and Oral Health, Mesa, and was approved by each institution's institutional review board. A cover letter describing the purpose and nature of the study accompanied the survey, and completion of the questionnaire was indicative of consent to participate.

Results

Analysis: entire study sample

A total of 1,945 respondents returned the completed questionnaires, for a response rate of 26 percent and a margin of error of ± 2.22 percent. Table 1 shows the demographics of the study sample. Among those who responded to the particular question, 82.3 percent were male; 85.7 percent were white; 84.5 percent had practiced more than 10 years; 56.1 percent were practicing in suburban areas and 28.6 percent in urban areas; and 6.2 percent attended the HSP program at the 2007 ADA annual session. The demographic distribution for sex, age and race was significantly different for the study sample compared with the total sampling frame of U.S.-based practicing general dentists (Table 1). Compared with the total sampling frame, the study sample had fewer women (21.2 percent versus 17.7 percent, respectively); was older (40 years or older, 81.3 percent versus 84.8 percent, respectively); and consisted of fewer Asians (12.7 percent versus 6.5 percent, respectively), fewer African Americans (4.7 percent versus 2.6 percent, respectively) and more whites (82.2 percent versus 85.7 percent, respectively). Although the demographic distribution of the study sample is significantly different from that of the total sampling frame, these differences are not of practical or clinical importance; the large sample size allows for small, yet not meaningful, differences to reach statistical significance.

Table 2 shows the distribution of responses and the mean ranks for each question item. The Friedman nonparametric ANOVA was significant for all questions, indicating an overall significant difference among the related items within each question.

CLINICAL IMPLICATIONS

The findings of this study regarding chairside medical screening may lead to changes in our approach to dental education and may help define the practice of dentistry in the future.

Table 3 shows post hoc pairwise comparisons of the mean rank sums for each item of each question, identifying specific significant differences between paired items within each question.

Importance of conducting medical screening (questions 1 and 2)

Nearly 90 percent of respondents indicated that they thought it was "important" ("very important" plus "somewhat important") for a dentist to screen for medical conditions. The overwhelming majority (68.8-85.8 percent) thought it was important for a dentist to conduct chairside screening for each of the specified conditions (hypertension, CVD, DM, hepatitis, HIV). Respondents ranked hypertension most positively (mean rank: 2.66) followed by CVD (mean rank: 2.99). Pairwise comparisons showed that respondents were significantly more willing to test for hypertension than for all other conditions and significantly less willing to test for HIV than for CVD or DM.

Willingness to perform action (question 3)

The overwhelming majority was willing ("very willing" plus "somewhat willing") to conduct chairside screening that yielded immediate results (83.4 percent), to discuss results immediately with the patient during the dental visit (76.0 percent) or to refer a patient for a medical consultation (96.4 percent). However, only 45.9 percent were willing to send samples out to a laboratory for testing. Respondents were most willing to refer a patient for a medical consultation (mean rank: 1.73). Post hoc comparisons showed that respondents were significantly more willing to refer a patient for a medical consultation than all other options and significantly less willing to conduct screening that required samples to be sent to an outside laboratory than all other options.

Willingness to collect types of measurements or samples (question 4)

The majority was willing to collect oral fluids (87.7 percent) and blood pressure measurements (90.8 percent); fewer respondents were willing to collect blood via finger stick (55.9 percent) and measurements of weight and height (57.4 percent). Respondents were most willing to collect blood pressure measurements (mean rank: 1.94), followed by oral fluid samples (mean rank: 2.05), and were least willing to collect blood via finger stick (mean rank: 3.05). Post hoc comparisons showed respondents were significantly more willing to collect blood pressure measurements than any other sample or measurement and significantly less willing

Table 2

Distribution of responses for total sample and mean rank

Survey question	Ranking,[1] with no. and percentage of respondents					Total	Mean rank[2]
	Very improtant (1)	Somewhat important (2)	Not sure (3)	Somewhat unimportant (4)	Very unimportant (5)		
1. How important do you think it is for dentists to identify patients who may benefit from interventions to prevent or control the onset of medical conditions?	1,228 (67.1)	413 (22.6)	74 (4.0)	52 (2.8)	64 (3.5)	1,831	Not applicable
2. How important do you think it is for a dentist to perform or conduct chairside screening for each of the following?							
- Hypertension	1,101 (57.5)	542 (28.3)	142 (7.4)	75 (3.9)	55 (2.9)	1,915	2.66
- Cardiovascular disease	922 (48.4)	541 (28.4)	265 (13.9)	113 (5.9)	65 (3.4)	1,906	2.99
- Diabetes mellitus	877 (46.1)	581 (30.5)	261 (13.7)	115 (6.0)	70 (3.7)	1,904	3.04
- Hepatitis	913 (47.8)	453 (23.7)	341 (16.4)	146 (7.6)	84 (4.4)	1,910	3.11
- Human immunodeficiency virus infection	895 (47.0)	414 (21.8)	343 (18.0)	157 (8.3)	94 (4.9)	1,903	3.19
	Very willing (1)	**Somewhat willing (2)**	**Not sure (3)**	**Somewhat unwilling (4)**	**Very unwilling (5)**		
3. If you were considering incorporating medical screening into your practice, how willing would you be to de each of the following?							
- Refer a patient for consultation with a physician	1,632 (84.6)	228 (11.8)	27 (1.4)	19 (1.0)	24 (1.2)	1,930	1.73
- Conduct chairside screening that yields immediate results	1,056 (55.1)	543 (28.3)	177 (9.2)	78 (4.1)	62 (3.2)	1,916	2.26
- Discuss screening results with patients during dental visit immediately after screening	869 (45.4)	586 (30.6)	242 (12.6)	121 (6.3)	97 (5.1)	1,915	2.55
- Conduct chairside screening that requires sending samples to an outside laboratory	280 (14.6)	599 (31.3)	421 (22.0)	400 (20.9)	215 (11.2)	1,915	3.46
4. How willing would you be to gather the following samples or data as part of your practice?							
- Blood pressure measurements	1,359 (70.1)	401 (20.7)	65 (3.4)	50 (2.6)	65 (3.4)	1,940	1.94
- Oral fluids for salivary diagnostics	1,245 (64.3)	454 (23.4)	104 (5.4)	60 (3.1)	74 (3.8)	1,937	2.05
- Height and weight measurements	640 (33.1)	471 (24.3)	297 (15.3)	300 (15.5)	228 (11.8)	1,936	2.96
- Blood via finger stick	552 (28.5)	530 (27.4)	320 (16.5)	316 (16.3)	218 (11.3)	1,936	3.05
	Very important (1)	**Somewhat important (2)**	**Not sure (3)**	**Somewhat unimportant (4)**	**Very unimportant (5)**		
5. If you were considering incorporating medical screening into your practice, how important would each of the following issues be?							
- Patients' willingness	1,606 (83.5)	248 (12.9)	44 (2.3)	15 (0.8)	10 (0.5)	1,923	2.77
- Liability	1,589 (82.4)	216 (11.2)	73 (3.8)	28 (1.5)	22 (1.1)	1,928	2.83
- Cost	1,466 (76.1)	383 (19.9)	46 (2.4)	23 (1.2)	9 (0.5)	1,927	2.94
- Time	1,453 (75.4)	397 (20.6)	34 (1.8)	32 (1.7)	11 (0.6)	1,927	2.96
- Insurance coverage	1,101 (57.4)	533 (27.8)	147 (7.7)	88 (4.6)	48 (2.5)	1,917	3.51

[1] Percentages are based on nonmissing frequencies and may not total 100 percent because of rounding.
[2] Results of Friedman nonparametric analysis of variance were significant for questions 2 through 5.

to collect blood via finger stick than oral fluids or blood pressure measurements.

Important issues for incorporating chairside medical screening into practice (question 5)
More than 85 percent of the respondents thought that each of the issues (patients' willingness, liability, cost, time, insurance coverage) was important. In this instance, the percentage distribution for the "very important" category highlights the difference in perceived barriers; only 57.4 percent thought insurance coverage was "very important" compared with 75.4 percent or more for all other issues. Respondents ranked patients' willingness as the most important consideration (mean rank: 2.77) and insurance coverage as the least important (mean rank: 3.51). Post hoc comparisons showed that respondents considered insurance coverage to be significantly less important than all other factors.

Analysis: subgroup, according to sex and years in practice
Because the sample was overwhelmingly male and composed of those who had practiced for more than 10 years, we do not present the frequency data for the subgroups. Wilcoxon-Mann-Whitney rank sum tests were conducted according to item for each question, comparing the responses of men and women and comparing the responses of those who had practiced 10 years or less and those who had practiced more than 10 years. After applying the Bonferroni correction factor for multiple comparisons, we noted a significant difference between men and women regarding importance of testing for hypertension, CVD and DM, willingness to refer a patient for medical consultation and the importance of insurance coverage when considering incorporating medical screening into practice. In comparison with their male colleagues, women rated these items as more important and were more willing to engage in these behaviors. There was no significant difference between men and women regarding the remaining items. In terms of years of practice, there was no significant difference between the two groups regarding any of the items.

The Friedman nonparametric ANOVA was conducted for each question for each subgroup; the results were significant for all questions (data not shown). Among the respondents who reported their sex, there were 1,544 men and 331 women. Among the respondents who reported years of practice, 1,623 had been in practice more than 10 years and 297 for 10 years or less. The rank order of items for each question was similar according to sex and years of practice (Table 4). The significant ($P < 0.05$) pairwise comparisons appear below.

Importance of conducting medical screening
All respondent subgroups were significantly less willing to test for HIV than for other select conditions. Female respondents were significantly less willing to test for HIV than for hypertension or hepatitis. Respondents practicing 10 years or less were significantly more willing to test for hypertension than for hepatitis or HIV.

Willingness to perform action
All respondent subgroups were significantly less willing to conduct screening that required samples to be sent to an outside laboratory than all other options. They also all were significantly more willing to refer a patient for a medical consultation than all other options.

Willingness to collect types of measurements or samples
All respondent subgroups were significantly more willing to take blood pressure and significantly more willing to take oral fluid samples than to obtain blood via finger stick or weight and height measurements.

Important issues for incorporating chairside medical screening into practice
All respondent subgroups thought insurance coverage was significantly less important than all other factors when considering incorporating chairside medical screening into practice.

Discussion

This study is the first nationwide survey of practicing general dentists in the United States to assess attitudes toward, acceptance of and perceived barriers regarding screening for medical conditions in a dental setting. The overwhelming majority of respondents thought it was important and were willing to conduct chairside screening for the specified medical conditions (68.8-85.8 percent) – including CVD, DM, hypertension, HIV and hepatitis infection – in a dental setting. The majority of respondents also was willing to collect oral fluid samples (87.7 percent), blood pressure measurements (90.8 percent) and blood samples via finger stick (55.9 percent); discuss results immediately with the patient (76.0 percent); and refer patients for medical consultation (96.4 percent). Data regarding potential barriers or obstacles revealed that health insurance coverage was the least important factor for incorporating chairside medical screening into dental practice. Subgroup analysis according to years of practice (10 years or less and more than 10 years) and according to sex yielded results similar to those for the total sample.

The significant differences between the study sample and the total sampling frame of U.S.-based dentists in terms of the distribution of sex, age and race/ethnicity raises the question of how representative the study sample is of the total population of U.S. dental practitioners. Although the study sample had fewer women, was older and had fewer Asians and blacks, the magnitude of the differences are not of practical or clinical importance but reached statistical significance because of the large sample size. There also is the possibility of response bias associated with survey research in general – specifically, the tendency for those with strong feelings (pro or con) to be more likely to respond or for respondents to answer questions in a way they think will please the questioner. Although we cannot evaluate the occurrence of this type of response bias directly, the questionnaire

Table 3

Pairwise comparisons for Friedman nonparametric analysis of variance according to questions for the total number of respondants for each question

Question 2: How important do you think it is for a dentist to perform or cunduct chairside screening for each of the following?		
Condition (A versus B)	Rank[1] (A-B)	Rank Difference
Hypertension versus cardiovascular disease (CVD)	2.66-2.99	-0.33[a]
Hypertension versus diabetes mellitus (DM)	2.66-3.04	-0.38[a]
Hypertension versus hepatitis	2.66-3.11	-0.45[a]
Hypertension versus human immunodeficiency virus (HIV)	2.66-3.19	-0.53[a]
CVD versus DM	2.99-3.04	-0.05
CVD versus hepatitis	2.99-3.11	-0.12
CVD versus HIV	2.99-3.19	-0.20[a]
DM versus hepatitis	3.04-3.11	-0.07
DM versus HIV	3.04-3.19	-0.15[a]
Hepatitis versus HIV	3.11-3.19	-0.08
Friedman nonparametric analysis of variance = 385; degrees of freedom = 4; *P* < 0.001. Critical value[2] = 0.1445; [a]: significantly different at P < 0.05.		
Question 3: If you were considering incorporating medical screening into your practice, how willing would you be to do each of the following?		
Activity (A versus B)	Rank (A-B)	Rank difference
Refer for medical consultation versus screen with immediate results	1.73-2.26	-0.53[b]
Refer for medical consultation versus discuss results immediately with patient	1.73-2.55	-0.82[b]
Refer for medical consultation versus send samples to outside laboratory	1.73-3.46	-1.73[b]
Screen with immediate results versus discuss results immediately with patient	2.26-2.55	-0.29[b]
Screen with immediate results versus send samples to outside laboratory	2.26-3.46	-1.20[b]
Discuss results immediately with patient versus send samples to outside laboratory	2.55-3.46	-0.91[b]
Friedman nonparametric analysis of variance = 2,816; degrees of freedom = 3; *P* < 0.001. Critical value = 0.1105; [b]: significantly different at P < 0.05.		
Question 4: How willing would you be to gather the following samples or data as part pf your practice?		
Conditions (A versus B)	Rank (A-B)	Rank difference
Blood pressure versus oral fluids	1.94-2.05	-0.11[c]
Blood pressure versus height and weight	1.94-2.96	-1.02[c]
Blood pressure versus blood via finger stick	1.94-3.05	-1.11[c]
Oral fluids versus height and weight	2.05-2.96	-0.91[c]
Oral fluids versus blood via finger stick	2.05-3.05	-1.00[c]
Height and weight versus blood via finger stick	2.96-3.05	-0.09
Friedman nonparametric analysis of variance = 2,131; degrees of freedom = 3; *P* < 0.001. Critical value = 0.1097; [c]: significantly different at P < 0.05.		
Question 5: If you were considering incorporating medical screening into your practice, how important would each of the following issues be?		
Conditions (A versus B)	Rank (A-B)	Rank difference
Patients' willingness versus liability	2.77-2.83	-0.06
Patients' willingness versus cost	2.77-2.94	-0.17[d]
Patients' willingness versus time	2.77-2.96	-0.19[d]
Patients' willingness versus insurance coverage	2.77-3.51	-0.74[d]
Liability versus cost	2.83-2.94	-0.11
Liability versus time	2.83-2.96	-0.13
Liability versus insurance coverage	2.83-3.51	-0.68[d]
Cost versus time	2.94-2.96	-0.02
Cost versus insurance coverage	2.94-3.51	-0.57[d]
Time versus insurance coverage	2.94-3.51	-0.55[d]
Friedman nonparametric analysis of variance = 762; degrees of freedom = 4; *P* < 0.001. Critical value = 0.1436; [d]: significantly different at P < 0.05.		

[1] 1 = very important/very willing; 5 = very unimportant/very unwilling.
[2] Critical values are based on the number of comparisons and the sample size for the specific question.

Table 4

Means ranks, [1] according to respondants' sex and years in practice

Item	Sex		Years in practice	
	Male	Female	More Than 10 Years	10 Years or Less
Question 2: Importance of Conducting Medical Screening				
Hypertension	2.65	2.69	2.65	2.86
Cardiovascular disease	3.00	2.92	2.92	3.00
Diabetes mellitus	3.08	2.99	2.93	3.08
Hepatitis	3.10	3.16	3.22	3.09
Human immunodeficiency virus	3.17	3.24	3.26	3.17
CRITICAL VALUE	0.1623	0.3498	0.1583	0.3705
Question 3: Willingness to Perform Action				
Refer for medical consultation	1.72	1.76	1.73	1.69
Screen with immediate results	2.27	2.23	2.27	2.24
Discuss results immediately with patient	2.56	2.54	2.55	2.60
Send samples to outside laboratory	3.45	3.47	3.46	3.47
CRITICAL VALUE	0.1240	0.2692	0.1209	0.2833
Question 4: Wililingness to Collect Types of Measurements or Samples				
Blood pressure	1.95	1.83	1.95	1.89
Oral fluids	2.04	2.06	2.03	2.14
Weight and heights	2.95	3.01	2.99	2.83
Blood via finger stick	3.05	3.09	3.04	3.14
CRITICAL VALUE	0.1229	0.2659	0.1200	0.2655
Question 5: Importance of Following Issues in Consideration of Incorporating Chairside Screening Into Practice				
Patients' willingness	2.76	2.78	2.75	2.86
Liability	2.83	2.84	2.83	2.82
Cost	2.92	2.96	2.94	2.91
Time	2.95	3.03	2.96	2.98
Insurance coverage	3.54	3.40	3.52	3.43
CRITICAL VALUE	0.1612	0.3471	0.1571	0.3686

[1] 1 = very important/very willing; 5 = very unimportant/very unwilling.

included no leading questions and was constructed to minimize the occurrence of this type of bias.

According to the theories of planned behavior and reasoned action, knowledge, attitudes and beliefs are strong predictors of intentions, and intention predicts behaviors (29-31). Our data suggest that dentists have the necessary attitudes, beliefs and intentions to incorporate chairside screening for medical conditions into dental practice. This study builds on a previous clinic-based study that demonstrated the effectiveness of chairside medical screen-ing by dentists as a strategy for identifying patients at increased risk of experiencing a CVD-associated event among patients who are unaware of their increased risk (20). The concept of having dentists screen for medical disease was proposed as early as 1926 in the Gies report (39) and reiterated as recently as 2002 (40). A recent editorial in The Journal of the American Dental Association advocated for the creation of a health home, a convergence of the medical home and the dental home, to facilitate more effective, coordinated evidence-based health care delivery (41). As noted by that author in an earlier editorial, this idea builds on an earlier concept of one-stop shopping that embraces expanded scope of services provided in offices of oral health care professionals, including services related to screening and monitoring for systemic diseases (42).

DM and CVD are significant public health concerns worldwide, with DM and prediabetes incidence continuing to rise (43). Hypertension, one of the primary risk factors for CVD and estimated to account for one-half of the CVD disease burden, kills 8 million people per year worldwide (44). Data indicate that at least one-third of DM and CVD cases are undiagnosed (3,4) and that primary prevention activities, including dietary modification and increased time spent in physical activity, can decrease the incidence of CVD and DM. In a recent longitudinal study conducted in China involving the modification of diet and physical activity, investigators reported a 51 percent lower incidence of DM in the intervention group compared with the control group during the active six-year intervention period (hazard ratio: 0.49; 95 percent confidence interval [CI]: 0.33-0.77). A 14-year follow-up in these patients revealed a continued significantly lower incidence of

disease in the intervention group (hazard ratio: 0.57; 95 percent CI: 0.41-0.81) (13). Another longitudinal dietary modification study to increase dietary fiber intake showed a significant effect on the risk of developing CVD across a 19-year follow-up (relative risk: 0.89; 95 percent CI: 0.80-0.99) for those in the highest quartile of dietary fiber intake compared with those in the lowest quartile (11).

Data also indicate that the majority of adults visit their dentist annually; 65 percent of adults aged 18 to 64 years and 58 percent of adults 65 years and older visited their dentist during a 12-month period (45). Given the well-documented effect of primary prevention activities, the large proportion of undiagnosed cases of CVD and DM, and the large percentage of patients who visit a dentist in a 12-month period, dentists have a unique opportunity to conduct targeted screening to identify patients who are in the early stages of disease and likely to benefit from primary disease prevention strategies.

Dentists have been involved in preventive health screening and interventions for other diseases, including smoking-cessation counseling and oral cancer screening and preventive counseling. Although study results reveal that dentists are aware of the importance of such activities, the lack of adequate training and knowledge were reported as barriers to complete incorporation of these activities into practice (46-49). This situation represents both an opportunity and a challenge. Disease prevention and control and comprehensive health care should be incorporated into the predoctoral dental and advanced general dental curricula. At one school where predoctoral students were instructed in blood glucose screening, the majority of students thought that the instruction was beneficial and indicated they might incorporate glucose screening into their practice (50). These data suggest a potential relationship between what students are taught and what they will do in practice. Other potential educational venues include traditional hands-on continuing education courses and structured workshops for dentists participating in practice-based research networks or enrolled in organized dental insurance companies.

One also must consider potential barriers and obstacles to incorporation of chairside medical screening into practice in a dental setting. One of the critical components of chairside medical screening is referral of at-risk patients to a physician for follow-up medical care. The results of our study suggest that the large majority of dentists was willing to refer a patient to a physician for further disease assessment and diagnosis, which mitigates dentists' willingness to refer as an impediment. Additional data on perceived barriers indicated that the most important concern was patients' willingness. Preliminary data from our ongoing survey of patients seeking treatment at dental clinics suggest that patients are willing to participate in chairside medical screening by the dentist (51), which mitigates the importance of patients' willingness as a potential barrier. The unexpected finding that dentists considered insurance coverage the least important barrier suggests that they are willing to expand their professional responsibilities beyond their financial interests.

Conclusion

The data from our study showed that dentists are willing to incorporate chairside medical screening into their practices, thus offering an opportunity for integrated disease prevention and control activities across disciplines. Primary disease prevention and control activities are meant to delay disease onset and control disease severity (52). The first step is identifying people with an increased likelihood of developing disease or experiencing escalating disease severity. This is particularly important considering that the majority of people who have a nonhospital-based cardiac arrest are thought to be unaware of their risk (53).

The rise in CVD and DM is a global issue for which successful disease prevention strategies require an integrated approach that incorporates health care providers across disciplines. The results of this study of U.S. dentists, along with those of previous studies (20,21), set the stage for a global initiative to assess the efficacy of chairside medical screening and the attitudes of oral health care professionals about such activities. These findings could influence how we define the practice of dentistry in the future (54).

Disclosure

None of the authors reported any disclosures.

Acknowledgements

The authors thank the staff of the American Dental Association Survey Center, Chicago, for assistance in preparing the mailing list for this study. They also thank Nelida Laracuente, Sue Jiang, Zulma Glover and Inez White of the New Jersey Dental School, University of Medicine and Dentistry of New Jersey, Newark, for their assistance in preparing the mailing packets and entering the data.

This article was originally published in Journal of American Dental Association 2010; 141: 52-62.

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