Addressing obesity in the dental setting: What can be learned from oral health care professionals' efforts to screen for medical conditions

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Abstract

Purpose: This scoping review focused on what can be learned from oral health professionals' (OHCPs) efforts to provide screenings for medical conditions in the dental setting that could guide strategies for addressing childhood obesity.
Methods: PubMed, Embase, Cochrane, Grey Literature, and CINAHL were searched (limitation English language). Search terms covered OHCPs and various oral systemic conditions of interest (details provided in the paper. Nineteen unduplicated, relevant articles were categorized based on relationship to question.
Results: Screening for diabetes and heart disease risk in the dental setting has been shown to be effective and patients and providers are willing to participate, although not yet routinely implemented. Screening/counseling for tobacco-cessation has been shown to be effective, but few (<10 percent) OHCPs provided this activity or received tobacco cessation training. For obesity screening/counseling, the majority of dentists (82 percent) reported they would be more willing to offer this service if obesity were directly related to oral disease. The one healthy weight intervention pilot study was well received by caregivers/patients and resulted in improved food choices. Successful implementation included a dedicated staff member, the dental hygienist. Lack of adequate training was a commonly reported barrier for all of these conditions; in addition, for obesity screening/counseling fear of appearing judgmental, and fear of patient rejection were also commonly reported.
Conclusions: Systematic studies are needed building on existing literature and exploring best implementation practices. Enhanced training is needed on relationship of oral health and systemic health and OHCPs' role.

Introduction

Since passage of the Patient Protection and Affordable Care Act (ACA), there has been increased emphasis on prevention and on integrated health care delivery (1). This is likely to focus greater attention on screening and interprofessional approaches to disease prevention and control. It has been suggested that the oral health care provider (OHCP) could be an additional resource in public health strategies to control major epidemics such as diabetes and heart disease, which are among the leading causes of morbidity and mortality (2,3).

There are a number of published studies on the efficacy of screening for risk of medical conditions such as diabetes and heart disease in the dental setting. Screening for risk of medical conditions or common risk factors in the dental setting can facilitate early identification of individuals at increased risk for disease yet unaware of their increased risk and can promote early entry into the medical system when medical and or behavioral interventions can impact the risk of developing disease (2). This will be referred to as screening for medical conditions going forward in this review. Individuals who are found to be at increased risk would be referred to a primary care provider for confirmatory diagnosis and

medical follow up. Suggestions have been made to expand state dental practice acts to include primary care activities such as screening for medical screening conditions (4). Within the oral health community, there recognition of the potential role OHCPs could play in addressing tobacco use. For tobacco use, OHCPs are encouraged to not only screen but also to provide cessation counseling. Data from the 2008 Medical Expenditure Survey Panel indicate that 24 percent of adults did not access general health care and of those 23 percent did see a dentist in that time period (5).

Addressing childhood obesity in the dental setting has become part of the discussion of expanded primary care activities for the OHCP. How big a problem is childhood obesity and why should OHCPs be concerned with this? Over the last 30 years the prevalence of childhood obesity has dramatically increased in the United States. According to data from the National Health and Nutrition Examination Survey (NHANES) there was a significant increasing trend in the percentage of children and adolescents ages 2-19 classified as obese data from 1988-1994 to 2013-2014; one out of every six children is obese and one out of every three is overweight (6). While overall US childhood obesity rates have not increased since 2008, rates are continuing to increase for Hispanic and non-Hispanic black children. Despite reports of weight stabilization in US children, NHANES data from 2004 through 2014 reveal increases in pediatric waist circumference percentiles (7). The impact of childhood overweight and obesity is both immediate and long-term. Studies suggest children who are overweight or obese are more likely to become obese or overweight as adults (8,9).

As part of recent guidelines on screening for childhood lipid levels, the US Preventive Services Task Force included recommendations that clinicians screen for obesity in children ages 6 or older and offer or refer them for comprehensive behavioral interventions (10). Additionally, *Healthy People 2020* calls for a 10 percent reduction in the proportion of children and adolescents who are considered obese (11).

Is there a role for the oral health care professional (OHCP) in combatting the growing childhood obesity epidemic? If yes, what should that look like? Oral health care utilization rates published by the American Dental Association's (ADA's) Health Policy Institute (HPI), suggest that oral health care utilization rates continue to increase among children, and the percentage of children lacking dental benefits is at its lowest since the Medical Expenditure Panel Study (MEPS) began tracking dental insurance coverage in 1999 (12). This increase is expected to continue as a result of the ACA, and the ADA HPI estimates that by 2018 approximately an additional 8.7 million children will gain access to some form of dental benefit. The authors note however, that the ACA does not address other critical issues around access to dental care, such as financial barriers and delivery system barriers (12,13). Based on MEPS data from 2008, 26 percent of children did not access general health care in 2006 and of those, 35 percent had seen a dentist in that time period (5). OHCPs have multiple patient contacts per year and begin to see children as early as age 1. The most recently available data from the National Survey of Children's Health (2011-2012) shows that parents reported that 78.4 percent of US children visited a dentist in that year (14). These data also show that 31.3 percent of children and adolescents ages 10-17 were overweight or obese (>85th percentile body mass index [BMI] for age) (14). Clearly, utilization data suggest that OHCPs could be among the main cadre of health professionals to reach children with childhood obesity. Moreover, there is a synergy with dietary messages used for caries prevention, and oral health personnel are accustomed to discussing these messages with children and their caregivers (15).

A 2005 editorial in the Journal of the American Dental Association challenged members of the oral health community to ask themselves whether direct participation in efforts to impact the growing obesity epidemic is a challenge they should consider, not only because obesity could have consequences for patients' oral health status but also because of a "desire to have a stronger impact on patients' general health."(16) This question is still relevant more than 10 years later, as there has been very little meaningful change in what role the dentist can and does play to address obesity among patients. A number of subsequent studies/commentaries over the years presented a compelling rationale in support of a role for the OHCP, the unique relationship of the dentist and their patients, and offered guidelines on what dentists could do, including determining weigh, height, and body mass index percentiles annually on their patients and for those with unhealthy weight trends, to refer them to a pediatrician, a family physician, and possibly a dietician (17-19).

What can be learned from studies on screening/counseling for risk of medical conditions in the dental setting that can inform future strategies to address childhood obesity in the dental setting? The purpose of this scoping review was to review published studies on OHCPs' efforts to address obesity and to review published studies on the role of OCHPs in efforts to screen/counsel for risk of other systemic health issues (i.e., diabetes, heart disease) or risk factors (i.e., obesity, tobacco use) to assess what can be learned from these studies to help inform the strategies that can be implemented in a dental setting to address childhood obesity.

Methods

The following databases were searched (limited to English): PubMed, Embase, Cochrane, Grey Literature, and CINAHL. The search was limited to English with no time specification.

Provider terms:

MESH: Dentists OR "dental auxiliaries"

General: Dentists OR "dental auxiliaries" OR dentist OR orthodontists OR orthodontist OR "dental assistants" OR "dental assistant" OR "dental hygienists" OR "dental hygienist" OR "oral hygienists" OR "oral hygienist" OR "dental technicians" OR "dental technician" OR denturists OR denturist OR "oral health care professionals" OR "oral health care professional" OR "oral health professionals" OR "oral health professional" OR "dental therapist" OR "dental therapists"

Health issues terms:

MESH: "tobacco use cessation" OR diabetes OR "blood pressure" OR "cardiovascular disease" OR "oral-systemic disease" OR obesity "pediatric obesity"

General: "tobacco use cessation" OR "tobacco cessation" OR "smoking cessation" OR diabetes OR "blood pressure" OR "cardiovascular diseases" OR "cardiovascular disease" OR "heart diseases" OR "heart disease" OR "oral-systemic diseases" OR "oral-systemic disease" OR "alcohol use" OR "pediatric obesity" OR "child obesity" OR "obesity, child" OR "childhood onset obesity" OR "obesity, childhood onset" OR onset obesity, childhood" OR "obesity in childhood" OR "childhood obesity" OR "obesity, childhood"

Added Terms: screening OR counseling OR advice OR

Twenty-six relevant unduplicated articles were categorized by the authors based on their relationship to the question according to the following categories: support for medical screening in the dental setting ($n = 11$), tobacco-cessation programs in the oral health setting ($n = 4$), obesity and the role of OHCPs, ($n = 4$), and obesity screening in the oral health setting ($n = 4$). Articles were excluded if they were not relevant. A description of the methodological approach, study limitations, and a summary of the findings is presented. Table 1 presents a brief summary of the articles included. Figure 1 shows a flow chart of search results.

Results

Summary of and attitudes surveys and efficacy studies on medical screening in the dental setting

Surveys conducted by Greenberg et al. among oral health and primary care providers and patients showed a favorable attitudes toward medical screening in the dental setting and the patients and providers were willing to participate in this activity (20-23). A 2008 national survey of practicing general dentists ($N = 1{,}945$) found that the majority thought it was important for dentists to screen for HIV, hepatitis, diabetes, cardiovascular disease, and hypertension and were willing to conduct tests that yield immediate results and refer patients for medical follow-up (20). Half to two-thirds were willing to collect necessary data/samples, with 57 percent willing collect height and weight information. Similar results were found in a 2013 national survey among dental hygienists ($N = 3133$) (21). Training, patient willingness, and time were the most frequently reported barriers among OHCPs (20,21). Approval from the dentist was the most important consideration among dental hygienist (21).

A 2012 national survey by Greenberg et al. among practicing primary care physicians ($N = 1{,}508$) reported that the majority felt it was valuable for a dentist to conduct screenings with referral for medical follow-up as appropriate, were willing to discuss the results with the dentists, and were willing to accept patient referrals from a dentist (23). Less-experienced primary care physicians (practicing <10 years) were more willing to accept a referral from a dentist than more experienced primary care physicians.

A 2008-2009 survey among a convenience sample of adult dental patients ($N = 470$) found that the almost three-fourths of these individual felt that it was important for dentists to conduct screenings for medical conditions and were willing to have their dentist conduct a medical screening that yielded immediate results, were willing to discuss results during the visit, and, were willing to receive a referral to a physician (22). In contrast to the dentists, where less than half were willing to collect height and weight, more than two-thirds of these patients also were willing to provide height and weight data. Confidentiality was the most important concern noted; the fact that the screening was done by a dentist rather than a physician was the least important concern noted (22). As with all surveys, there are potential limitations with generalizability since respondents are more likely to have strong opinions in either direction.

Several published studies have documented the efficacy and potential yield of medical screening for diabetes mellitus and cardiovascular disease in the dental setting using safe, simple, well-accepted, and well-validated screening tools. Medical screening in the dental setting for diabetes and coronary heart disease in the dental setting has been targeted to patients who are not aware of their increased risk and not routinely engaged with a primary care provider (3,24-27). A study in 2004 by Glick and Greenberg using NHANES data from 1999 to 2002 showed that based on theoretical calculations if dentist conducted chairside screening for cardiovascular disease risk among patients >45 years of age, no history of CVD, no medication use for CVD, no primary care visit in the previous 12 months, and did have a dental visit in that time period, 18 percent would screen positive for increased CVD risk (2). In 2005-2006, Greenberg et al. conducted a study in an inner-city university-based dental clinic to assess targeted medical screening in the dental setting (patients included adults ages >40, with no history of disease or relevant medication use, and with no visit to a primary care provider in the previous 12 month) for increased risk for heart disease and diabetes in an inner-city university-based dental clinic (3). Validated, simple, safe screening tools

Table 1 Abstraction Table

Citation	Purpose	Methods	Results
Studies on screening for medical conditions in a dental setting			
Greenberg et al. (2010) (20)	To assess dentists' attitudes, willingness, and perceived barriers regarding medical screening in the dental office.	A national, random sample of US general dentists was surveyed by mail by means of an anonymous, self-administered questionnaire.	Of the 1,945 respondents (response rate 26%), The majority (89%) felt screening in the dental setting was important and they were willing to participate in these activities depending on the type of sample needed; 56% % height and weight, 87% oral fluids, and 90% blood pressure. Among the barriers cited were cost, training, and patient willingness.
Greenberg et al. (2016) (21)	To assess dental hygienists' attitudes toward medical screening in a dental setting. A nationwide sample	A nationwide sample of practicing dental hygienists in the United States was surveyed by mail by means of an anonymous, self-administered questionnaire.	Of the 3,133 respondents, (response rate of 49%), the majority felt screening for medical conditions in the dental setting was important, and they were willing to participate in these activities. The most important considerations were support from the dentist and patient willingness.
Greenberg (2011) (22)	To assess patient attitudes toward medical screening in a dental setting	A self-administered, anonymous questionnaire was given to a convenience sample of adult patients attending an inner-city dental school clinic and two private practice settings in the United States.	Of the 470 patients surveyed, the majority felt it was worthwhile for the dentist to screen for medical conditions, were willing to participate, and were willing to discuss the results during their visit and be referred to a primary care health professional as needed.
Greenberg et al. (2015) (23)	To assess primary care physicians' attitudes toward medical screening in a dental setting.	A nationwide sample of practicing primary care providers in the United States was surveyed by mail by means of an anonymous, self-administered questionnaire.	Of the 1,508 respondents (response rate of 22%), the majority felt it was worthwhile for a dentist to screen for medical conditions, were willing to discuss the results with the dentist, and were willing to accept patients referred by the dentists.
Glick and Greenberg (2005) (2)	To determine theoretical efficacy of conducting medical screening in a dental setting for diabetes and heart disease.	The authors used the Nutrition and Health Examination Survey (NHANES) data to assess the potential efficacy of screening for heart disease in a dental setting among male patients > age 40 who were unaware of their increased risk, had visited a dentist in the previous 12 months, but had not visited a physician in that same time period.	Fifty-four percent of men who had no reported risk factors for heart disease or diabetes and no reported medication use for heart disease or diabetes did not see a physician in the previous 12 months but did see a dentist in that time period. Eighteen percent had an increased risk for experiencing a severe coronary heart disease event within 10 years.
Greenberg et al. (2007) (3); Greenberg (2013) (24)	To assess the efficacy of using oral health care providers (OHCPs) as a resource for identifying patients who were unaware of their increased risk for developing cardiovascular disease (CVD) or diabetes mellitus (DM) in an inner-city dental clinic.	OHCPs conducted medical screenings using safe, effective available tools to identifying patients who were unaware (<40 years of age, no history of medication for CVD or DM, no visit to a primary care provider in the previous 12 months) of their increased risk for developing s severe heart disease event or DM in an inner-city dental clinic. Dentists measured blood pressure and used finger stick blood samples to test cholesterol levels, high-density lipoprotein	Seventeen percent of 100 patients > 40 years of age with nor reported history of or medication use for CVD or DM and who had not visited a primary care provider in the previous 12 months. screened were at increased risk for heart disease using determined by the Framingham Risk Score yet were unaware of their increased risk. One percent was at increased risk for diabetes (using hemoglobin A1c cutpoint at the time of the study). Patients at increased risk for developing disease

Table 1. Continued

Citation	Purpose	Methods	Results
		levels and hemoglobin A1c levels. Patients who were at increased risk were referred to a primary care provider.	were referred to a primary care provider for medical follow up.
Lalla et al. (2011) (25)	To assess the sensitivity of hemoglobin A1c testing among periodontal disease patients and to see if adding dental parameters increased the sensitivity.	OHCPs conducted hemoglobin A1c screenings for DM among patients attending a dental school clinic for periodontal disease. They then assessed the added sensitivity of including dental parameters to an A1c test for determining risk for diabetes among adults > age 40 years.	They found the use of hemoglobin A1c measurements in conjunction with two dental features improved sensitivity over A1c alone for identifying unrecognized diabetes among adults > age 40 years; sensitivity improved from 75 to 92%.
Jontell and Glick (2009) (26)	To assess among private general practice dentists in Sweden the efficacy and yield of screening for increased risk of dying from a severe CVD event and to what extent these patients were given a subsequent medical intervention following referral to a primary care provider	OHCPs conduct medical screening to identify patients at risk for experiencing a fatal CVD event. Patients who had increased risk were referred for medical follow up. They also assessed to what extent those practitioners' findings would result in medical interventions. Eligibility criteria were: > age 40 years, no reported history or medication use for heart disease or diabetes, and no visit to a primary care health professional.	Six percent of 200 patients who had glucose levels, total cholesterol levels, or blood pressure assessed were found to be an increased risk for a fatal CVD event. Of those who completed the medical referral, 50% were given a medical intervention.
Genco et al. (2014) (27)	To assess the feasibility and efficacy of conducting hemoglobin A1c screening for DM among community practitioners and in a community health center.	OHCPs screened dental patients ages 45 years and older who were not aware of their diabetic status underwent evaluation for diabetes risk with hemoglobin A1c measurements. Participants with an HbA1c level of 5.7% or greater were referred to their physicians for diagnosis. Follow-up diagnosis was obtained.	Forty-one percent of the patients had abnormal hemoglobin A1c values, and of those 35% were diagnosed with diabetes within 1 year. Participants with a hemoglobin A1c level of 5.7% or greater were referred to their physicians for diagnosis. Follow-up diagnosis was obtained.
Nasseh et al. (2014) (28)	To estimate the short-term health care cost savings that would result from OHCPs performing chronic disease screenings.	A cost benefit analysis was conducted using available data to determine cost savings that would result from OHCPs performing chronic disease screenings.	Screening for diabetes in a dental setting could save the health care system $5.1-$65.3 million over 1 year depending upon the rate of referral completion for the dental clinic to the physician office.
Studies on screening/counseling for tobacco use in a dental setting			
Albert et al. (2002) (29)	This study assessed the tobacco-cessation knowledge, attitudes, and behaviors of dentists participating in a large managed care dental plan.	Participating dentists in four states were surveyed via mail. A total of 355 were sent surveyed, and 21% responded.	Few had prior training in tobacco control, few asked their patient about tobacco use, and few provided advice on nicotine-replacement therapy. Patient expectations did not create a demand for these services.
Hu et al. (2006) (30)	This study assessed practices of dentists in east Texas on tobacco-use cessation counseling, their adherence to tobacco-use-cessation counseling guidelines, and barriers to adherence.	A cross-sectional survey assessed demographic characteristics and knowledge, attitudes, and activities of 783 dentists. The survey focused on familiarity with the guidelines and adherence to the recommended steps.	Most dentists were unfamiliar with guidelines and did not follow the recommended steps.
Andrews et al. (1999) (31)	An intervention trial to evaluate the effect of a dental-office tobacco-	75 dental practices were blocked and randomized to usual care and minimal and extended intervention; for	Analysis of data from a randomized intervention study among 75 dental offices showed a significantly greater sustained

Table 1. Continued

Citation	Purpose	Methods	Results
	cessation program on smokeless tobacco use.	the outcome of smokeless tobacco cessation, the two intervention arms were collapsed. The intervention, implemented by the dental hygienist consisted of assessing any oral health issues related to tobacco use, giving direct advice to quit, providing a packet of written informational material, and providing a kit comprising items to help the cessation process.	quit rate (12 months) of smokeless tobacco for the intervention group compared to the usual care group, 9.83% versus 3%, $P < 0.01$.
Gordon et al. (2010) (32)	A follow-up randomized trial among 68 private dental clinics to assess the effect of dental-office-based tobacco-use cessation interventions.	The intervention consisted of assessing any oral health issues related to tobacco use, giving direct advice to quit, providing a packet of written informational material, and providing a kit comprising items to help the cessation process. In addition, the clinician could refer the patient to a tobacco telephone quitline.	At the 12-month assessment, intervention group had a significantly greater proportion meeting the 9-month prolonged abstinence (3% versus 2%, $P < 0.01$) and in the 12-month point prevalence for smoking cessation (12% versus 8%, $P < 0.01$). However, the results do not support an added value of a referral to a quitline.
Studies on screening for obesity in a dental setting			
Braithwaite et al. (2008) (33)	To document current nutrition/ healthy lifestyle counseling practices of pediatric dentists in NC and examine factors associated with those practices.	A 65-item survey instrument contained questions in six domains: academic preparation, knowledge, confidence, opinions, practice patterns, and barriers. It was sent to all clinically active pediatric dentists in NC.	70/102 responded (response rate of 69%). Less than 35% provided nutritional counseling services. Logistic regression showed that higher overall knowledge, comfortable discussing weight-related issues, those in practice>10 years. and females were significantly more likely to provide nutrition counseling.
Curran et al. (2010) (34)	The authors conducted a study to assess dentists' interest in and barriers to providing obesity counseling to patients.	The authors surveyed a random sample of 8,000 American Dental Association members by mail, stratified according to census region (West, Midwest, South, Northeast) and dentist type (general, pediatric). The authors weighted respondents' data to account for the unequal probability of selection and nonresponse rates among regions and dentist types.	A total of 2,965 dentists responded (response rate of 37%). Four and a half percent reported offering some form of counseling services, and 51% reported they were interested in offering obesity-related counseling services. The majority reported fear of offending patients (54%) and appearing judgmental (5%) as major barriers; this was followed by lack of trained personnel and fear of patient rejection. 82% agreed that dentists would be more willing to intervene if obesity were definitively linked to oral disease.
Lee et al. (2012) (37)	The study's purpose was to explore the practices and attitudes of pediatric dentists regarding weight-and caries-related counseling.	Data were analyzed from 1,779 pediatric dentists. Data were weighted to account for unequal probability of selection and nonresponse rates among regions and dentist types.	Sixty-five percent reported increased proportion overweight or obese patients seen since they began practice, and approximately 9% offered weight-related counseling. Fifty-three percent reported an interest in offering these services. Major barriers to offering weight-related counseling included fear of offending parents/patient (54%), appearing judgmental (47%), not enough trained personnel (43%), and

Table 1. Continued

Citation	Purpose	Methods	Results
			insufficient time (28%). Multivariate analysis showed female gender, Hispanic ethnicity, nongroup practice setting, practice ownership, and dentist self-reported normal or underweight status were predictors of providing counseling.
Tavares and Chomitz (2009) (38)	The authors presented a dental-office–based healthy weight intervention (HWI) protocol designed for all children.	At each preventive/diagnostic visit, a hygienist collected information about each child's obesity risk factors with respect to food, physical activity, "screen time." and meal habits, and calculated body mass index (BMI) for age percentile. This information was used for an individualized "Health Report Card" The child selected a "healthy living" goal for the next 6 months and recorded this on the report card. The hygienist or dentist provided medical referral for children with a BMI $\geq$ 85%.	Preliminary results showed that the HWI can be feasible and well accepted in a pediatric dental setting. Hygienists could conduct the entire visit plus the HWI in less than 40 minutes. Hygienists and clinical staff felt intervention was important, and they were willing to make minor scheduling adjustments. Among the participants, 96% reported making better food choices. Only 32% felt it made the visit longer.

were used that yielded immediate results within 5-7 minutes. Methods are described in detail in the original publication (3). Hemoglobin A1c levels were used to determine the risk of developing diabetes and the Framingham Risk Score was used to determine increased risk of developing a severe heart disease event within 10 years; finger stick blood was take for the A1c testing and to determine total cholesterol and high density lipoprotein levels. Patients who screened positive were referred for medical follow-up. Seventeen percent of these adults had an increased risk of developing a severe coronary heart disease event within 10 years, 28 percent had high blood pressure, and 29 percent were overweight or obese (3). Using the current glycated hemoglobin (A1c) screen positive threshold set by the American Diabetes Association in April 2010 (>5.7 percent), 21 percent would have been at increased risk for diabetes (24). Lalla et al. (2009-2010) found the use of A1c measurements in conjunction with two dental features (at least four missing teeth and at least 26 percent of teeth with deep ($\geq$5mm) periodontal pockets) had a 92 percent sensitivity for identifying unrecognized diabetes, while either A1c alone or the two dental parameters alone had 73-75 percent (25).

A 2008 yield study by Jontell and Glick in Sweden found that OHCPs identified 6 percent of individuals at increased risk for dying from a coronary heart disease event within 10 years yet were unaware of their risk (36). These individuals were referred for follow up medical care and among those who saw a primary care provider, 50 percent were subsequently given a medical intervention (26). In 2014, Genco et al. reported results from a preliminary field trial on screening for diabetes (using A1c measurements) among patients from 11 general dental practices and one periodontal specialty practice; 41 percent of those screened had abnormal A1c values, and of those 35 percent were diagnosed with diabetes within 1 year (27). A cost-benefit study in 2013 estimated that medical screening in the dental setting for chronic disease conditions in a dental setting could result in health care cost savings between $5.1 and $65.3 million, depending on referral completion rates over a 1-year period (28).

Tobacco-cessation attitude surveys and screening programs

Attitude surveys

In 2000-2001, Albert et al. conducted a survey to assess the tobacco-cessation knowledge, attitudes, and behaviors of dentists participating in a large managed-care dental plan (29). Among the 355 dentists responding (response rate 21 percent), tobacco cessation was not a regular activity in these dental practices, and less than 10 percent of the dentists had prior training in tobacco-cessation. Those who were more confident about their tobacco-cessation knowledge advised their patients more frequently. Additionally, few of these dentists had prior training in tobacco control, few asked their

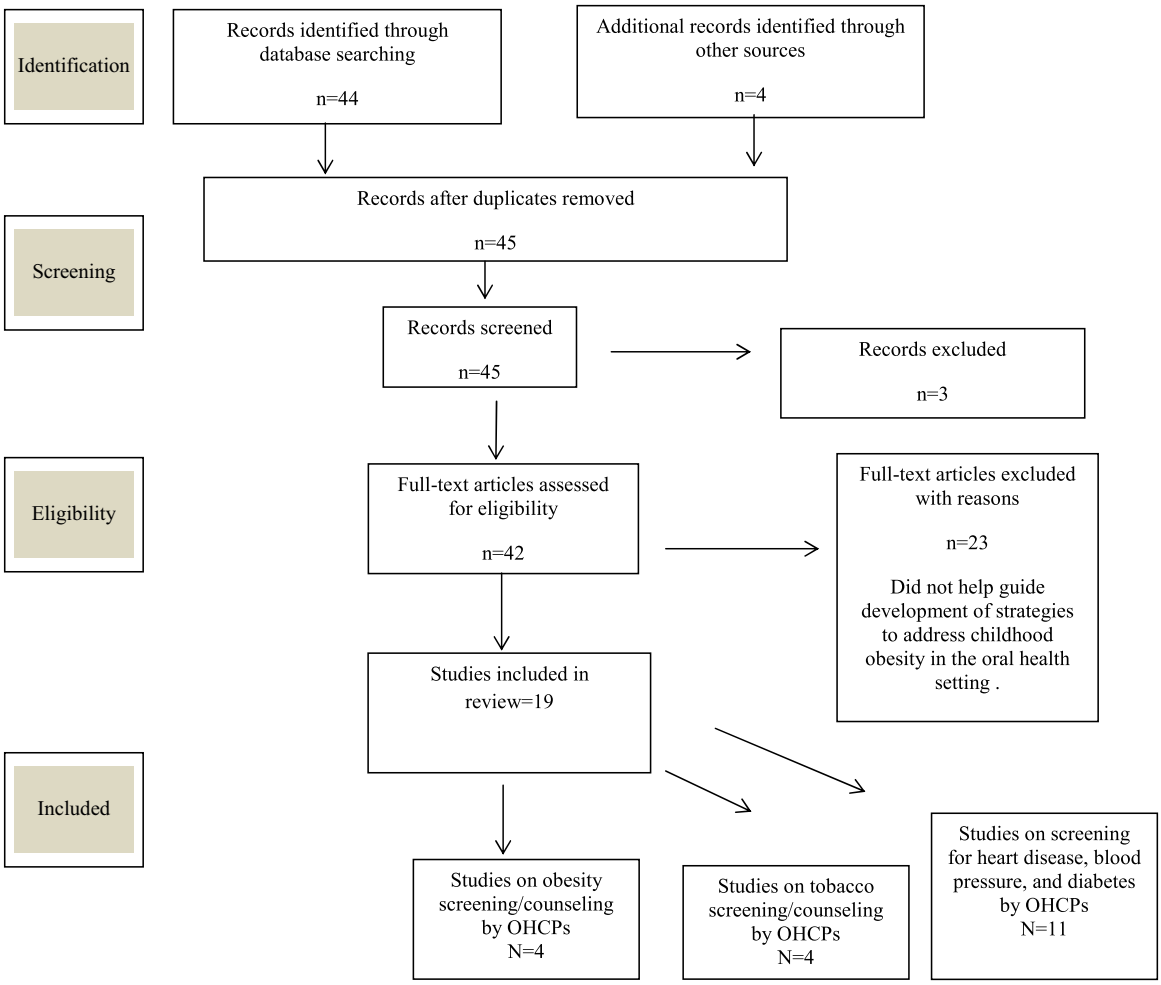

Figure 1 Search flow chart.

patients about tobacco use, and few provided advice on nicotine- replacement therapy. However, 9 percent were willing to receive training. Only 12 percent reported that time was not a barrier, and 25 percent reported that reimbursement was not a barrier.

In 2004, Hu et al. conducted a survey of 783 practicing dentists in Texas to assess familiarity and compliance with clinical practice guidelines on tobacco-cessation counseling (30). A majority of the respondents indicated that they usually or always discuss the health risks of tobacco use with their patients, but less than 20 percent indicated they spend 3 minutes or more per patient on counseling. A greater percentage of those who were familiar with the guidelines discussed the risk of smoking with their patients (76 percent among those familiar with the guidelines and 54 percent among those not familiar). Lack of training on tobacco-cessation counseling was the most-often-cited barrier to counseling, followed by their preference to focus on disease treatment rather than disease prevention.

Intervention studies

In 1999, Andrews et al. reported in 1999 results from a randomized tobacco cessation program in a dental setting and in 2005-2006 Gordon et al. conducted another randomized trial on tobacco-cessation programs in dental settings (31,32). The interventions, implemented by the dental hygienist during a routine visit, consisted of determining patients' tobacco use, assessing any oral health issues related to the patients' tobacco use, giving direct advice to quit and relating this advice to oral health, and providing a packet of written material and a kit comprising items to help the cessation process (including sugarless candy, gum, rubber bands, flavored toothpicks). Data

showed significantly greater sustained quit rates (12 months) of smokeless tobacco for the intervention group.

Obesity screening and counseling attitudes and intervention studies in the dental setting

Attitude surveys

Braithwaite et al. conducted a survey in 2006 among pediatric dentists in North Carolina to assess nutrition counseling practices. Data, although of limited generalizability, suggested that the majority of pediatric dentists do not provide nutritional counseling services (33). Although all 62 respondents believed childhood obesity was a major health concern and would be willing to participate in efforts to address this problem, only 38 percent felt qualified to provide general/non-caries-associated nutritional counseling, and only 32 percent felt comfortable providing these services. Data revealed that 67 percent and 94 percent indicated they do not regularly document weight and height, respectively; 81 percent reported they had never referred a child to another health care provider for weight counseling. The most commonly reported barriers were lack of a trained staff member, lack of time, lack of sufficient nutritional knowledge, and lack of patient interest or willingness. Results of stepwise multiple logistic regression showed that higher overall knowledge, being very confident in ability to provide counseling, those in practice for more than 10 years, and female practitioners were significantly more likely to provide nutritional counseling. As this study was conducted only in North Carolina, the generalizability of the results is limited, however, the study still provides.

Curran et al. conducted a national survey in 2007 among a random sample of 8,000 general and pediatric dentists to assess their attitudes about addressing obesity in their patients (34). The investigators used an iterative process with a variety of experts across relevant clinical disciplines to develop the contents of a self-administered questionnaire that applied social cognitive theory (35,36). Among the 2,965 respondents, only 2.6 percent (95 percent CI: 1.72-3.57) of general dentists and 6.3 percent (95 percent CI: 5.17-7.45) of pediatric dentists, respectively, offered some type of weight-related screening services. Pediatric dentists were significantly more likely to respond that dentists do have a role in helping overweight or obese patients (numbers not reported), while general dentists were significantly more likely to feel that patients' weight problems were due to their lack of willpower (numbers not reported) and to indicate that they would not to be interested in advising patients about their weight until there is sufficient evidence on the relationship of obesity and oral disease. Overall, respondents indicated a greater willingness to offer these services if a definitive link was demonstrated to exist between obesity and oral health. Pediatric dentists were more confident in their abilities to calculate and interpret BMI (45 versus 32.4, $P < 0.001$) and in providing nutritional counseling skills (45.9 versus 35.4, $P < 0.001$) (data provided in figures, but exact numbers are not provided in the manuscript). Consistent with these results, a significantly greater proportion of pediatric dentists reported having received education in nutritional counseling and behavior modification activities during their professional training. The barriers most frequently cited (results presented in a figure without displaying exact numbers or percentages) were "fear of offending the patient or parent" and fear of "appearing judgmental of the patient or parent." Additional barriers included lack of trained personnel, lack of patient acceptance, and lack of training in weight-loss counseling.

In 2008-2009, Lee et al. surveyed a random sample of 4,154 practicing pediatric dentists, stratified by region, with results weighted to account for unequal distribution by region and for nonresponse (37). Of the 1,779 respondents, 65 percent reported an increased proportion of overweight or obese patients presenting to their practice since they began practice. While 53 percent reported an interest in offering weight-related counseling to their patients, only 9 percent indicated they offered these services. Major barriers to offering weight counseling included: fear of offending parents/patient (54 percent), appearing judgmental (47 percent), not enough trained personnel (43 percent), and, insufficient time (28 percent). This survey also asked about provision of caries-related counseling; interestingly the authors found that 32 percent of pediatric dentists providing caries-related counseling reported that they would not provide weight-related counseling until there is an established link between obesity and oral health. Approximately, 36 percent felt overweight people lack willpower. There was no difference in the percentage reporting they received weight-related nutritional training in dental school among those who did and did not offer weight-related services. Multivariate analysis showed female gender (adj. OR: 1.62, 95 percent CI:1.07-2.43), Hispanic ethnicity (adj. OR: 2.49, 95 percent CI: 1.40-4.44), nongroup practice setting (adj. OR: 0.40, 95 percent CI: 0.26-0.62), practice ownership (adj. OR: 0.60, 95 percent CI: 0.40-0.91) and dentist self-reported normal or underweight status (adj. OR: 0.60, 95 percent CI: 0.35-0.90) were significant predictors of providing counseling. However, the methods and presentation of the results were not sufficiently detailed to determine how the final model was built and what variables were considered for entry into the model.

Intervention studies

Tavares and Chomitz adapted and pilot tested a preventive "healthy weight intervention" (HWI) from 2006 to 2009 for pediatric dental patients based on the concepts of

motivational interviewing (38). The foundation lies in the fact that the child patient sets a target and behavioral goals to be reached within a set period of time (39,40). This pilot study tested the intervention on 139 children ages 6-13, of any weight, who returned for at least two or three visits over 18 months. At each preventive/diagnostic dental visit, the dental hygienist collected information on physical activity, "screen time," and eating habits, measured height and weight, and calculated BMI for age percentile. This information was then used to complete a "Healthy Kids Report" for each child that included recommendations for health behavior modifications. Each child then selected a goal for the next 6 months. Children with a BMI greater than 85 percent were given a medical referral by the hygienist or dentist. Preliminary results showed that the HWI can be feasible and well-accepted in a pediatric dental setting. Hygienists conducted the HWI with visit in an average of less than 40 minutes. Hygienists and clinical staff felt the intervention was important, and they were willing to make minor scheduling adjustments to accommodate it. Among the caregivers of children who received the intervention, 96 percent reported making better food choices to meet their goals. The results did not show consistent weight change but did show the HWI was associated with reported change in eating behaviors including, more frequent eating dinner at the table, more frequent consumption of vegetables and of breakfast.

Discussion

This scoping review successfully assessed efforts by OHCPs on screening for medical conditions in the dental setting and what can be learned from these efforts to address childhood obesity in the dental setting. The review was limited to English language studies to allow for complete review of the studies included. This scoping review suggests that screening for medical conditions in the dental setting is feasible and can be an effective strategy to identify patients who could benefit from efforts to prevent disease onset or control disease severity (3,24-27). While limited in number, studies have also shown that screening in the dental setting for risk factors such as obesity and tobacco use can be effective as well (29,38). To date, there is only one pilot intervention study addressing childhood obesity in the dental setting (38). The results suggest that such a program implemented by dental hygienists is feasible, effective at engaging parents/guardians in their child's weight issues, and acceptable to patients/guardians. These results are quite encouraging and suggest a larger systematic intervention study should be conducted to corroborate these results, assess more long-term impact, and identify best implementation practices.

There also is a body of literature consistently showing that OHCPs and dental patients have a favorable attitude toward and are willing to participate in medical screenings in the dental setting (20,21,23). Common barriers expressed were patient willingness, additional time needed, and the need for additional training. Additional barriers noted specifically for obesity screening were fear of seeming judgmental and not wanting to offend patients (34,37). Patient attitudes data also show a favorable attitude toward screening for medical conditions in the dental setting, with the most often-cited barriers being confidentiality and training of the clinician, suggesting patient willingness would not be an obstacle (23). Primary care physicians also have a favorable attitude toward screening for medical conditions in the dental setting and are willing to discuss results with the dentist and accept patient referrals from the dentist (22). Less-experienced primary care physicians (practicing less than 10 years) were more willing to accept a referral from a dentist, suggesting that there may be a trend toward greater acceptance of an integrated and interdisciplinary approach to health care delivery among younger practitioners (22).

One disturbing element that emerged among the dentists was the lack of appreciation and understanding of the evidence base for the relationship between obesity and oral health, suggesting the educational model would need to be reconfigured to more adequately address this, as well as the need to provide more interprofessional educational opportunities across dentistry and medicine (34). Given that few dentists actively address tobacco use with their patients (29) a condition with a well-documented association to oral health (41), this underscores the need for expanded educational efforts that address the role of the OHCP in conducting prevention activities with their patients. As with the physicians, in some instances there were differences in attitudes about obesity screening by number of years in practice among OHCPs, which could be a function of education and the evolving nature of optimal health-care-delivery models (33). These results suggest that additional studies should be designed specifically to look at differences by educational experience and years of practice on practice behavior. Data from tobacco-cessations studies, although limited in generalizability, do provide further evidence in support of the need for more adequate education on conducting prevention activities with patients (30-32).

Conclusion

While studies have shown the efficacy and acceptance of screening for medical conditions in the dental setting, research is still needed to identify best practices for integrating medical screening into the day-to-day operations of the dental practice and effective mechanisms for communication and patient referral among health care providers. Increased training efforts are needed on the relationship of oral health and patient well-being, including the relationship between obesity and oral health. Successful implementation and

outcomes of screening for medical conditions in the dental setting will necessitate an interprofessional approach. In order to do this, effective communication with patients and across disciplines is needed, as well as the need to establish effective patient referral mechanisms. Widespread implementation will also require viable reimbursement models. Additional studies are need that build on evidence from the existing literature and that explore best implementation practices and factors that could motivate OHCPs to provide screening for medical conditions.

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