

Education Research

Maryland dental hygienists' knowledge and opinions of oral cancer risk factors and diagnostic procedures

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OBJECTIVES: To examine Maryland dental hygienists' (DHs) knowledge of oral cancer risk factors and diagnostic procedures, as well as opinions about the currency and adequacy of their oral cancer knowledge, educational preparation, interest in, and preferred types of, continuing education courses.

METHODS: Seven hundred DHs were randomly selected from a registry of 2677 Maryland licensed dental hygienists. A mailed survey instrument provided baseline data on 331 (RR = 60%) DHs. Stratified tabular and logistic analytical techniques were employed (alpha level ≤ 0.05). **RESULTS:** Most correctly identified tobacco use (99.7%) and alcohol use (89%) as risk factors; however, 31% incorrectly identified poor oral hygiene as a risk factor. 64% of DHs correctly identified older age as a risk factor, yet only 16% identified that the majority of oral cancers are diagnosed in the 60+ year old age group. Nearly 91% correctly identified the examination procedures of the tongue for oral cancer detection; while only 16% of DHs correctly identified erythroplakia and leukoplakia as the conditions most likely associated with oral cancer.

CONCLUSIONS: Gaps in knowledge exist and strongly suggest the need for continuing education courses to clarify risk factors and diagnostic procedures associated with earlier oral cancer detection and prevention.

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Introduction

Cancers of the mouth and pharynx (hereafter called oral cancer) involve carcinomas of the oral cavity and pharynx.

Of these sites, the tongue and floor of the mouth account for the majority of oral cancers. In the US, alcohol and tobacco use are the two most important risk factors for oral cancer (Mashberg *et al*, 1981, 1993; Blot *et al*, 1988; Bofetta *et al*, 1992; Rubright *et al*, 1996; ADA, 1997; Sanderson *et al*, 1997; Lazarus *et al*, 1998). These risk factors act individually as significant independent risk factors; together they exponentially increase the chance of developing oral cancer. Survival from oral cancer also is strongly linked to patients' alcohol and tobacco use history (Yu *et al*, 1997). Approximately 30 000 new cases of oral cancers will be diagnosed in the US in 2000 and nearly 8000 deaths will be attributed to oral cancer (Greenlee, 2000). In the scheme of all cancer types diagnosed, oral malignancies comprise 2–3%.

Maryland ranks 27th among all states in the incidence of oral cancer but the mortality rate is the 7th highest overall and 6th highest for males (Landis, 1999). Compared to whites, the 5-year survival rate in Maryland for black males has actually decreased over the last 20 years. This is consistent with downward survival trends for black men across the US (Shiboski *et al*, 2000). Public health strategic interventions aim to address the alarmingly high oral cancer incidence and mortality rates in Maryland (Carpenter *et al*, 1993). Factors that may contribute to the lack of early detection of lesions and their subsequent advanced-stage diagnosis include: (1) patients' lack of symptoms; (2) obscured location of lesions; (3) low number of diagnostic exams performed; (4) low knowledge levels both of the public and of health care providers regarding signs, symptoms, and risk factors; and (5) inadequate early identification of patients' risk behaviors for oral cancer and subsequent lack of educational activities targeting reduction of risk factors (Horowitz *et al*, 1995; Winn *et al*, 1998).

In the US, Maryland serves as one of the state models for the prevention and early detection of oral cancer by having had its public and health care providers surveyed about their knowledge, opinions and preventive practices regarding oral cancer. The frequency of patient contact, and keen assessment and educational skills of dental hygienists, make them a primary health care provider target of this

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state-wide assessment. Dental hygienists' knowledge of oral cancer's signs, symptoms, risk factors and diagnostic procedures is important in early detection and prevention.

This specific study was one of a series of studies conducted as part of a state-wide needs assessment of health practitioners and the public. Maryland dental hygienists were surveyed in this study to determine their knowledge of oral cancer risks and diagnostic practices. Relationships also were explored between: (1) Maryland dental hygienists' background characteristics and knowledge of oral cancer; (2) knowledge and opinions about the currency of oral cancer knowledge; (3) knowledge and opinions about adequacy of oral cancer education; (4) knowledge and opinions about interest in future oral cancer continuing education; and (5) preferred approaches to continuing education courses.

Materials and methods

To address the objectives of this study, information obtained through the Maryland Oral Cancer Survey of Dental Hygienists (MDOCSDH, 1997) was analyzed. The sampling frame for this survey consisted of a mailing list of all member and non-member Maryland licensed dental hygienists ($n = 2677$) maintained by, and purchased from, the Maryland Dental Hygienists' Association. Beginning in November 1997, a piloted 40-item survey instrument, cover letter and stamped, addressed envelope were mailed to a simple random sample of 700 Maryland registered dental hygienists. The survey questionnaire included items dealing with various aspects of Maryland dental hygienists' knowledge, opinions and practices regarding oral cancer. Surveys were coded only to serve as the basis for follow-up with additional mailings to non-respondents. An initial, follow-up postal card was mailed 1 week later and two additional complete mailings were sent to all non-respondents at 3 and 7 weeks, respectively, after the initial mailing. Individuals no longer active in the dental hygiene profession and practitioners who had moved out of state were asked to return blank surveys since they were not eligible to participate in the study. Based on these field procedures, 331 usable questionnaires were received, yielding a response rate of 60% from the 556 eligible respondents. The background characteristics of the 331 Maryland dental hygienists studied mirrored the characteristics of dental hygienists nationwide (ADHA, 1992) and are shown in Table 1.

From a content perspective, the analyses focused on responses to 14 questions regarding knowledge of oral cancer risk factors: seven of these questions addressed real risk factors—those substantiated through research—and seven questions addressed non-real risk factors—those unsubstantiated through research. Responses to nine other questions also were analyzed to determine dental hygienists' knowledge of oral cancer diagnostic procedures.

To assess opinions regarding the currency of their oral cancer knowledge and four aspects of the adequacy of their educational training, five items were asked with the following precoded response categories: 'strongly agree', 'agree', 'disagree', 'strongly disagree', and 'don't know'. Respondents were asked to rate the quality of their entry-level dental hygiene educational program in terms of the

emphasis given to oral cancer examinations. They also were queried about their interest in participation in continuing education courses, and if so, what were their first and second preferred approaches. They also were asked to rate their oral cancer educational preparation from 'very good' to 'very poor'.

Two indices—one for overall knowledge of oral cancer risks and one for overall knowledge of oral cancer diagnostic procedures—were established by counting the number of correct items in each of these domains. In developing these two indices, a correct response was assigned a score of '1'. Respondents were then classified into three groups relative to one another depending on the number of correct responses to each group of pertinent items. Each of the index scores was then grouped into three approximately equal categories.

On the index for knowledge of oral cancer risks, respondents identifying 0–6 risk factor items correctly were assigned a low score; those getting 7–8 items correct, a medium score; and DHs correctly identifying 9–14 items, a high score. Similarly, on the index for knowledge of oral cancer diagnostic procedures, a low score was assigned for respondents identifying 0–4 diagnostic procedures correctly; a medium score, for those getting 5 correct items; and a high score, for 6–9 correctly identified items. An overall summary index based on the 14 knowledge items and nine diagnostic procedures items also was constructed in the same way. Correct responses on these 23 items also were used to classify respondents more generally as having a low (0–11 correct items), medium (12–14 correct) or high (15–22 correct) level of knowledge of oral cancer risks and diagnostic procedures combined. The low, medium and high score categories for the first two indexes then were used to develop a typology of Maryland dental hygienists' patterns of knowledge of oral cancer.

Since the response rate was low, data analyses were carried out using unweighted data. In the analyses, the extent to which Maryland dental hygienists responded correctly to the individual items on oral cancer risk factors and diagnostic procedures first was determined. The overall effect of selected background characteristics on the likelihood of achieving a high score on the three indexes—oral cancer risks, diagnostic procedures, and risks and diagnostic procedures combined—then were analyzed.

Assessed next was the relationship between Maryland dental hygienists' general levels of oral cancer knowledge and their opinions about how current their oral cancer knowledge was, the adequacy of their oral cancer training, the quality of their dental hygiene educational program and interest in future participation in oral cancer continuing education courses.

Both stratified and logistic data analysis techniques were employed using the statistical software packages Statistical Analysis System (Version 6, SAS Institute) and SUDAAN (Release 7.0, Research Triangle Institute). All statistical results were evaluated at an alpha level ≤ 0.05 . Respondent confidentiality was maintained throughout data analyses. Data were reported in group format and no individual respondent was identified in the analyses.

Table 1 Dental hygienists' background characteristics

Characteristic	Respondents	
	No.	Percentage ^a distribution
All respondents	331	100.0
Gender		
Female	323	99.4
Male	2	0.6
Age		
<24-30	55	16.7
31-40	131	39.8
41-50	110	33.4
51-65+	33	10.0
Graduation year from entry level dental hygiene program		
1990-1997	89	27.2
1980-1989	101	30.8
1970-1979	103	31.4
pre-1970	35	10.5
Degree awarded upon graduation from entry level program		
Certificate in Dental Hygiene	37	11.4
Associate Degree in Dental Hygiene	187	57.7
Baccalaureate Degree in Dental Hygiene	100	30.9
Highest degree earned		
AA/AAS	160	50.3
BS/BA	133	41.8
Masters	14	4.4
Doctorate	3	0.9
Other	8	2.5
Membership in professional organizations		
American Dental Hygienists' Association	177	53.5
National Dental Hygienists' Association	15	4.5
American Public Health Association	-	-
American Association of Public Health Dentistry	2	.6
American Association of Dental Schools	3	.9
International Association for Dental Research	4	1.2
Other	20	6.0
No membership in any professional organization	110	33.2
Practice Setting		
General Practice	292	88.8
Specialty Practice	24	7.3
Public Health/Government	6	1.8
Hospital Practice	-	-
Other	7	2.1

Source: MDOCSDH, 1997.

^aPercentages may not add to 100 due to rounding

Results

Knowledge of risk factors

Figure 1 shows the percentage of dental hygienists providing correct responses to questions about real risks and non-real risks of oral cancer. Regarding real risk factors, nearly all dental hygienists correctly identified patients' use of tobacco (99.7%) and having a prior oral cancer lesion (97.8%) as risk factors for oral cancer. The majority of Maryland dental hygienists correctly identified another real-risk factor, patients' use of alcohol (74.3%). Regarding other real risk factors, only 64% correctly identified older age as a risk factor, 56% recognized that lip cancer is related to sun exposure, but less than one-third (31.4%) knew that low consumption of fruits and vegetables is a risk factor. In

sharp contrast, a mere 6% of the dental hygienists recognized that the majority of oral cancers are diagnosed in patients aged 60 years or older.

With regard to non-real risk factors, the majority of dental hygienists (89.3%) knew that consumption of hot foods and beverages is not a risk factor for oral cancer. About 71% knew that consumption of spicy foods and obesity are not oral cancer risk factors. About 56% knew that poor oral hygiene is not a risk factor for oral cancer. Less than half knew that familial clustering of cancer *per se* is not an oral cancer risk factor. Less than 18% knew that poor-fitting dentures are not a risk factor for oral cancer, and a family history of cancer (16.4%) in itself does not constitute a risk factor for oral cancer.

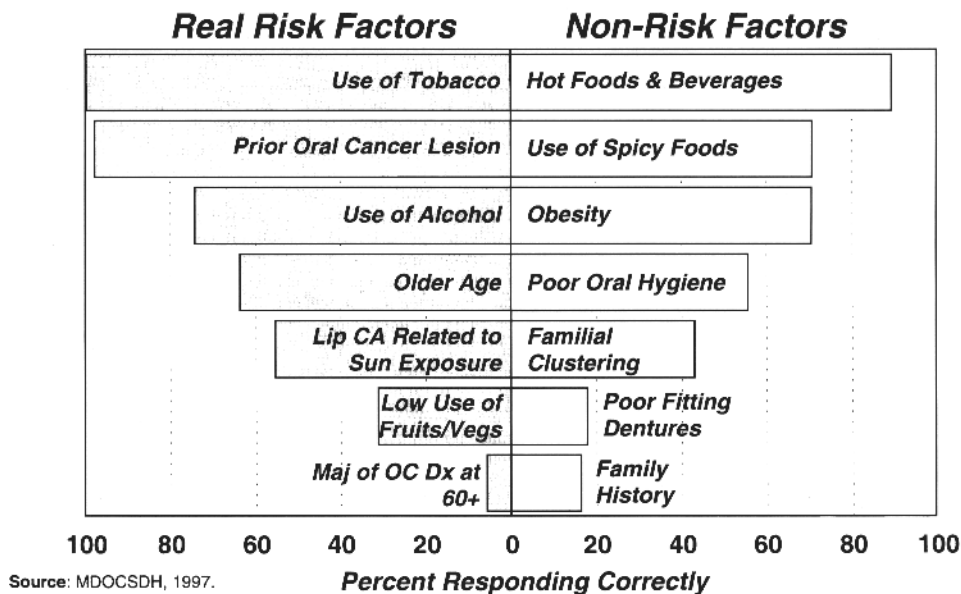


Figure 1 Percentage of dental hygienists providing correct responses to questions about real risks and non-risks of oral cancer: Maryland, 1997

Knowledge of diagnostic procedures

Figure 2 shows the percentage of dental hygienists providing correct responses to selected items on knowledge of oral cancer diagnostic procedures. Nearly 91% correctly identified the examination procedures of the tongue for oral cancer detection. Seventy-six percent correctly identified that early oral cancers are asymptomatic and 74% correctly identified early oral cancer lesions usually appearing as small, painless, red areas. Less than 68% correctly identified that when a lymph node most characteristic of oral cancer metastasis is palpated, it is hard, painless, and mobile or fixed. Sixty-two percent correctly identified the ventral lateral border of the tongue as the likeliest site for oral cancer. Nearly 56% correctly identified squamous cell

carcinoma as the most common form of oral cancer, while 53% correctly identified both the tongue and floor of the mouth as the most common sites of oral cancer. Half of the respondents correctly identified that oral cancer lesions are most often diagnosed in advanced stages, but only 16% correctly identified erythroplakia and leukoplakia as the conditions most likely to be associated with oral cancer.

Patterns of levels of knowledge of oral cancer risks and diagnostic procedures

Figure 3 shows the percentage distribution of dental hygienists by pattern of levels of knowledge of oral cancer risks and diagnostic procedures. Nearly 41% of the respondents scored high on knowledge of oral cancer risks and

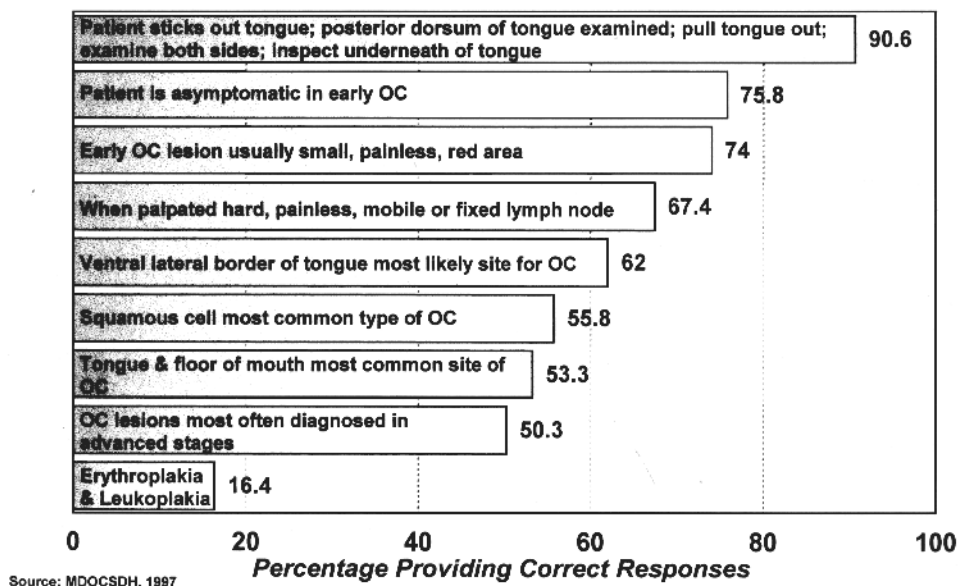


Figure 2 Percentage of dental hygienists providing correct responses to selected items on knowledge of oral cancer diagnostic procedures: Maryland, 1997

Knowledge of Oral Cancer Diagnostic Procedures	Knowledge of Oral Cancer Risks			All Dental Hygienists
	Low Score (0-6 Items)	Medium Score (7-8 Items)	High Score (9-14 Items)	
Low (0-4 Items)	13.9	10.9	10.9	35.7
Medium (5 Items)	6.3	6.3	9.1	21.7
High (6-9 Items)	8.5	13.3	20.9	42.7
All Dental Hygienists	28.7	30.5	40.9	100.0

Source: MDOCSDH, 1997

Figure 3 Percentage distribution of dental hygienists by pattern of levels of knowledge of oral cancer risks and diagnostic procedures: Maryland, 1997

43% scored high on knowledge of oral cancer diagnostic procedures, while nearly 21% achieved high scores on both of the oral cancer knowledge domains.

Background characteristics and knowledge of oral cancer
Relationships were explored between seven background characteristics of the dental hygienists and selected aspects of their oral cancer knowledge. The seven background characteristics explored were type of practice, typical ages of patients seen, interval since last oral cancer continuing education course, period of graduation, entry-level certificate or degree, number of professional association memberships, and membership in the American Dental Hygienists' Association (ADHA). The three aspects of oral cancer knowledge explored were possession of an above average (high level of) knowledge of oral cancer risks, an above average (high level of) knowledge of diagnostic procedures, as well as an overall above average (high level of) knowledge of both risks and diagnostic procedures in combination. Only one out of seven background characteristics was positively associated with even one of the three selected aspects of above average knowledge of oral cancer. Dental hygienists who were members of the ADHA (46%) were relatively more likely to have above average knowledge of oral cancer risks than dental hygienists who were not ADHA members (34%). Practice setting, typical ages of patients seen, interval since last oral cancer CE course, period of graduation, entry-level degree and number of professional association memberships held were not associated with an above average knowledge of oral cancer risks and diagnostic procedures, nor an above average knowledge of risks and diagnostic procedures in combination.

Opinions regarding currency of oral cancer knowledge and adequacy of training

Figure 4 depicts selected opinions of Maryland dental hygienists regarding the currency of their oral cancer knowledge and the adequacy of their oral cancer training. Forty-seven percent of dental hygienists reported that their

oral cancer knowledge was current, but only 1% strongly agreed with that statement. A larger percentage of dental hygienists reported that they felt their oral cancer training was adequate (77%) for examining patients for oral cancer. However, when examining dental hygienists' opinions on specific aspects regarding the adequacy of their oral cancer training only 41% felt that their training was adequate for palpating lymph nodes; even less (32%) felt that their training was adequate for providing tobacco cessation services and 13% for providing alcohol cessation services. With regard to dental hygienists' opinions about the quality of their dental hygiene oral cancer educational preparation, nearly half (49%) of the respondents reported that their undergraduate programs gave comparable emphasis to the oral cancer examination compared to other clinical procedures in terms of numerical requirements and the receipt of credit. Additionally, 34% rated their dental hygiene programs as 'very good' regarding training in providing oral cancer examinations.

Levels of oral cancer knowledge and opinions about currency of oral cancer knowledge and adequacy of oral cancer educational preparation

Additional analyses were conducted assessing potential associations among dental hygienists' level of knowledge of oral cancer risk factors, diagnostic procedures and general oral cancer knowledge (risks and diagnostic procedures) and their opinions about the currency of their oral cancer knowledge. Results indicate that dental hygienists with low levels of each type of oral cancer knowledge were, respectively, 3.2, 3.0 and 3.6 times less likely than were their counterparts with high levels of each type of knowledge, to agree that their oral cancer knowledge was current.

Potential associations among dental hygienists' level of knowledge of oral cancer risk factors, diagnostic procedures and overall oral cancer knowledge and their opinions about being adequately trained to examine patients for oral cancer were explored through additional analyses.

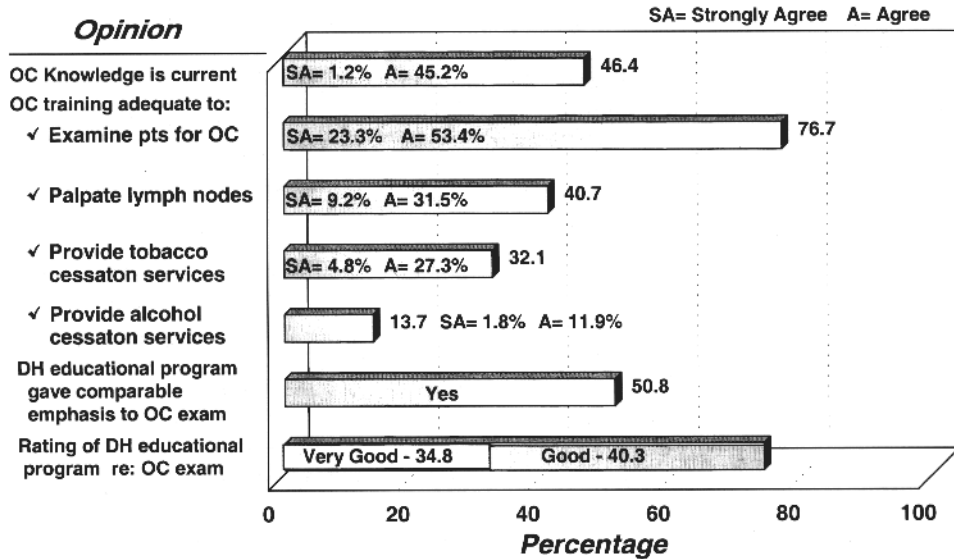


Figure 4 Selected opinions of dental hygienists regarding the currency of their oral cancer knowledge and the adequacy of their oral cancer training: Maryland, 1997

Results of these analyses show that dental hygienists with low levels of each type of oral cancer knowledge also were respectively, 2.6, 2.4, and 2.3 times less likely than their counterparts with high levels of each type of knowledge, to agree that they were adequately trained to examine patients for oral cancer.

Interest in and preferred educational approaches for oral cancer continuing education

The majority of respondents (96%) indicated an interest in attending continuing education courses on oral cancer in the future. When given the opportunity to rank their first and second choices for preferred instructional approaches for oral cancer continuing education, respondents identified lectures (53%) and clinical demonstration (nearly 53%) formats almost equally in importance. Thirty-seven, 22 and 13 percent of the respondents, respectively, preferred audio-visual slides or videotapes, and a handout/booklet with self-test as either their first or second preferred approaches. Together, study clubs, satellite communication programs, conference calls with experts in the field and other educational approaches comprised less than 16% of the first and second ranked educational approaches.

Discussion

Several issues regarding the generalization of the results beyond the actual study's group must be discussed. The present study's response rate (60%) is consistent with, if not slightly better than, response rates of other recent mail surveys of health practitioners (Asch *et al*, 1997). Regardless, given that the response rate for this study was low, it is technically impossible to generalize these results to the target population. Although the results reported are based on a low number of survey respondents from one northeastern state in the US, still this study's findings provide valuable baseline insight into the knowledge and opinions of

dental hygienists practicing in a state noted for its poor early oral cancer detection and subsequent survival rates.

Additionally, developing weighted measures for data analyses was not indicated since the low response rate rendered it technically impossible to generalize these results beyond the study population. Thus, the results are based on the unweighted data obtained from 331 Maryland dental hygienists who participated in the survey. There is also the potential for non-response bias to impact on the generalizability of the study findings since the survey respondents more likely represent those individuals having a greater knowledge of, and interest in, the subject matter. This may lead to results reflecting more positive knowledge levels and acceptable behaviors than what may be the case in the target population. Thus, if there is potential bias due to non-response, it may be in the direction that knowledge gaps are underestimated and that interest in future oral cancer continuing education is overestimated.

Small sample size limits the extent to which background characteristics can be taken into account in various analyses. The fact that only one out of seven background characteristics—current membership in ADHA—was found to be positively associated with only one of three indicators of oral cancer knowledge, that is, above average or a high level of knowledge of oral cancer risks, appears idiosyncratic and may represent a chance finding. One plausible explanation for this finding, however, could be that information on oral cancer risks may have appeared in journals or other publications received by ADHA members but not by non-members.

Overall Maryland dental hygienists' knowledge of risk factors for oral cancer was slightly lower than that of Maryland dentists (Canto *et al*, 2000). Compared to dental hygienists, dentists were more likely to know that use of alcohol is a real oral cancer risk factor and that most oral cancer diagnoses are made among persons 60 years and over. Dentists and dental hygienists were equally likely to

know that smokeless tobacco users are not at greater risk for oral cancer than cigarette smokers (Canto *et al*, 2000).

While it is heartening that the large majority of Maryland dental hygienists identified most real risk factors for oral cancer (Figure 1), it is less encouraging that many dental hygienists could not distinguish the non-real risk factors for oral cancer. Dental hygienists tended to incorrectly identify family history, poor fitting dentures, familial clustering of cancer and poor oral hygiene as risk factors, and over 25% reported incorrectly that use of spicy foods and obesity are oral cancer risk factors. Thus, there is a relatively high level of misinformation among this group. Since many indicated not taking a continuing education (CE) course on oral cancer within the last 5 years, this misinformation can reasonably be attributed to gaps in educational curricula (Tomar *et al*, 1998; Rankin *et al*, 1999) and the use of partially inaccurate resources during the course of respondents' entry-level dental hygiene programs.

Some misinformation concerning real vs non-real oral cancer risk factors exists in textbooks frequently used during the educational preparation of dental and dental hygiene students, particularly regarding the non-real oral cancer risk factors of poor oral hygiene and the wearing of ill-fitting removable prostheses (Little *et al*, 1997; DeBiase, 1999). No scientific evidence supports that these compromising oral health factors are real risk factors for oral cancer (Mashberg and Samit, 1995). Misinformation about oral cancer also exists in the literature available to the general public (Canto *et al*, 1998; Chung *et al*, 2000).

Since practices of health care professionals are influenced by their knowledge and opinions (Yellowitz and Goodman, 1995; Horowitz *et al*, 1996; Dolan *et al*, 1997; Horowitz *et al*, 2000; Yellowitz *et al*, 2000) and the clinical behaviors attained while undergoing academic and professional education (Ahluwalia *et al*, 1995; Goodman *et al*, 1995; Yellowitz *et al*, 1995; Tomar *et al*, 1998; Rankin *et al*, 1999), gaps in curricula and lack of CE courses on oral cancer may explain the infrequent delivery of oral cancer examination services as reported by adults in Maryland (Canto *et al*, 1998a; Horowitz *et al*, 1998) and nationwide (Horowitz and Nourjah, 1996; Martin *et al*, 1996) and their inadequate knowledge of risk factors and diagnostic procedures regarding oral cancer.

Respondents were less inclined to indicate a preference for oral cancer CE course formats that require self-paced/self-instruction such as audiovisual slides or videotapes, handouts/booklets with self-test, CE journals, study clubs, satellite communication programs, and conference calls with experts in the field. Respondents favored lectures and clinical demonstration styles as their preferred format for oral cancer CE. These preferred CE formats may be more familiar and consistent with the educational formats presented via their entry-level dental hygiene curricula.

The survey findings provide an important profile of oral cancer knowledge and information gaps that should prove useful in planning and implementing entry-level dental hygiene educational curricula and CE courses for dental hygienists in Maryland.

Conclusions

Singling out individual states and locales noted for consistently high oral cancer mortality rates and assessing health care professionals who have potentially key roles in early detection of oral cancer lesions is a logical first step in addressing high oral cancer mortality and morbidity rates in the US and perhaps other countries. Opportunities to deliver screening and preventive oral cancer services during routine dental visits may be missed by oral health care professionals. Dental hygienists have been identified as vital to strategic interventions aimed at reducing missed opportunities for oral cancer risk factor identification as well as for their role in early detection of oral cancer and the delivery of health educational messages regarding risks for disease. This target group of oral health care professionals are in need of accurate oral cancer information on risk factors and comprehensive examination procedures in order to facilitate the prevention and early detection of oral cancer. Maryland dental hygienists appear to accurately assess the currency of their own level of oral cancer knowledge and adequacy of oral cancer examination training. They were not as knowledgeable about real risk factors and diagnostic procedures for oral cancer as they could be and appropriately recognize their knowledge deficits. Additionally, interest in attending future continuing education courses on oral cancer is high among Maryland dental hygienists. The two most preferred methods of continuing education are lectures and clinical demonstration formats. Educational curricula need to focus on risk factors for oral cancer, as well as what to look for, and where to look, when conducting oral cancer examinations.

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References

- Ahluwalia KP, Yellowitz JA, Goodman HS *et al* (1998). An assessment of oral cancer prevention curricula in U.S. medical schools. *J Cancer Educ* **13**: 90-95.
- American Dental Association, Centers for Disease Control and Prevention, National Institute of Dental Research, National Institutes of Health (1997). Proceedings: National Strategic Planning Conference for the Prevention and Control of Oral and Pharyngeal Cancer, August 7-9, 1996. Centers for Disease Control and Prevention: Atlanta.
- American Dental Hygienists' Association (1992). Extension Study: Retention of Dental Hygienists in the Workforce. Final Report, April 1992.
- Asch DA, Jedrzewski, MK, Christakis NA (1997). Response rates in mail surveys published in medical journals. *J Clin Epidemiol* **52**: 1129-1136.
- Blot WJ, McLaughlin JK, Winn DM *et al* (1988). Smoking and drinking in relation to oral and pharyngeal cancer. *Cancer Res* **48**: 3282-3287.

- Boffetta P, Mashberg A, Winkelmann R *et al* (1992). Carcinogenic effect of tobacco smoking and alcohol drinking on anatomic sites of the oral cavity and oropharynx. *In J Cancer* **52**: 530–533.
- Canto MT, Drury TF, Horowitz AM. A survey of Maryland dentists' knowledge of oral cancer. Health Promotion Practice 2001 (in press).
- Canto MT, Horowitz AM, Goodman HS *et al* (1998a). Maryland veterans' knowledge of risk factors and signs of oral cancers and their use of dental services. *Gerodontology* **15**: 79–86.
- Canto MT, Kawaguchi Y, Horowitz AM (1998b). Coverage and quality of oral cancer information in the popular press: 1987–98. *J Public Health Dent* **58**: 241–247.
- Carpenter RD, Yellowitz JA, Goodman HS (1993). Oral cancer mortality in Maryland. *Maryland Med J* **42**: 1105–1109.
- Chung V, Horowitz AM, Canto MT *et al* (2000). Oral cancer educational materials for the general public: 1998. *J Public Health Dent* **60**: 49–52.
- DeBiase CB (1999). The patient with cancer. In: Wilkins EM, ed. *Clinical practice of the Dental Hygienist*. Lippincott Williams & Wilkins: Philadelphia, pp 721–735.
- Dolan Ta, McGorray SP, Grinstead-Skigen CL *et al* (1997). Tobacco control activities in U.S. dental practices. *J Am Dent Assoc* **128**: 1669–1679.
- Goodman HS, Yellowitz JA, Horowitz AM (1995). Oral cancer prevention: the role of the family practitioners. *Arch Fam Med* **4**: 628–636.
- Greenlee RT, Murray T, Bolden S *et al* (2000). Cancer statistics, 2000. *Cancer J Clin* **50**: 7–33.
- Horowitz AM, Drury TF, Goodman HS *et al* (2000). Oral pharyngeal cancer prevention and early detection: dentists' opinions and practices. *J Am Dent Assoc* **131**: 453–462.
- Horowitz AM, Goodman HS, Yellowitz JA *et al* (1996). The need for health promotion in oral cancer prevention and early detection. *J Public Health Dent* **56**: 319–330.
- Horowitz AM, Moon H-S, Goodman HS *et al* (1998). Maryland adults' knowledge of oral cancer and having oral cancer examinations. *J Public Health Dent* **58**: 281–287.
- Horowitz AM, Nourjah PA (1996). Factors associated with having oral cancer examinations among US adults 40 years of age or older. *J Public Health Dent* **56**: 331–335.
- Horowitz AM, Nourjah P, Gift HG (1995). U.S. adult knowledge of risk factors and signs of oral cancers: 1990. *J Am Dent Assoc* **126**: 39–45.
- Landis SH, Murray T, Bolden S *et al* (1999). Cancer Statistics, 1999. *CA—A Cancer J Clin* **49**: 8–13.
- Lazarus P, Sheikh SN, Ren Q *et al* (1998). p53, but not p16 mutations in oral squamous cell carcinomas are associated with specific CYP1A1 and GSTM polymorphic genotypes and patient tobacco use. *Carcinogenesis* **19**: 509–514.
- Little JW, Falace DA, Miller CS *et al* (1997). Oral cancer. In: *Dental Management of the Medically Compromised Patient*. Mosby: St. Louis, pp 516–545.
- Martin LM, Bouquot JE, Wingo PA *et al* (1996). Cancer prevention in the dental practice: Oral cancer screening and tobacco cessation advice. *J Public Health Dent* **56**: 336–340.
- Mashberg A, Samit A (1995). Early diagnosis of asymptomatic oral and oropharyngeal squamous cancers. *CA Cancer J Clin* **45**: 328–351.
- Mashberg A, Boffetta P, Winkelman R *et al* (1993). Tobacco smoking, alcohol drinking, and cancer of the oral cavity and oropharynx among U.S. veterans. *Cancer* **72**: 1369–1375.
- Mashberg A, Samit A, Harris S (1981). Alcohol as a primary risk factor in oral squamous carcinoma. *CA Cancer J Clin* **31**: 146–156.
- Rankin KV, Burzynski NJ, Silverman S *et al* (1999). Cancer curricula in U.S. dental schools. *J Cancer Educ* **14**: 8–12.
- Rubright WC, Hoffman HT, Lynch CF *et al* (1996). Risk factors for advanced-stage oral cavity cancer. *Arch Otolaryngol Head Neck Surg* **122**: 621–626.
- Sanderson RJ, De Boer MF, Damhuis RAM *et al* (1997). The influence of alcohol and smoking on the incidence of oral and oropharyngeal cancer in women. *Clin Otolaryngol* **22**: 444–448.
- Shiboski CH, Shiboski SC, Silverman S (2000). Trends in oral cancer rates in the United States, 1973–1996. *Community Dent Oral Epidemiol* **28**: 249–256.
- Tomar SL, Silverman S, Carpenter WM (1998). Oral cancer education training methods. *J Cancer Educ* **13**: 141–144.
- Winn DM, Diehl SR, Horowitz AM *et al* (1998). Scientific progress in understanding oral and pharyngeal cancers. *J Am Dent Assoc* **129**: 713–718.
- Yellowitz JA, Goodman HS (1995). Assessing physicians' and dentists' oral cancer knowledge, opinions and practices. *J Am Dent Assoc* **126**: 53–60.
- Yellowitz JA, Goodman HS, Horowitz AM *et al* (1995). Assessment of alcohol and tobacco use in dental schools' health history forms. *J Dent Educ* **59**: 1091–1096.
- Yellowitz JA, Horowitz AM, Drury TF *et al* (2000). Survey of U.S. Dentists' knowledge and opinions about oral pharyngeal cancer. *J Am Dent Assoc* **131**: 653–661.
- Yu GP, Ostroff JS, Xhang ZF *et al* (1997). Smoking history and cancer patient survival: A hospital cancer registry study. *Cancer Detect Prev* **21**: 497–509.