

Title: An Assessment of Oral Cancer Curricula in Dental Hygiene Programs: Implications for Cancer Control

Authors:

Kathleen K. Thacker, RDH, MPH  
Illinois Department of Public Health

Linda M. Kaste, DDS, MS, PhD  
Associate Professor  
College of Dentistry and School of Public Health  
University of Illinois at Chicago

Karen D. Homsy, BA, BS  
Research Volunteer  
College of Dentistry  
University of Illinois at Chicago

Charles W. LeHew, PhD  
Research Scientist  
College of Dentistry and Institute for Health Research and Policy  
University of Illinois at Chicago

Correspondence:  
Charles W. LeHew  
Institute for Health Research and Policy  
University of Illinois at Chicago  
1747 W. Roosevelt Road  
Suite 500  
Chicago, IL 60608  
Phone (312) 355-4479  
FAX (312) 996-0665  
[lehew@uic.edu](mailto:lehew@uic.edu)

The authors have no disclaimers or disclosures.

## **Clinical Relevance**

**Scientific rationale.** This study investigates variability in the preparation of dental hygiene students to engage in oral cancer prevention and control in their clinical practice in order to inform a broader discussion about how to prepare the oral health workforce to implement the Crete Declaration on Oral Cancer Prevention. **Principal findings.** We found inconsistent preparation of dental hygienists in one U.S. state. **Practical implications.** Levels of preparedness to engage in cancer control are variable and unstandardized. Standards are warranted to ensure adequate, up-to-date preparation and an ability to serve diverse and changing populations.

**Abstract**

**Purpose:** To assess oral cancer prevention and early detection curricula in Illinois associate-degree dental hygiene programs and highlight global health applications.

**Methods:** An email invitation was sent to each Illinois associate-degree granting dental hygiene program's oral cancer contact to participate in a survey via a SurveyMonkey™ link to a 21-item questionnaire. Questions elicited background information on each program and inquired about curriculum and methods used for teaching oral cancer prevention and early detection.

**Results:** Eight of the 12 (67%) programs responded. Three (37.5%) reported having a specific oral cancer curriculum. Five (62.5%) require students to perform examinations for signs and symptoms of oral cancer at each clinic visit. Variations exist across the programs in the number of patients each student sees annually and the number of oral cancer exams each student performs before graduation. Seven programs (87.5%) conduct early detection screening in community settings. All programs included risk assessment associated with tobacco. All other risk factors measured were treated inconsistently.

**Conclusion:** Significant differences in training and experience were reported across Illinois dental hygiene programs. Training is neither standardized nor uniformly comprehensive. Students' preparation for delivering prevention and early detection services to their patients could be strengthened to ensure competence including reflection of risk factors and behaviors in a global context. Regular review of curricular guidelines and program content would help dental hygienists meet the expectations of the Crete Declaration on Oral Cancer Prevention.

**Keywords:** Mouth neoplasms, dental hygienists/education, curriculum, world health, international migration

## Introduction

Cancers of the lip, oral cavity, and oropharynx (oral cancers or OC) are the 9<sup>th</sup> most common cancers in the world, representing about 4.7% of all cancers diagnosed in 2012.<sup>1</sup> OC incidence rates are highly variable geographically and temporally.<sup>2-4</sup> This variability extends to gender disparities and to different oral subsites affected, particularly when comparing cancers in the oral cavity versus the oropharynx. Much of this complex variability is attributable to differences in lifestyle and associated risk factors across populations and over time. Lifestyle-associated risk profiles in populations change over time and are also subject to migration as populations move,<sup>5</sup> presenting challenges to preparing an oral health workforce capable of addressing the needs of diverse and changing populations.

Worldwide, the most important OC risk factors are tobacco (including bidi) and alcohol use.<sup>5-7</sup> Paan use is a primary risk factor in much of South and Southeast Asia.<sup>5,7</sup> Any of these products used in combination appear to work synergistically, greatly increasing risk.<sup>4,6,7</sup> In the western world, human papillomavirus (HPV) has emerged as a major risk factor for cancers of the oropharynx.<sup>3</sup> Poor diet is also regarded as a risk factor. High fat, low nutrient diets have long been a problem in the West, particularly in the U.S.<sup>8</sup> There is evidence that the dietary habits of much of the developing world are worsening as well,<sup>9</sup> and dietary changes are also associated with human migration.<sup>5,10</sup>

It is possible to detect many oral cancers in early stages of disease by oral examinations in clinic.<sup>11</sup> The Crete Declaration on Oral Cancer Prevention<sup>12</sup> calls for vigilance and specifically nominates primary health care providers to perform screening and early detection services. This vigilance requires appropriate training and good knowledge of risk factors in all populations served.

Dentists and dental hygienists (DH) are trained to detect OC and to identify risk factors in their patients.<sup>13,14</sup> However, studies have shown gaps in dental health providers' ability to detect signs and to identify risks of OC.<sup>13-15</sup>

Dental hygienists are of particular importance because they are often the first health care providers to see new dental patients. OC examinations and risk assessment are expected functions of the profession, and dental hygienists can be held legally liable for missing lesions or incomplete documentation.<sup>13</sup>

An association between health care providers' knowledge and attitudes towards OC exams and risk education has been demonstrated. The more education a provider has on these subjects the more inclined the provider will be to perform exams and to address risk factors with patients.<sup>13,16,17</sup> This implies that professional behaviors are affected by educational program emphases.<sup>13,16</sup> Data on the curricula that influence provider behavior are needed to ensure dental hygiene graduates understand oral cancer risk factors, incidence, signs, and symptoms.

The State of Illinois has been at the forefront of efforts in the U.S. to promote prevention and early detection through provider interventions. Over the past decade and a half Illinois has produced three state oral health plans.<sup>18-20</sup> Each plan has called for improved prevention and early detection of OC. To implement these plans, the State conducted an assessment of oral health provider training programs in 2003 as part of a statewide needs assessment and program planning process.<sup>21,22</sup> On this basis the state launched a statewide oral cancer control program which, among other things, emphasized training of oral health providers, including practicing and training dental hygienists, in risk assessment, early detection, and lesion management. Through 2010 over 700 providers had been trained.<sup>23</sup>

Over the 20-year span of data available from the Illinois Cancer Registry, substantial shifts in OC burden have occurred in Illinois (Table 1).<sup>24</sup> The number of total incident cases has risen, even as the incidence rate for African-American males dropped dramatically. For other groups the rate remained essentially unchanged, despite well-documented reductions in tobacco use, suggesting that other risk factors, particularly HPV, may be keeping the rates from falling in all population groups. Immigration is changing Illinois' population<sup>25</sup> which may change distributions of relevant OC risk factors. The purpose of the present study is to assess the curricula in Illinois associate-degree dental hygiene programs on OC, in light of local and global implications.

### **Study Population and Methodology**

A list of all 12 associate-degree DH programs in the State was obtained from the IDPH and contact information was verified on-line or by phone call. A letter was sent to the schools' deans, program coordinators, and teachers of community health, inquiring which faculty members would be the most appropriate correspondents for the survey. All 12 programs designated a contact.

Using SurveyMonkey™ ([www.surveymonkey.com](http://www.surveymonkey.com), Palo Alto, CA), a 21 item survey questionnaire was sent July 1, 2012 to the designated correspondent for each school. A reminder, with the SurveyMonkey™ link, was sent July 11, 2012 to those who had not responded. The survey closed on July 30, 2012.

The survey instrument included questions related to the programs' oral cancer training components. Questions elicited background information on each program's curriculum, and teaching and learning methods.

The data analysis is descriptive. This study was deemed exempt by the University of Illinois at Chicago Institutional Review Board, IRB Protocol # 2011-0674.

## **Results**

Eight of the 12 associate-degree DH programs in the State responded to the survey. The respondents were four directors, one co-director, two instructors, and one “other”.

Most of the programs are located in suburban counties adjacent to the city of Chicago or in rural areas (Table 2). The majority of the counties have at least one dental health provider shortage designation. Mean program enrollment is 48 students with an average graduation size of 25 students. The programs require between 78 and 89 semester hours of credit, with an average of 84 hours, for graduation. One program requires students to earn a certificate in dental assisting before enrollment.

Five of the programs (62.5%) reported having a specific, required oral cancer curriculum. The remaining programs indicated students learn about OC in other courses, such as pathology, anatomy, and clinical practice.

Methods of examination (visualization and palpation) taught also are consistent across programs (Table 3), except that palpation of tonsils is taught by less than half of the programs. All programs teach students to recognize lesions that are suspicious for oral cancer. Variation was reported in what students learn about OC risk assessment. All programs teach students to identify tobacco use as a risk factor and counsel patients about its risks. Nutrition counseling is taught by the majority, but few or none teach counseling on sexual practices, alcohol, or betel nut/pan.

Almost two-thirds of the programs have students examine patients for OC at every visit (Table 4). The number of patients seen annually varies, as does the number of OC examinations

performed by the students. Half of the schools provide limited experience in community settings.

## **Discussion**

This study may be viewed narrowly as an assessment of OC curricula in DH programs in Illinois. However, if the findings of variability in DH training can be extended to other programs in the U.S. and abroad, then its implications are much broader as well. It is seen that training programs are not uniform in preparing dental hygienists to serve a diverse and changing population in the important mission of oral cancer control. Deficiencies are seen despite intensive state efforts to improve prevention and early detection of OC in the state. Moreover, the programs assessed do not seem to be adapting fully to changing risk profiles in the population.

### **Early Detection**

Several signs and symptoms of OC and pre-cancer can be observed in patients. It is important for clinicians to be aware of these signs and symptoms and to evaluate patients accordingly.<sup>11</sup> It is important to note that early OC lesions often do not cause dysfunction or pain, which reinforces that early detection requires regular screening by a trained professional.<sup>11,26</sup>

This 2012 assessment's probe found one program does not specifically teach examination of the lateral borders of the tongue. The tongue is the single most common subsite in the oral cavity where OC is diagnosed in the U.S.<sup>27</sup> The tongue is readily accessible and should always be examined thoroughly. In addition, only three programs report teaching students to palpate the tonsils. Given the tendency of HPV-positive cancers to develop on the tongue and tonsils,<sup>28,29</sup> these may be viewed as significant deficiencies. It is desirable that students in dental hygiene programs be taught to examine all subsites of the oral cavity and oropharynx thoroughly.



### **Risk Reduction**

Several risk factors for OC have been identified. Some are greater threats than others.<sup>30</sup> Important, modifiable risk factors include tobacco, alcohol, combined tobacco and alcohol, betel nut/panan, human papillomavirus (HPV), and poor nutrition.<sup>11,30</sup> All of these risks are modifiable in that steps can be taken to reduce or to eliminate them unlike age, gender, and race, which also play a role in OC development, but are not amenable to management or alteration.

In this 2012 assessment, the majority of programs reported identification of nutrition and sexual practices, in addition to the more traditional risk factors, but the curricula remain weak on developing hygienists' counseling skills in some areas. Different risk factors for OC are sometimes associated with OC development in different anatomical regions and also may affect different populations.<sup>31,32</sup> This variability in risk patterns should be understood and taken into account in clinical practice.

### **Tobacco**

Recognition by oral health practitioners of the risks associated with tobacco use has been widely studied; and dental hygienists, in particular, have been assessed regularly for their ability to counsel patients on tobacco use.<sup>33-35</sup> The programs in Illinois uniformly teach assessment and counseling for tobacco use.

### **Alcohol**

Alcohol is an independent risk factor. However, it's interaction with tobacco is of greatest consequence. The synergistic effect of tobacco and alcohol together on OC is well established.<sup>36,37</sup> The risk is even higher for people with specific genetic susceptibility.<sup>38</sup> Inclusion of alcohol and its synergy with tobacco is reasonable for DH programs. Notably, no

program reported teaching students to counsel patients about alcohol use. This omission is significant.

### **Nutrition**

Research has shown a diet high in fruits and vegetables is beneficial for prevention of OC.<sup>11</sup> Dental hygienists are prevention oriented and should be taught to counsel patients about diet. Only one program does not do so, representing strength of DH instruction in Illinois.

### **Sexual Behavior/HPV**

HPV infection has been increasingly recognized as a risk factor of OC. More than 60% of OC in certain subsites may be due to HPV infection.<sup>11</sup> HPV infection is associated with oral sexual behaviors.<sup>39</sup> Correspondingly, HPV-associated OC rates have increased for white men and women in the U.S. between 1973 and 2009.<sup>11,40</sup> Hence, counseling on the risk factors of oral sexual behavior and how it relates to HPV and OC may be an important intervention and should be part of dental hygiene training. Only a quarter of the programs addressed sexual behavior counseling, reflecting a substantial deficiency that needs to be addressed.

### **Betel Nut/Paan Use**

In the U.S., betel nut/paan (areca nut) is not a controlled or specially taxed substance and may be found in many Asian grocery stores. The use of betel nut/paan, especially if combined with tobacco, can increase the risk of OC by five times.<sup>41,42</sup> In Illinois, between the 2000 and 2010 censuses, the population growth of Asians was the most rapid of all measured ethnic groups and reached 4.5% of the Illinois population in 2010.<sup>25</sup> The practice of betel nut/paan nut use has strong cultural ties.<sup>43</sup> Areca nut is classified by the International Agency for Research on Cancer as “carcinogenic to humans” and therefore should not be exposed to epithelial tissues of the mouth or other body cavities.<sup>42</sup>

Each community has individual population characteristics and cultural ties. Betel nut/paan use may or may not be an issue in every community. Further research is needed to explicate the extent of risk attributable to these products in Illinois and elsewhere. Nevertheless, given the growth of the potentially at-risk population, attention to this product in DH programs is warranted, as at least two DH training programs in Illinois have concluded.

### **Clinical and Field Experience**

The data show substantial variability in clinical and field experience hygienists receive across training programs. Examinations performed in clinical settings ranged widely across programs while examinations performed in community settings ranged even further. Variations in hands-on, clinical experience imply some graduates will have developed substantially greater expertise and comfort with oral examination techniques.

Variations in field experience may have further implications. The people seen in community settings may be quite different from those who present in a clinical setting. Field experience may afford greater opportunities to encounter people of different cultural backgrounds, races, ethnicities, and age groups. Edentulous people, for example, will often avail themselves of these oral exams, although they are not likely to appear in a dental clinic for traditional dental services. Concern for access to OC screening for edentulous patients has been expressed for decades.<sup>44</sup>

Field experience can be targeted to ensure interaction with specific segments of the community. Community outreach can help students connect with the general population and with different cultures. This not only gives them broader exposure, but it also can help meet the needs of the communities where the programs are located.<sup>45</sup>

Even if students conduct large numbers of screening in high risk populations, it is likely that students will not actually encounter a cancer during an examination. However, students are likely to encounter suspicious lesions, particularly leukoplakia. Direct experience in identifying abnormalities in actual patients can make them better practitioners and should be facilitated by clinical training programs.

Perhaps recent debate about efficacy of OC screening affects the utilization of community-based screening.<sup>46-48</sup> However, it should be kept in mind that the current statements are mainly hampered by the limited number of high quality studies.<sup>47,48</sup> Recent assessment of insurers does show their support for preventive screening for oral cancer.<sup>49</sup>

Different populations have different risk profiles, and may also be susceptible to developing cancers in different subsites.<sup>31,32</sup> In the U.S., the focus has traditionally been on men, particularly older men and black men. However, the disparities that set these groups apart have been diminishing even as new disparities may be emerging. Incidence rates for oropharyngeal and tonsillar cancers have risen for younger white men and for women.<sup>29,50,51</sup> Immigration of new populations also leads to shifting risk and subsite patterns as incoming populations bring their particular risk profiles with them.<sup>31,32</sup>

These changing population risk profiles suggest training for risk assessment and counseling should be broad to ensure DH are prepared for all populations they may encounter. Similarly, examination procedures also need to be expansive to ensure all subsites are adequately inspected. Thorough head and neck exams are needed.<sup>52</sup>

### **Study Limitations**

This study has several limitations. Cancers of the lip, though common in Illinois, were not addressed. The small number of programs surveyed and the study's confinement to Illinois

limit the study's generalizability. As a cross-sectional survey, recall bias is distinctly possible. Additionally, the limited data were not amenable to statistical analysis and rigor. Finally, the methods in the assessment are not entirely consistent with the earlier (2003) study by Maurizio,<sup>22</sup> thus limiting our ability to assess change over time.

These limitations point to additional research that should be done. Future research should address lip cancers, should be extended to other programs in other locations, and should attempt to obtain larger samples. If the data reported here can be shown to be consistent with findings in other states and nations, then the need for clear and adequate standards will be well established. This was a need highlighted in Maurizio's study<sup>22</sup> and has yet to be met even at the most local level a decade later.

Oral cancer is a world problem requiring a pervasive and comprehensive approach. This study suggests that we may be far from having a sufficiently vigilant public health strategy in place, despite significant international efforts to make that happen.

### **Conclusion**

Illinois dental hygienists appear to be well prepared to perform examinations and to assess some aspects of patient risk. However, deficiencies were detected in this study. Examination techniques taught in DH programs need to be more thorough. DH's capacity to address patient risk also needs to be strengthened. The breadth of DH preparation is not as great as it should be, especially in light of highly variable and ever changing risk profiles and shifts in populations at risk. DH should be broadly prepared and kept up to date. Standards are needed and should be periodically updated. Further assessments are warranted. Much work remains to be done to achieve an adequate public health response to a growing world health problem.

### **Acknowledgements**

Mrs. Thacker developed this study while a Fellow of the MidAmerica Regional Public Health Leadership Institute, Year 19, 2010-2011. The authors wish to thank Dr. Sara Gordon, formerly of the University of Illinois at Chicago College of Dentistry, for her guidance on the development of the survey and Dr. David E. Miller, former Illinois Dental Director for editorial contributions. Great appreciation is expressed for the respondents to this survey and the work they do to prepare the dental hygiene workforce.

Table 1: Illinois oral cavity and pharynx cancer cases and incidence rates by population groups<sup>24</sup>

		Total Cases	Male Cases (Incidence Rate)	Female Cases (Incidence Rate)
1986-1990	All Races	5,871	3,990 (17.3)	1,881 (6.3)
	Black	1,043	752 (29.2)	291 (8.5)
	White	4,742	3,189 (15.7)	1,553 (5.9)
2006-2010	All Races	7,615	5,267 (16.9)	2,348 (6.5)
	Black	1,016	693 (18.3)	323 (6.5)
	White	6,269	4,349 (16.7)	1,920 (6.4)

Table 2: Characteristics of Responding Illinois Associate-Degree Dental Hygiene Programs

Characteristic	Count (Percentage)
Total	8 (75%)
Location*	
Chicago	0 (0%)
Suburban	3 (37.5%)
Rural	3 (37.5%)
Urban	2 (25.0%)
Dental Health Provider Shortage Area Designation Basis**	
Medicaid Eligible	2 (25.0% - 1 also Penitentiary)
Low Income	4 (50.0% - 2 also Correctional Center)
Correctional Center (only)	1 (12.5%)
None	1 (12.5%)
Program Enrollment Size (Total)	
<40	3 (37.5%)
41-50	1 (12.5%)
51-60	3 (37.5%)
61-70	1 (12.5%)
Annual Graduates	
<20	1 (12.5%)
20-29	5 (62.5%)
30-39	2 (25%)
Semester Hours Required ***	
<78	2 (25%)
79-84	3 (38%)
>85	3 (38%)

\*Location designation is by the Illinois Department of Public Health

\*\*Dental Health Provider Shortage Area Designation (D-HPSA) as listed on

<http://hpsafind.hrsa.gov/HPSASearch.aspx><sup>53</sup>

\*\*\* Obtained from DH program websites Table 3: Examination, Risk Factor Assessment and Counseling



Table 3: Elements Reported in the Curriculum of Illinois Associate-Degree Dental Hygiene Programs

Examination Element	Positive Responses (Percentage of Responders)
Visualization	
	Oral Cavity 8 (100%)
	Oropharynx 8 (100%)
	Base of Tongue 8 (100%)
	Lateral Border of Tongue 7 (87.5%)
Palpation	
	Nodes 8 (100%)
	Tonsils and the Tonsillar Pillars 3 (37.5%)
	Buccal Mucosa 8 (100%)
	Floor of Mouth 8 (100%)
	Tongue 8 (100%)
Lesions Characteristics	
	Discoloration 8 (100%)
	Textural Changes 8 (100%)
	Swellings and Bumps in the epithelium 7 (87.5%)
	Ulceration 8 (100%)
Risk Factor Assessment	
	Tobacco/Smoking 8 (100%)
	Alcohol 7 (87.5%)
	Nutrition 7 (87.5%)
	Sexual Practices 6 (75.0%)
	Betel Nut/Paan 2 (25.0%)
Risk Factor Counseling	
	Tobacco/Smoking 8 (100%)
	Alcohol 0 (0.0%)
	Nutrition 7 (87.5%)
	Sexual Practices 2 (25.0%)
	Betel Nut/Paan 0 (0.0%)

Table 4: Distribution of Clinical Examination Experience in the Curriculum of Illinois Associate Degree Dental Hygiene Programs

Dental Hygiene Student Clinical Experience	Positive Responses (%)
Patient visit when receiving oral cancer examination	
Initial Visit	2 (25.0%)
Every Visit	5 (62.5%)
Prophy Visit	1 (12.5%)
Average number of OC exams performed by students by graduation	
≤40	1 (12.5%)
41-74	1 (12.5%)
≥75	5 (62.5%)
No Response	1 (12.5%)
Average number of OC exams performed by students in community	
<10	4 (50.0%)
25-50	2 (25.0%)
51-100	1 (12.5%)
No Response	1 (12.5%)

## References

1. World Cancer Research Fund International. Cancer Statistics. [Internet] 2014 [Cited 2014 June 18] Available from [http://www.wcrf.org/cancer\\_statistics/world\\_cancer\\_statistics.php](http://www.wcrf.org/cancer_statistics/world_cancer_statistics.php).
2. Cancer Research UK. Oral Cancer Incidence Statistics, Update June 11, 2014. Available from: <http://www.cancerresearchuk.org/cancer-info/cancerstats/types/oral/incidence/uk-oral-cancer-incidence-statistics#world>. Accessed October 15, 2014.
3. Chaturvedi AK, Anderson WF, Lortet-Tieulent J, Curado MP, Ferlay J, Franceschi S, Rosenberg PS, Bray F, Gillison ML. Worldwide trends in incidence rates for oral cavity and oropharyngeal cancers. *J Clin Oncol* 2013;31:1-10.
4. Petersen PE. Oral cancer prevention and control—The approach of the World Health Organization. *Oral Oncol* 2009;45:454-60.
5. Petti S. Lifestyle risk factors for oral cancer. *Oral Oncol* 2009;45:340-50.
6. Subapriya R, Thangavelu A, Mathavan B, Ramachandran CR, Nagini S. Assessment of risk factors for oral squamous cell carcinoma in Chidambaram, southern India: a case-control study. *Eur J Cancer Prev* 2007;16:251-6.
7. Balaram P, Sridhar H, Rajkumar T, Vaccarella S, Herrero R, Nandakumar A, Ravicandran K, Ramdas K, Sankaranarayanan R, Gajalakshmi V, Munoz N, Franceschi S. Oral cancer in southern India: the influence of smoking, drinking, paan-chewing and oral hygiene. *Int J Cancer* 2002;98:440-5.
8. Vadiveloo M, Scott M, Quatromoni P, Jacques P, Parekh N. Trends in dietary fat intake and high-fat foods from 1991-2008 in the Framingham Heart Study participants. *Br J Nutr* 2014;111(4):724-34.
9. Wang Y, Chen H-J, Shaikh S, Mathur P. Is obesity becoming a public health problem in India? Examine the shift from under- to overnutrition problems over time. *Obesity Reviews* 2009;10:456-74.
10. Flegal KM, Ogden CL, Carroll MD. Prevalence and trends in overweight in Mexican-American adults and children. *Nutrition Reviews* 2004;62(7):S144-8.
11. American Cancer Society. Oral Cavity and Oropharyngeal Cancer [Internet] 2014 [Accessed October 15, 2014]. Available from: <http://www.cancer.org/cancer/oralcavityandoropharyngealcancer/index>
12. Crete Declaration on Oral Cancer Prevention 2005. Available from: [http://who.int/oral\\_health/media/orh\\_crete\\_declaration\\_april05.pdf?ua=1](http://who.int/oral_health/media/orh_crete_declaration_april05.pdf?ua=1)

13. Cotter JC, McCann AL, Schneiderman ED, De Wald JP, Campbell PR. Factors affecting the performance of oral cancer screenings by Texas dental hygienists. *J Dent Educ* 2011;85(4):326-34.
14. Patton LL, Ashe TE, Elter JR, Southerland JH, Strauss RP. Adequacy of training in oral cancer prevention and screening as self-assessed by physicians, nurse practitioners and dental health professionals. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;102(6):758-64.
15. LeHew CW, Kaste LM. Oral Cancer Prevention and early detection practices of Illinois dentists. *J Public Health Dent* 2007;67(2):89-93.
16. McCunniff MD, Barker GJ, Barker BE, Williams K. Health Professional's Baseline Knowledge of Oral/Pharyngeal Cancers. *J Cancer Educ* 2000;15:79-81.
17. LeHew CW, Epstein JB, Kaste LM, Choi YK. Assessing oral cancer early detection: clarifying dentists' practices. *J Public Health Dent* 2010;70(2):93-100.
18. Illinois Department of Public Health and IFLOSS. The Illinois Oral Health Plan and the Community Oral Health Infrastructure Development Project Springfield, Illinois: IFLOSS Coalition; 2002. Available from: <http://ifloss.org/pdf/IOHP.pdf>. Accessed October 15, 2014.
19. Illinois Department of Public Health and IFLOSS. Oral Health Care in Illinois; Comprehensive Care for Children and Families; A Roadmap to the Future: The Illinois Oral Health Plan II. Springfield, Illinois: IFLOSS Coalition; 2007. Available from: <http://ifloss.org/pdf/IOHP2/fullversion.pdf>. Accessed October 15, 2014.
20. Illinois Department of Public Health. Healthy People, Healthy Smiles: Assuring an Agenda for Action. Illinois: Illinois Department of Public Health; 2012. Available from: [http://ifloss.org/pdf/Healthy\\_People\\_Healthy\\_Smiles\\_FINAL\\_JULY\\_2013.pdf](http://ifloss.org/pdf/Healthy_People_Healthy_Smiles_FINAL_JULY_2013.pdf). Accessed October 15, 2014.
21. Warnecke RB, LeHew CW, Maurizio SJ. Oral Cancer Prevention and Early Detection in Illinois: Final Report to the Division of Oral Health, Illinois Department of Public Health. November 15, 2004.
22. Maurizio SJ. Assessment of oral cancer curriculum in health professional education programs in the state of Illinois. Dissertation. Southern Illinois University, Carbondale, IL. 2004.
23. LeHew, CW. (April 2010). Successful Strategies for Building and Sustaining Community-Based Oral Cancer Prevention and Early Detection Programs: The Illinois Model. Presented at the National Oral Health Conference, Portland, OR.

24. Illinois Department of Public Health. Illinois State Cancer Registry. Illinois: Illinois Department of Public Health [Internet] 2014 [Cited 2014 Apr 28]. Available from: <http://www.idph.state.il.us/cancer/statistics.htm>.
25. Hall M. 2011 Population change during trying times: Illinois' new demographic reality. Institute of Government and Public Affairs, University of Illinois [Internet] 2014 [Accessed October 15, 2014]. Available from: [igpa.uillinois.edu/system/files/Illinois\\_Population\\_Change\\_IGPA\\_0.pdf](http://igpa.uillinois.edu/system/files/Illinois_Population_Change_IGPA_0.pdf).
26. Neville BW, Day TA. Oral cancer and precancerous lesions. *CA-Cancer J Clin* 2002;52:195–215.
27. Surveillance Epidemiology and End Results Program. SEER Stat Fact Sheets: Oral Cavity and Pharynx Cancer [Internet] 2014 [Accessed October 15, 2014]. Available from <http://seer.cancer.gov/statfacts/html/oralcav.html>.
28. Gillison ML. Human papillomavirus-associated head and neck cancer is a distinct epidemiologic, clinical, and molecular entity. *Semin Oncol* 2004;31(6):744-54.
29. Shiboski CH, Schmidt BL, Jordan RGK. Tongue and tonsil carcinoma: Increasing trends in the U.S. populations ages 20-44 years. *Cancer* 2005;130(9):1843-9.
30. National Cancer Institute. PDQ® Oral Cancer Prevention. Bethesda, MD: National Cancer Institute. Date last modified July 2, 2014.] Available from: <http://www.cancer.gov/cancertopics/pdq/prevention/oral/HealthProfessional/>. Accessed October 15, 2014.
31. Warnakulasuriya KASS, Johnson NW, Linklater KM, Bell J. Cancer of mouth, pharynx and nasopharynx in Asia and Chinese immigrants resident in Thames regions. *Oral Oncol* 1999;35:471-5.
32. Auluck A, Hislop G, Bajdik C, Poh C, Zhang L, Rosin M. Trends in oropharyngeal and oral cavity cancer incidence of human papillomavirus (HPV)-Related and HPV unrelated sites in multicultural population. *Cancer* 2010;116:2635-44.
33. Maillet JP, Tax CL, Neish, NR, Denny AL. Evaluation of outcomes for tobacco cessation counseling in the Dalhousie University dental hygiene curriculum. *J Dent Educ* 2010;74(3):311-7.
34. Davis JM, Koerber A. Assessment of tobacco dependence curricula in U.S. dental hygiene programs. *J Dent Educ* 2010;74(10):1066-73.
35. Koerber A, Davis JM, Newton NA. A qualitative study of tobacco dependence treatment in 19 U.S. dental hygiene programs. *Prev Chronic Dis* 2012;9:120-1.

36. Blot WJ, McLaughlin JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S, Bernstein L, Schoenberg JB, Stemhagen A, Fraumeni JF. Smoking and drinking in relation to oral and pharyngeal cancer. *Cancer Res* 1988;48:3282-7.
37. Turati F, Garavello W, Tramacere I, et al. A meta-analysis of alcohol drinking and oral and pharyngeal cancers: Results from subgroup analyses. *Alcohol Alcohol* 2013;48(1):107-18.
38. Peters ES, McClean MD, Marsit CJ, Buckett B, Kelsey KT. Glutathione S-transferase polymorphisms and the synergy of alcohol and tobacco in oral, pharyngeal, and laryngeal carcinoma. *Cancer Epidemiol Biomarkers Prev* 2006;15(11):2196-202.
39. D'Souza G, Cullen K, Bowie J, Thorpe R, Fakhry C. Difference in oral sexual behaviors by gender, age, and race explain observed difference in prevalence of oral human papillomavirus infection. *PLoS ONE* 2014;9(1):e86023.
40. Jemal A, Simard EP, Dorell C, Noone A-M, Markowitz LE, Kohler B, Ehemann C, Saraiya M, Bandi P, Saslow D, Cronin KA, Watson M, Schiffman M, Henley SJ, Schymura MJ, Anderson RN, Yankey D, Edwards BK. Annual Report to the nation on the status of cancer 1975-2009, featuring the burden and trends in human papillomavirus (HPV)-associated cancers and HPV vaccination coverage levels. *J Natl Cancer Inst* 2013;105:175-201.
41. Lu CT, Yen YY, Ho CS, Ko YC, Tsai CC, Hsieh CC, et al. A case-control study of oral cancer in Changhua County, Taiwan. *J Oral Pathol Med* 1996;25:245-8.
42. International Agency for Research on Cancer (IARC) Working Group on the Evaluation of Carcinogenic Risks to Humans. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 85: Betel-quid and areca-nut chewing and some areca-nut-derived nitrosamines. IARC Monographs 2004: Lyon, France. [Internet] 2014 [Cited 2014 May 12] Available from: <http://monographs.iarc.fr/ENG/Monographs/vol85/mono85.pdf>
43. Warnakulasuriya S, Trivedy C, Peters TJ. Areca nut use: an independent risk factor for oral cancer: The health problem is under-recognized. *BMJ* 2002;324:799-800.
44. Guggenheimer J, Hoffman RD. The importance of screening edentulous patients for oral cancer. *J Prosthet Dent* 1994;72:141-3.
45. Atchison KA, Thind A, Carreon DC, Nakazono TT, Gutierrez JJ, Afifi AA, Andersen RM. Comparison of extramural clinical rotation days: did the Pipeline Program make a difference? *J Dent Educ* 2010;75(1):52-61.
46. Brocklehurst P, Kujan O, O'Malley LA, Ogden G, Shepherd S, Glenny AM. Screening programmes for the early detection and prevention of oral cancer. *Cochrane Database of Systematic Reviews* 2013, Issue 11. Art. No.: CD004150. DOI:10.1002/14651858.CD004150.pub4.

47. Edwards PC. Editorial: Oral cancer screening for asymptomatic adults: do the United States Preventive Services Task Force draft guidelines miss the proverbial forest for the trees? *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013;116(2):131-4.
48. Moyer VA on behalf of the U.S. Preventive Services Task Force. Screening for oral cancer: U.S. Preventive Services Task Force Recommendation Statement. *Ann Intern Med* 2014;160:55-60.
49. Feinstein-Winitzer RT, Pollack HA, Parish CL, Pereyra MR, Abel SN, Metsch LR. Insurer views of reimbursement of preventive services in the dental setting: results from a qualitative study. *Am J Public Health* 2014;104:881-7.
50. Chaturvedi AK, Engels EA, Anderson WF, Gillison ML. Incidence trends for human papillomavirus-related and –unrelated oral squamous cell carcinoma in the United States. *J Clin Oncol* 2008;26(4):612-9.
51. Brown LM, Check DP, Devesa SS. Oropharyngeal cancer incidence trends: diminishing racial disparities. *Cancer Causes and Control* 2011;22:753-63.
52. Oral Cancer Foundation. Early Detection and Screening. [Internet] 2014 [Cited 2014 June 20] Available from: <http://www.oralcancerfoundation.org/understanding/early-detection.php>.
53. U.S. Department of Health and Human Services. Find shortage areas: HPSA (Health Professional Shortage Area) by state and county. Health Resources and Services Administration; [Internet, cited 2014 May 12] Available from <http://hpsafind.hrsa.gov/HPSASearch.aspx>.