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- The Use of Fluorescence Technology versus Visual and Tactile Examination in the Detection of Oral Lesions: A Pilot Study

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STATEMENT OF PURPOSE

The *Journal of Dental Hygiene* is the refereed, scientific publication of the American Dental Hygienists' Association. It promotes the publication of original research related to the profession, the education, and the practice of dental hygiene. The Journal supports the development and dissemination of a dental hygiene body of knowledge through scientific inquiry in basic, applied and clinical research.

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Rebecca S. Wilder, RDH, BS, MS

Rebecca S. Wilder, RDH, BS, MS



A Life Well Lived: Professor Michele Leonardi Darby, BSDH, MS

Michele Darby is gone. She was my friend... and not just a friend to me, but to the entire dental hygiene community throughout the world. Michele Darby devoted her entire career to the improvement, recognition and respect of dental hygienists in every corner of the globe.

Did you know that Michele received both a Certificate in Dental Assisting and a Certificate in Dental Hygiene at the beginning of her career? She was also one of the early dental hygiene educators who received not only a Bachelor of Science in Dental Hygiene but also a Master of Science in Dental Hygiene. She graduated from Columbia University, which was the first university to offer a Master of Science degree in Dental Hygiene to prepare "teachers." Michele was one of several wonderful academicians and leaders who graduated from that program.

Michele conducted the majority of her career at Old Dominion University in the Gene W. Hirschfeld School of Dental Hygiene. She handled several roles in the Division of Dental Hygiene, from serving as Chair of the Dental Hygiene Program to her role as Graduate Program Director. She earned the rank of Full Professor in 1986 and was also recognized with a professorship, Eminent Professor and Eminent Scholar from 1986 throughout her remaining career.

Michele will best be known for her textbook, *Dental Hygiene Theory and Practice*, which is in its fourth edition. Along with her co-author, Dr. Margaret (Peg) Walsh, she instilled the concept of the Human Needs Model. Both Michele and Peg were early proponents of critical thinking in dental hygiene education and practice. But Michele also wrote a groundbreaking book with her colleague, Professor Denise Bowen, titled *Research Methods for Oral Health Professionals*. The book, published in 1980, can still be found on my bookshelf, worn and tattered but still used frequently! Michele was an early proponent for research and its necessity for moving the profession forward. She mentored faculty, students and professionals in research methods, writing, and publishing throughout her career.



Michele Darby at the 3rd North American/Global Dental Hygiene Research Conference, October, 2014
Pictured: Second row (left to right): Linda Kramer, Ann Spolarich, Denise Bowen, Jane Forrest
First row (left to right): Michele Darby, Margaret (Peg) Walsh



Michele Darby (right) mentoring Anna Hilla, BSDH (left), a first year graduate student in Dental Hygiene Education at the University of North Carolina Chapel Hill School of Dentistry

Michele was passionate about service as well. She was the editor of the publication *Dental Hygiene* and also *Educational Directions*, both produced by the ADHA. She also served on the Editorial Review Board for the *Journal of Dental Hygiene*.

for most of her career and she was also the Associate Editor for the International Journal of Dental Hygiene for seven years. She was a leader in the field of publishing with more than 50 publications in peer-reviewed journals.

Michele was always an advocate for global oral health. In 1981, Darby was part of a delegation of visiting professionals who visited the People's Republic of China, sharing dental hygiene concepts and techniques with Chinese dentists. Later in 2010 she was a Fulbright Scholar and she spent six months in Irbid, Jordan, at the Jordan University of Science and Technology. There she provided training to faculty and students and served as a curriculum consultant.

Michele received many prestigious awards throughout the years. But aside from all the accolades that she received and rightly deserved, Mi-

chele will be remembered as someone who gave the gift of time. She gave her time to her wonderful family, husband Dennis and children, Devan and Blake. She gave her time to making the world a better place for dental hygienists. She gave her time to write textbooks and scientific papers that will contribute to the dental hygiene profession for years to come. She gave her time to mentor graduate students, speak at professional meetings, consult with oral health care companies, and she gave her time to think about the future of dental hygiene. Michele was excited about dental hygiene in our country and abroad. She will be greatly missed... but her legacy will live on everyday as her work continues to inspire dental hygienists around the world!

Sincerely,

Rebecca Wilder, RDH, BS, MS
Editor-in-Chief, Journal of Dental Hygiene

Linking Research to Clinical Practice

Is Non-Surgical Periodontal Therapy Cost Effective?

Denise M. Bowen, RDH, MS

The purpose of Linking Research to Clinical Practice is to present evidence based information to clinical dental hygienists so that they can make informed decisions regarding patient treatment and recommendations. Each issue will feature a different topic area of importance to clinical dental hygienists with a Conclusion to translate the research findings into clinical application.

Introduction

There has been interest recently in the cost effectiveness of various health care treatment options, including non-surgical periodontal therapy (NSPT) and periodontal surgery. Cost effectiveness is determined by the outcomes of a treatment option and its relative cost. Also, a recent review was conducted as an economic analysis of the U.S. periodontal service market with services being delivered by general dentists, dental hygienists and periodontists. An economic analysis is a systematic approach used to estimate the most appropriate use of resources and may also be used to compare 2 different business approaches to delivery of services to consumers. Most dental hygienists likely perceive the NSPT care they provide to be economical and cost effective for their patients, but very few studies have analyzed this notion.

Based on the findings of these 2 studies, the following conclusions can be drawn:

- An economic analysis using data from 2000 to 2009 found that dental hygienists in the U.S. provide almost all NSPT. The vast majority of NSPT also is being delivered in general dental practice settings. Additionally, 95% of all adult oral prophylaxes, the most common procedure delivered in the U.S., were rendered in general dental practices. ADHA policy has defined the discipline of dental hygiene as "the art and science of preventive oral health care including the management of behaviors to prevent oral disease and promote health." These data provide evidence to support that definition of the discipline.
- Clinical outcomes have been shown to be equal when periodontal surgery is compared to NSPT,

- especially in periodontal pockets of 4 to 6 mm.
- The increase in demand for NSPT services over the past 20 years provides evidence for the strength of the market. There is virtually no alternative to NSPT for patients with periodontitis, other than surgery or extraction of teeth. These alternatives are relevant when teeth are affected by severe periodontitis.
- Estimated hourly earnings in a dental practice from scaling and root planing are estimated at 6 to 9-times greater compared with oral prophylaxis.
- NSPT costs significantly less than periodontal surgery over 12 months, including maintenance therapy. Although significant money could be saved on average by performing NSPT instead of surgery, surgery reduced the need for supportive care and systemic antibiotics.
- At 12 months, both nonsurgical and surgical periodontal treatment modalities have been shown to be equally effective with <1% of all subjects having periodontal probing depths ≥ 3 mm.

The following 2 abstracts provide evidence for the economics and cost effectiveness of NSPT, the majority of which is provided by dental hygienists.

Flemming T, Beikler T. Economics of periodontal care: market trends, competitive forces and incentives. *Periodontol* 2000. 2013;62(1):287-304.

Abstract: The adoption of new technologies for the treatment of periodontitis and the replacement of teeth has changed the delivery of periodontal care. The objective of this review was to conduct an economic analysis of a mature periodontal service market with a well-developed workforce, includ-

ing general dentists, dental hygienists and periodontists. Publicly available information about the delivery of periodontal care in the USA was used. A strong trend toward increased utilization of non-surgical therapy and decreased utilization of surgical periodontal therapy was observed. Although periodontal surgery remained the domain of periodontists, general dentists had taken over most of the nonsurgical periodontal care. The decline in surgical periodontal therapy was associated with an increased utilization of implant-supported prosthesis. Approximately equal numbers of implants were surgically placed by periodontists, oral and maxillofacial surgeons, and general dentists. Porter's framework of the forces driving industry competition was used to analyze the role of patients, dental insurances, general dentists, competitors, entrants, substitutes and suppliers in the periodontal service market. Estimates of out-of-pocket payments of self-pay and insured patients, reimbursement by dental insurances and providers' earnings for various periodontal procedures and alternative treatments were calculated. Economic incentives for providers may explain some of the observed shifts in the periodontal service market. Given the inherent uncertainty about treatment outcomes in dentistry, which makes clinical judgment critical, providers may yield to economic incentives without jeopardizing their ethical standards and professional norms. Although the economic analysis pertains to the USA, some considerations may also apply to other periodontal service markets.

Commentary

This article reported the results of an economic analysis of periodontal services provided in the U.S. Although the data used is from 2000 to 2009, the analysis was completed in 2014 and trends reported seem to remain relevant today. As indicated in the abstract, the analysis showed a shift of the type of periodontal care from periodontal surgeries to nonsurgical periodontal therapy. This Journal of Dental Hygiene commentary focuses on the portions of the economic analysis that are related to NSPT and periodontal maintenance procedures delivered by dental hygienists. Flemming and Beikler noted that periodontal care is provided by dental hygienists, general dentists and periodontists. In 1990, 3 out of 4 scaling and root planing procedures were delivered by periodontists, and in 2005 to 2006, 9 out of 10 of these procedures were rendered in general dental practices. The authors further stated that dental hygienists in the U.S. "provided almost all nonsurgical periodontal therapy." Additionally, the economic analysis indicated that 95% of all adult oral prophylaxis, the most common single procedure

delivered in dentistry in the U.S., were rendered in general dental practices.

A 2009 survey of general dentists in Michigan with similar findings, cited by Flemming and Beikler, indicated that dental hygienists provided most of the periodontal care in general dental practices.¹ When asked who provided periodontal care in their practices, the majority of respondents (59%) indicated that they did not personally treat periodontal disease in a typical week, whereas only 7% reported treating more than 5 patients per week. Conversely, 14% of dental hygienists were reported to not treat periodontal cases in a typical week, and 59% treated over 5 patients. These general dentists also reported that 80% of their dental hygienists often provide NSPT, 15% sometimes delivered it, and only 5% never provided NSPT.¹

Factors influencing the shift from surgical to nonsurgical periodontal services included increased placement of implants, a larger percentage of services being delivered in general dental practices versus periodontal specialty practices, and a decline in prevalence of periodontitis. Characteristics of patients referred from the general dentist to the periodontist also changed from patients with moderate and severe periodontitis to patients with severe periodontitis and fewer teeth. This trend may be related to the fact that patients see the general dental care providers first, and patients rely on the information and referrals provided by their primary care provider. Providers should keep in mind the comparative results of each type of periodontal therapy in moderate periodontal pockets versus deeper periodontal pockets. A previous systematic review indicated that, 12 months following treatment, surgical therapy results in 0.6 mm more probing depth reduction and 0.2 mm more attachment level gain than NSPT in deep periodontal pockets (>6 mm), whereas NSPT resulted in 0.4 mm more attachment gain and 0.4 mm less probing depth reduction than surgical therapy in 4 to 6 mm pockets.² Another systematic review showed, for periodontal pockets initially measuring 4 to 6 mm, the mean reduction in probing depth was 1.29 mm with a net gain in clinical attachment levels of 0.55 mm following scaling and root planing.³ A 2012 systematic review, to be discussed next, showed a pronounced chance of pocket closure at 3 and 6 months following scaling and root planing (NSPT) with or without adjunctive antibiotics, although the addition of antibiotics showed additional benefits.⁴ This study also concluded that there was no difference in treatment outcomes between surgery and NSPT.

Although the economic analysis by Flemming and Beikler assessed the administration of both local and systemic antibiotics, that discussion falls outside of the purview of this paper. Nonetheless, the clinical and economic benefits of mechanical therapy alone are clear, and this procedure is primarily performed by dental hygienists according to this analysis.

Further examination of the periodontal services market indicated that 3 out of 4 general dentists employed 1 or more dental hygienists in 2009, and as described previously, dental hygienists provided most of the preventive and non-surgical periodontal services. The predicted increase of numbers of dental hygiene graduates through 2020, and the fact that most of them will be employed by general dentists, further increases competition between general dentists and periodontists for the periodontal service market. The increase in demand for NSPT services over the past 20 years provides evidence for the strength of the market. There is virtually no alternative to NSPT other than surgery or extraction of teeth, and the latter 2 options are primarily directed at teeth affected by severe periodontitis. Implants are substitutes for both periodontal surgery and fixed partial dentures, and the demand for dental implants has also increased. The economic analysis indicated that implant services are delivered equally by general dentists, periodontists and oral surgeons. Training in dental curriculum for new dental graduates is increasing.

Factors included in the analysis that impacted providers' earnings before income taxes and interest were average fixed costs such as employee wages, fringe benefits, and rent or lease of space, as well as average variable costs such as supplies and laboratory fees. Wages of dental hygienists were considered as variable because they provide care largely independently of dentists, albeit most frequently under their supervision. Fees varied considerably for NSPT services as providers set their own fees. Patients who self-paid, estimated at 28%, provided larger profit margins than those with dental insurance, although a current and future decline in percentages of insured patients was recognized.

Scaling and root planing fees for 1 quadrant with 4 or more affected teeth ranged from \$149 to \$294 for general dentists and \$220 to \$400 for periodontists. The average fee for prophylaxis was \$78, and professionally-administered fluoride applications added an estimated \$31. Assuming 1 hour per quadrant for NSPT provided by dental hygienists, the estimated earning per hour was \$158

for general dentists and \$238 for periodontists for self-pay patients and slightly lower for insured patients, estimated at \$122 and \$187, respectively. Flemming and Beikler estimated hourly earnings from scaling and root planing at 6 to 9-times greater compared with oral prophylaxis. Further, periodontal maintenance therapy performed in 1 hour by a dental hygienist was estimated to result in hourly earnings of \$52 for self-pay patients and \$44 for insured patients in general dental practices and \$74 and \$63, respectively, in periodontal specialty practices.

When both specialist and general practitioners delegate these preventive and nonsurgical periodontal services to dental hygienists, the patient may not perceive any difference. Although U.S.-educated dental hygienists are taught to practice the entire scope of dental hygiene services, this economic analysis reports that dental hygienists working with periodontists generally see more patients with severe periodontitis and provide more NSPT than their counterparts working in general dental practices. It is estimated that dental hygienists working in periodontal practices rendered an average of 4 times as many scaling and root planing services than those working with general dentists, and 21 times more periodontal maintenance therapies. The increase in non-surgical periodontal care in general dental offices will likely impact these differences in the future.

The authors concluded that competitive forces will continue to increase and influence periodontal services markets in the U.S. New technologies and innovative deliveries of periodontal care will continue to affect existing dental practice business models and provide additional options and value for patients. They did not discuss changing models of delivery of dental hygiene services, including direct access and mid-level providers, as potential influencing factors. These changes are likely to impact the market. Future studies of the economic impact of dental hygiene services is needed.

Miremadi SR, De Bruyn H, Steyaert H, Princen K, Sabzevar MM, Cosyn J. A randomized controlled trial on immediate surgery versus root planing in patients with advanced periodontal disease: a cost-effectiveness analysis. *J Clin Periodontol.* 2014;41:164-171.

Abstract:

Aim: To compare immediate surgery to scaling and root planing (SRP) in the treatment of advanced periodontal disease focusing on the preva-

lence of residual sites and cost-effectiveness (1); to evaluate the adjunctive effects of azithromycin in a second treatment phase (2).

Materials and Methods: Thirty-nine patients (18 males, 21 females; mean age: 54.6) received oral hygiene instructions and were randomly allocated to surgery (n = 19) or SRP (n = 20). Patients with residual pockets (≥ 6 mm) at 6 months received re-debridement of these sites and systemic azithromycin. Treatment groups were followed up to 12 months and evaluated in terms of clinical response parameters and cost-effectiveness. Chair-time was used to assess the financial impact of treatment.

Results: Both treatment arms were equally effective in terms of clinical outcome demonstrating less than 1% residual pockets at 12 months. Surgery imposed an extra 746 Euro on the patient up to 6 months when compared to SRP. At 12 months, 46 Euro of this amount could be offset as a result of a reduced need for supportive care. Only 6 patients in the surgery group needed systemic antibiotics, whereas 14 patients in the SRP needed such additional treatment.

Conclusions: Although 700 Euro could be saved on average by performing SRP instead of surgery, the latter significantly reduced the need for supportive care and systemic antibiotics.

Commentary

This study was a well-designed randomized clinical trial with multiple purposes. In addition to measuring clinical outcomes, the researchers also assessed cost effectiveness of immediate surgery versus NSPT in patients with advanced periodontitis. In addition, the same outcome measures were assessed for treatment of residual pockets in both groups with a systemic antibiotic, azithromycin. The traditional treatment approach begins with biofilm control and nonsurgical periodontal therapy (NSPT) followed by surgical therapy in areas indicated to allow for reevaluation, reduced marginal gingival inflammation and an environment more favorable to periodontal surgery. For patients with advanced periodontitis, surgical procedures generally are needed; therefore, there may be some advantage to immediate surgery, without phase I NSPT, in these cases. For residual periodontal pockets following either or both modalities, local or systemic antibiotics may be indicated. Miremedi et al designed this study to test the hypothesis that periodontal surgery would result in less residual sites when compared to NSPT, albeit at a higher cost. The secondary aim was to

assess the clinical outcome of re-debridement of residual sites, ≥ 6 mm, 6 months post-treatment, with adjunctive use of 500 mg azithromycin once daily for 3 weeks.

All patients in both groups received oral hygiene instruction at baseline including tooth brushing and interdental brush use with reinforcement at 2 weeks and 3, 6, and 12 months following treatment. Pre- and post-assessment of clinical parameters included probing depths, measurement of clinical attachment loss, plaque and bleeding on probing. Cost was based upon chair-time, a measure which apparently can be associated to estimate cost effectiveness. The authors discuss the limitation that chair-time may be influenced by operator skill and variable charges for particular procedures performed.

The trial had many design strengths including random group assignment of patients, blinding of treatment provided to the periodontist performing all pre- and post-assessments, performance of all NSPT by 1 periodontist, and provision of all surgical procedures by 2 periodontists who were supervised by the same periodontist-observer. Patients in the NSPT group received scaling and root planing, using both ultrasonic instrumentation and hand cures, under local anesthesia, in 2 appointments with no time limitations. Treatment was concluded when the clinician determined the root surfaces were smooth and calculus-free.

The surgery group received open flap debridement with osseous and soft tissue surgical procedures as indicated. Surgery was performed at 4 appointments using a quadrant approach. All patients in both groups were prescribed an analgesic post-treatment, and post-operative pain was measured by a visual analog scale 1 week after treatment without clinicians present. Patients in both groups with residual periodontal pockets ≥ 6 mm, after 6 months, were prescribed the antibiotic regimen with re-debridement of indicated areas.

The groups were remarkably similar with no significant differences at the start of the study related to gender, age, smoking habits, number of teeth present or severity of periodontal destruction. Neither group had significantly more drop outs. Results indicated that both the NSPT and the surgery were effective in significantly reducing PPD, CAL and BOP at 6 months. The average visual analog scale for pain and number of analgesics taken were also similar.

At 6 months, the reduction in full-mouth prob-

ing depths was not significantly different (2.9 to 0.6 mm for NSPT, 2.7 to 0.3 mm for surgery). Full-mouth clinical attachment loss was also reduced similarly in both groups (4.9 to 0.2 mm for NSPT, 4.4 to 0.1 for surgery). At this time interval, however, the percentage of residual pockets was $8.6 \pm 9.4\%$ in the NSPT group and $1.0 \pm 1.8\%$ in the surgery group, indicating significantly less surgery patients than NSPT patients (7.6% more) requiring antibiotics.

Chair-time was significantly longer for surgery than for SRP (5.25 hours versus 7.35 hours). Chair-time required for maintenance therapy between 6 and 12 months differed significantly in favor of the surgery group, requiring an average of 27 less minutes and associated with a cost savings of 45 euros. Nonetheless, the total 12 month treatment time could be translated into a cost of 745 euros for NSPT and 1,445 euros for surgery. The non-surgical option was delivered at significantly lower cost as measured by currency. This cost savings was considered particularly significant due to the equivalence of treatment outcomes at 12 months. At 12 months, both treatment modalities were equally effective with $<1\%$ of all subjects having probing depths ≥ 3 mm. This finding was true regardless of whether the patients were prescribed adjunctive antibiotics or not.

The cost for some patients in both groups, with 7.6% more in the NSPT group, however, was the need for systemic antibiotics which present risks for side-effects for the patient and antibiotic resistance for society. It seems that a similar study using locally-delivered antibiotics or a collagenase inhibitor such as 50 mg doxycycline hyclate may be beneficial to ameliorate these concerns. Also, a future study in the U.S. with NSPT performed by dental hygienists is indicated based on the fact

that the vast majority of these services are delivered by dental hygienists in general practices rather than by periodontists.

Conclusion

Dental hygienists are preventive professionals responsible for providing NSPT to address periodontal treatment needs in the U.S. In fact, dental hygienists provide an estimated 90% of the non-surgical periodontal care delivered in general dental practices. The delivery of these services in general dental practice has increased significantly over the past 20 years and that trend is expected to continue. NSPT and surgical periodontal therapy has been shown to have equal clinical outcomes in terms of probing depth reduction, clinical attachment levels, and less bleeding, especially in patients with 4 to 6 mm pockets and moderate periodontitis. The studies discussed in this article provide some evidence that NSPT is also economical and cost effective. Further study of these important outcomes, as well as patient satisfaction, is needed.

Denise M. Bowen, RDH, MS, is Professor Emeritus in Dental Hygiene at Idaho State University. She has served as a consultant to dental industry, as well as numerous government, university and private organizations and presently is a member of the National Advisory Panel for the National Center for Dental Hygiene Research in the U.S. She has served as Chair of the American Dental Hygienists' Association Council on Research and Chair of the Research Committee for the Institute for Oral Health and has received national awards for excellence in dental hygiene. Professor Bowen is widely known through her published articles and textbook chapters and dynamic continuing education programs related to nonsurgical periodontal therapy, preventive oral self-care, research methodology, and dental hygiene education.

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Review of the Literature

Enhancing Dental and Dental Hygiene Student Awareness of the Lesbian, Gay, Bisexual and Transgender Population

Elizabeth Aguilar, RDH, MS; Jacquelyn Fried, RDH, MS

Introduction

If the U.S. hopes to achieve effective and equitable delivery of health care services, the attainment of cultural competence through increased cultural awareness must be included in health care providers' education.^{1,2} Cultural awareness in health care means having an understanding of the many lenses through which people assess health and interpret and understand health care concepts. Taylor defined cultural competence as "the use of evidence to guide practice featured prominently, including research from a range of disciplines concerning caring for, and working with, people from different cultures and religions."¹ Culturally competent delivery of care adapts to and is mindful of individuals' unique characteristics. The more health care workers and health professions' students achieve cultural competence and become aware of cultural sensitivities, the better they will transmit desired health information and render individualized care to their patients. In turn, patients may experience better health care outcomes. The delivery of culturally competent care has the potential to reduce health disparities.^{2,3}

The purpose of this literature review is to systematically review available literature on health care provider's delivery of culturally competent care to the lesbian, gay, bisexual and transgender (LGBT) community. The investigators searched electronic databases that included Medline (Ovid), Eric and PubMed with consultation from information specialists at the Health Science and Human Services Library at the University of Maryland. The literature search for peer reviewed articles and published documents began the fall of 2011 and continued through the year 2012. The following key words framed the search: cultural diversity/awareness, lesbian, gay, bisexual, transgender and sexual mi-

Abstract

Purpose: Although cultural competence education is being incorporated into most health care curricula, content addressing sexual minorities is lacking or, if present, inadequate. This void can result in compromised health care and can contribute to the social stigma surrounding the lesbian, gay, bisexual and transgender (LGBT) community. Increasing the knowledge and demystifying sexual minority issues can enhance the confidence and attitudes of health care workers when treating LGBT individuals. Suggestions for creating a more welcoming health care environment for LGBT individuals in different health care settings such as private clinics, public health settings and school based programs are offered.

The purpose of this literature review was to systematically review available literature on health care providers' delivery of culturally competent care to the LGBT community. The investigators searched electronic databases that included Medline (Ovid), Eric and PubMed with consultation from information specialists at the Health Sciences and Human Services Library at the University of Maryland. The information was categorized into content areas. Discussion of the findings and future directions regarding health care delivery for the LGBT community are provided.

Keywords: cultural diversity, LGBT, sexual minorities, health care services, dental and dental hygiene education

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Investigate how diversity among populations impacts the promotion of oral health and preventive behaviors.

norities, health care services, and dental and dental hygiene education.

Professional Underpinnings

Recognizing diversity, understanding gender based issues and adopting ethical approaches to health care are essential inclusions in cultural competence education. The American Dental Hygienists' Association's Code of Ethics states that justice and beneficence are integral to a high standard of dental hygiene practice. Equitable service delivery, health promotion and "doing good" are essential attributes of care for all populations served. The Code of Ethics further states that dental hygienist must "serve all clients without discrimination and avoid actions toward any individual or group that may be interpreted as discriminatory."⁴ Another charge is

to “recognize that cultural beliefs influence clients’ decisions.”⁴ The Commission on Dental Accreditation’s (CODA) guidelines for dental hygiene education mandates the need for cultural awareness, the attainment of competence in effective communication with individuals, diverse population groups and other health care providers. The guidelines further state that dental hygienists should recognize “the cultural influences impacting the delivery of health services to the individual and the communities” and that patients with special needs such as medical, physical, psychological or social require adaptation and modification of oral health care delivery.⁵ The patient’s experience at a health care visit encompasses the entire encounter where the whole health care/dental team plays an integral role in the patient’s experience and the delivery of care.

To achieve optimal health care for all, cultural diversity training should be designed to address all demographic aspects of the population, including sexual identity and sexual orientation. The LGBT population is a group characterized by unique sexual identities and sexual orientations; its uniqueness must be addressed and incorporated into health care delivery. The literature indicates that health care professionals from various disciplines misunderstand and/or stigmatize the LGBT population.^{6,7} When seeking health care, many members of the LGBT population are hesitant to report their sexual identity or sexual orientation;⁸ similarly, many health care workers are reluctant to probe the sexual identities of patients. These constraints have led to a description of the LGBT population as “the nation’s invisible population.”⁷⁻⁹

Data gathered through scientific inquiry create the foundation for public health. Research data are essential to addressing the needs of the U.S. population and to guide legislative action to improve the health of the public.⁸ Research can increase the understanding of sexual minorities, their similarities and differences from the heterosexual majority. The widespread neglect of LGBT individuals in public health research has devastating consequences for the health of this community.⁸ Limited research on sexual minorities may contribute to the failure of public health providers and programs to address the needs of the LGBT population.¹⁰ Recognizing that generalizing the conditions and illnesses of the heterosexual population to that of the LGBT community may be invalid,⁸ the National Center for Transgender Equality in conjunction with the National Gay and Lesbian Task Force conducted a national survey of the LGBT population to establish baseline population data.¹¹ The survey instrument was developed and distributed electronically and hard copies were disseminated by community advocates, LGBT friendly

centers, transgender leaders and researchers. An 80.6% response rate was obtained. The respondents (n=6,456) represented the 50 U.S. states, the District of Columbia, Puerto Rico, Guam and the U.S. Virgin Islands.¹¹ Respondents reported experiencing widespread discrimination in community clinical, private, and hospital health care settings.¹¹ Other sources indicate that LGBT individuals have poorer experiences in health care as compared to the general population^{7,9,12} and sexual minority issues in cultural competency training appear to get little to no attention.^{6,13}

Culturally Competent Health Care

The U.S. is rich in diversity and cultural heritage. This increasing diversity affects all aspects of health care delivery.^{7,14-16} Health disparities among cultural minorities and vulnerable populations are well documented.^{3,15} The idea of culturally competent health care is not new; however, it has recently gained popularity in the health care professions as health disparities continue to grow.^{3,8} The U.S. Surgeon General’s Report points to the need for a culturally competent dental workforce to increase access to care and enhance oral health.¹⁴ According to some researchers, the delivery of culturally competent health care services may increase the efficacy of health care workers and staff, thus reducing the incidence of medical/dental errors.³ By becoming more culturally competent, it is hoped that oral health professionals will recognize the importance of respecting differences among groups and not place diverse cultures into homogenous groups. The need to integrate the patients’ definition of what health care means to them in service delivery is critical.¹⁷ Keenan states that, “We need to ensure the cultural safety of our patients by embracing their differences.”¹⁷

LGBT Experiences in Health care Settings

Experiences in the health care system can affect how patients view their relationships with health care professionals and whether they decide to seek medical/dental advice.⁹ Patients’ perceptions can influence their treatment and health status.⁹ Some LGBT individuals report negative health care experiences involving prejudice and denial of services.^{6,9,11} Compared with heterosexual and non-transgender socioeconomically matched peers, LGBT individuals are more likely to face barriers accessing appropriate medical care.¹² These barriers can create or increase existing disparities.¹² The extent of health care disparities among LGBT individuals has prompted the U.S. Department of Health and Human Services to elevate sexual orientation from a noted disparity in their Healthy People 2010 objec-

tives, to a target group of concern and needed improvement in Healthy People 2020.^{8,18,19}

A nationwide U.S. survey addressing LGBT experiences in health care revealed some important findings. Survey participants reported that when sick or injured, many postponed medical care due to discrimination.¹¹ Nineteen percent of respondents stated that they were refused medical care altogether.¹¹ LGBT patients report anxiety about disclosing sexual identity and avoidance of preventive services for fear of discriminatory treatment.^{6,13} Some LGBT patients allow the health care professional to assume they are heterosexual for fear that disclosing their sexual identity would decrease the quality of health care delivered.^{6,8}

Regarding their personal privacy, LGBT patients need a clear understanding of why health care workers' questions are relevant to their health care, who would have access to their information, how persons viewing the information would handle the answers received and how the information would be stored.⁶ Wilkerson found that LGBT patients feel safe revealing sexual and gender identity information only after their concerns are addressed.⁶ LGBT individuals report difficulty in accessing culturally competent primary care services.²⁰ Family physicians' lack of awareness regarding LGBT issues and respect for the LGBT community has been described as a "blind spot."²⁰ Among LGBT individuals, transgender patients report the highest levels of health care worker discrimination.^{6,11} Transgender patients struggle to find health care workers with enough cultural competence and knowledge to support their gender identity transitions.⁶ In the case of negative reactions from health care workers, transgender patients' greatest fears relate to safety and privacy concerns associated with disclosure.⁶

LGBT individuals suffer disproportionately from a range of conditions and are at disproportionate risk for others.^{7-9,12} According to Wilkerson, LGBT patients have a desire for their health care workers to understand why the LGBT community's risks exist, to talk to them about these risks within the social context, and to offer culturally relevant solutions for reducing harm.⁶ A U.S. nationwide survey revealed that LGBT individuals have a 41% rate of attempted suicide versus 1.6% in the general population.¹¹ LGBT individuals have a high prevalence of tobacco and alcohol use.⁷ Suicide counseling, tobacco and alcohol cessation are services that could help prevent death and reduce harm. Oral health professionals are positioned to address substance abuse problems and to make referrals for their LGBT patients.

Health Care Providers' Attitudes toward Treatment of LGBT Patients

Health care providers' negative attitudes towards patients with stigmatized conditions constitute a barrier to the LGBT population's optimal utilization of health care services.²¹ In several studies, health care workers reported facing barriers when attempting to provide culturally competent care to LGBT patients.^{6,13,15} Some health care workers, who provide care to a significant number of LGBT patients, fear discrimination by homophobic patients or coworkers.⁶ Health care workers also find it difficult to provide culturally competent care when coworkers lack education about LGBT health.⁶ Providers' attitudes may be influenced by public opinion. Data from a random sample of U.S. citizens found that 30% would change providers if they learned that their provider was LGBT; and 35% reported they would switch to a different clinic or practice if they learned that the practice employed LGBT health care providers.¹³

LGBT Education in Professional Health Care Programs

The lack of health professions students' education in cultural competence particularly in the area of sexual identity may result in future providers who are uncomfortable working with LGBT patients.¹³ Health care workers' formal education needs to challenge the negative attitudes and stereotypes about LGBT people. Students and providers must learn how to ask their patients questions about sexuality and gender.¹³ The Association of American Medical Colleges has recommended that "medical school curricula ensure that students master the knowledge, skills, and attitudes necessary to provide care for LGBT patients."¹²

A study conducted in the U.S. reported that the "result of the lack of education in most medical education is that many physicians feel uncomfortable working with LGBT patients."¹³ The same study found that in one medical school, approximately half of the subjects responded that they had no education about gay male issues, 61% received no content on lesbian health, 78% reported no education on bisexual health and 76% received no information on transgender health.¹³ These trends were consistent in medical residencies and medical continuing education classes.¹³

Research related to the LGBT population in dental school environments is scarce.⁷ In a study of U.S. and Canadian dental schools, 76.6% of respondents reported receiving no education related to LGBT issues.⁷ Additional studies conducted in the U.S. and

the United Kingdom regarding the LGBT community found similarities.⁹ Without designated cultural competence education on LGBT issues, physicians, medical students and oral health professions' students may reflect the same extent of homophobia and heterosexism present in the broader society.¹³ The lack of adequate education and experience has been a major reason for oral health professionals' reluctance to care for patients from sexually stigmatized populations; integrating the topic of homosexuality in the curriculum may help increase student sensitivity toward sexuality, gender questions and comfort levels treating LGBT patients.^{7,21}

Clinicians' knowledge is limited by the dearth of available population-based data. Practice environments also may be affected by the contentious and stigmatized nature of homosexuality, with health care professionals holding a range of beliefs about minority sexual orientation that are occasionally pathological and commonly minimizing.¹⁸ To address these concerns, the 2011 Institute of Medicine report to the National Institutes of Health recommended focused intra and extramural research efforts to build a LGBT health evidence base, to amass demographic data on LGBT individuals, develop standardized sexual orientation/gender identity measures and to improve research methods for conducting LGBT health research.¹²

Dental and dental hygiene education must prepare future oral health care professionals to treat patients from non-heterosexual backgrounds in a professional manner.⁷ Standards of best practices for the LGBT community are lacking, policies vary and training on LGBT health issues are inadequate.⁶ Health care professional training programs that do not address the LGBT community add to its stigmatization. In addition to considering the extent to which LGBT-related issues are addressed in the formal dental school curriculum, the academic climate must be inclusive so students, staff, faculty members and patients from LGBT backgrounds are not subjected to discrimination.⁷ By providing oral health professions students with more inclusive curriculum, they can become more patient-friendly and accepting of individuals with diverse sexual orientations.^{21,22}

Improving LGBT Experiences in Health Care Settings

An analysis of the clinical environment relevant to the delivery of culturally competent health care includes 3 aspects: interpersonal, structural and systemic.⁶ A systematic review offered the following suggestions for improving LGBT experiences in health care settings. To improve interpersonal rela-

tionships between the health care professional and the patient, the following topics were identified:^{6,7,9}

1. Avoiding homophobia and heterosexism and assuming that a patient is heterosexual
2. Improving health care workers' knowledge
3. Being perceptive to the terminology used by the patient to engender patient trust
4. Understanding embarrassment and the importance of affirmation
5. Reducing over-cautiousness

Ideas as simple as displaying an LGBT friendly sticker in a well viewed window can improve the structural environment. Not designating restrooms as male and female, but having both figures on the door or simply the word "restroom," is another measure of inclusivity (Woodward, personal communication, 2012). LGBT individuals have mentioned the lack of LGBT-friendly resources in the waiting room as a concern in a number of studies.^{6,9} Having LGBT friendly pamphlets and reading material might make the LGBT community feel more welcome.

Improving protocols, appropriate referrals and patient confidentiality can deflect systemic barriers.^{6,9} Continuity of care also is desirable for anyone utilizing health care services but it may be particularly important for LGBT individuals; i.e., continuity of care limits the number of times a person is required to reveal their sexual orientation, and it promotes the formation of a trusting relationship between patient and health care worker.⁹

Both patients and health care workers would like an LGBT-friendly provider directory.⁶ Patients say they would use the directory to identify health care workers who have made providing care to LGBT patients a focus of their practice, and Health care workers believed the directory would assist them when referring LGBT patients to a specialist.⁶

Investing the whole health care team in relevant interpersonal, structural and systemic changes, can create an environment in which LGBT patients feel less stigmatized and receive more culturally competent health care.^{6,13} Staff meetings and in-service programs are vehicles for enabling positive change (Woodward, personal communication, 2012).

Discussion

The LGBT community requires health care monitoring and prevention. This community faces discrimination by society and inadequate health care.¹¹ Despite the work of the Human Rights Campaign and Gay and Lesbian Medical Association, gaps exist in defining and implementing culturally compe-

tent LGBT health care.^{9,11} As patient advocacy groups across the nation are calling for cultural competency training for physicians and other health care providers, these calls must include diversity related to sexual and gender identification.¹⁹

Research suggests that LGBT populations suffer from a range of conditions and are at disproportionate risk for others.^{7-9,12} Increased awareness of the LGBT population may help to decrease the stigma surrounding it.^{6,7} Raising awareness and increasing the knowledge base regarding the LGBT population could begin to break down the barriers to health care delivery and increase the health care worker's confidence in treating LGBT individuals.^{6-8,20,21} Pioneer psychologists from the mid-twentieth century established that through communication comes understanding.²³

A limitation of the current study is the dearth of studies available about LGBT's oral health care providers and health care delivery.²⁰ Another limitation is the sensitive nature of the topic. A recurrent theme found in this literature review is the hesitation and fear LGBTs have in revealing their sexual identities and providing health care workers with related information.^{6-11,13} This reticence interferes with the ability to collect data about this population.⁷ Further research is needed to better understand the health care needs of the LGBT community.¹¹ Longitudinal studies would be useful to observe changes over time in attitude and or confidence of students and health care workers when treating LGBT patients. The government, accreditation agencies and regulatory bodies are calling for action to address the health care needs of the LGBT population. Studies that track curricular innovations in health professions' education, and that assess private and public sectors' implementation of governmental directives and adherence to ethical principles in health care delivery are essential.

Accredited continuing education courses, online learning and published works in journals provide options for health care workers to learn about the LGBT community. Dental/medical conventions are venues where information can be presented. Academic pro-

grams can provide many opportunities for student engagement. Students can be involved in cultural awareness projects, community events, participate in poster sessions, and engage in practicums at centers where LGBT populations are a segment of the target population. Ethics and cultural competency courses provide opportunities to incorporate content related to sexual minorities, gender bias, discrimination, justice and the importance of culturally competent care.

Conclusion

The demographic changes in the U.S. cannot be ignored. Health care providers including dentists and dental hygienists need to adapt to meet the needs of the people.^{4,5} Cultural awareness education for effective health care delivery is required.^{1,2} Health disparities can potentially be reduced when cultural and sexual minorities receive culturally competent care.^{2,3}

Dental and dental hygiene educators must include the LGBT community in their discussion of unique patient populations.⁷ Incorporating culturally competent didactic and clinical learning experiences into the educations of future oral health professionals may enhance the delivery of relevant and high quality health care to the LGBT population.^{3,2,12} More research is needed to better understand the LGBT community, their unique health care concerns and provider attitudes toward treating this population.

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Evaluating the Impact of Expanded Practice Dental Hygienists in Oregon: An Outcomes Assessment

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Introduction

Lack of access to dental care has become a public health focus over the past several years in the U.S. and has led to much discussion and change in the profession of dental hygiene.¹ The past 20 years have seen an increase in the amount of decision-making responsibility of the dental hygienist, a reduction in the level of required supervision, and an increase in independent practice among dental hygienists.²⁻⁴ The independent practice of dental hygienists and the mid-level dental provider are concepts that have gained momentum in an attempt to alleviate disparities in access to dental care. The most recent U.S. Department of Health and Human Services report states that there are 4,585 dental health professional shortage areas in which 45 million people live.⁵ The utilization of dental hygienists working in independent practice is a logical approach to help alleviate this access to care challenge.

As of 2012, 35 states allow dental hygienists to provide patient care in a setting outside of a dental office and without a dentist present.⁶ Alaska and Minnesota both license mid-level providers, who are allowed to provide basic restorative treatment in addition to the catalogue of typical dental hygiene services, also without the supervision of a dentist.⁶ Mid-level dental providers have been recognized internationally for many years,² and 5 states are currently forwarding legislation to create dental hygiene based mid-level provider licensure (Vermont, Kansas, Washington, Connecticut and Maine).⁶

Currently, Oregon does not license or employ a mid-level dental provider. However, Oregon is one

state in which dental hygienists are allowed to practice without the supervision of a dentist. Expanded Practice Permit Dental Hygienists (EPDHs) (previously known as Limited Access Permit (LAP) dental hygienists) are allowed to render most services

Abstract

Purpose: Currently the dental hygiene practice model in Oregon includes the Expanded Practice Dental Hygienist (EPDH), which allows dental hygienists with an Expanded Practice Permit (EPP) to provide care to limited access populations without the supervision of a dentist. The number and types of services provided by EPDH practitioners is thus far undocumented. The purpose of this study is to conduct an outcomes assessment of EPDH practitioners in order to quantify the impact, defined by count of services, on the access to care crisis in Oregon.

Methods: A 16 question confidential survey was developed and approved by the Pacific University institutional review board. The mail-based survey was sent to 181 EPDHs in Oregon in November 2011 (all EPDHs except pilot testers and one author). A second mailing was sent to non-respondents. Data were analyzed using descriptive statistics and chi-square analysis in SPSS.

Results: The response rate was 39% (n=71). Approximately 41% (n=29) of the respondents were currently using their EPP to provide care to limited access patients with an additional 21% (n=15) planning to start their own expanded practice. The majority of practicing EPDHs provide care in residential care facilities (n=21) and in school settings (n=13). Of the current practicing EPP holders, 76% practice ≤ 10 hours per week, and 66% make $< \$10,000$ per year. Total services reported in an average month from all responding EPDH practitioners were: 254 adult prophylaxes, 1,003 child prophylaxes, 106 adult fluorides, 901 child fluorides and 1,994 fluoride varnishes, among many other preventive procedures.

Conclusion: To a limited extent, the amount and type of services provided by EPDHs has now been quantified, and EPDHs are making an impact on the access to care crisis in Oregon. Continued outcomes assessment is needed to further quantify the impact of EPDHs.

Keywords: dental hygienists, professional practice, outcome assessment, health services accessibility

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within the typical dental hygiene scope of practice without the supervision of a dentist, in specified settings or for populations who experience lack of access to care (defined in ORS 680.205). EPDHs are required to refer patients to a dentist at least once annually for examination and treatment of active dental disease. An EPDH also has the ability to administer local anesthesia, place temporary restorations and prescribe prophylactic antibiotics and non-steroidal anti-inflammatory drugs, but must have a collaborative agreement with an Oregon-licensed dentist.⁷ There are 2 pathways through which one may qualify for the expanded practice permit (EPP), which is the permit required to become an EPDH. The first pathway requires 2,500 hours of supervised clinical dental hygiene practice, as well as 40 hours of CE courses in either clinical dental hygiene or public health earned since licensure. The second pathway requires 500 hours of clinical practice (either before or after graduation from a dental hygiene program) working with patients defined in ORS 680.205, while under the direct supervision of faculty members of accredited dental or dental hygiene programs.⁸ Despite the need for expanded access to care in Oregon and other states, support for the expansion of the dental hygiene scope of practice and the evolution of the mid-level provider has been mixed among dental hygienists and dentists.⁹⁻¹² One question central to the debate of independent practice in dental hygiene and the advancement of a mid-level provider is the question of need: is there a need to have dental hygienists practicing independently? In other words, what is the actual impact of dental hygienists in independent practice on access to care?

In 2008, Battrell et al conducted a qualitative study to analyze the impact of the LAP legislation in Oregon and to determine the nature of the relationships of dental hygienists and dentists who participated in the model. In addition to providing the history of the development of the LAP model, authors presented results of interviews with participating dentists and dental hygienists. Authors concluded that entrepreneurship, lifelong learning and a commitment to underserved populations were common motivations among study participants and that the relationships between the dental hygienists and dentists were positive. At the time of the study, there were 71 licensed LAP dental hygienists. Authors noted that while the number of licensed practitioners was relatively small, there were a growing number of individuals interested in pursuing this practice modality. This finding has proven true, as the number of practitioners has since more than doubled (at the time of the current study, there were 186 dental hygienists who held an EPP). Authors determined that at the time of the study,

there was not enough information to draw conclusions regarding the impact of LAP dental hygienists, and that an appropriate next step was evaluation of outcomes. As a qualitative study, this information provides a foundation for the continued assessment of this practice model, what is now the EPDH.¹³

While some form of unsupervised practice has existed since 1997, the settings and services provided by EPDHs have not been measured. The purpose of this study was to conduct an outcomes assessment of EPDH permit holders to assess the extent to which they are utilizing their permit, the scope of the services they are providing, and the number of patients who are being served.

Methods and Materials

A cross-sectional survey of EPDHs was conducted in November 2011. The survey instrument was developed by the authors. The survey instrument and study protocol were reviewed by the Pacific University institutional review board, and the study was approved as exempt. A list of all EPDHs was obtained from the Oregon Board of Dentistry (n=186). A convenience sample of 2% was selected to pilot test the survey instrument. Improvements were made according to feedback from the pilot testers. Surveys were mailed to all EPDHs, with the exception of those who completed the pilot testing, and one of the authors who holds an EPP (n=181). The 16 item survey contained both closed and open-ended questions, as well as one Likert-scale question, that assessed the following areas: demographics, income from EPDH practice, amount and types of services provided, details of EPDH practice, and perceived barriers to practicing as an EPDH. This article focuses on the outcomes assessment sections. Perceived barriers to utilizing an EPP will be addressed in a separate report.

The survey tool was distributed via mail along with a cover letter explaining the purpose of the study and consent was implied by returning the survey. The first mailing was conducted in early November 2011, with the second mailing following after 3 weeks. To maintain confidentiality, the surveys were numerically coded, and the principal investigators were the only people with access to the coding file. The coding file was maintained solely to facilitate the second mailing (a second survey was only sent to non-respondents 3 weeks following the initial mailing). Once data collection was completed, the coding file was destroyed. Data entry was completed manually by the principal investigators. For open-ended questions, answers were categorized by each author independently and then reviewed. Any discrepancies in categorization

Table I: Demographics of Responding EPDHs

	Number of Respondents	Category	n	Percent
Age by Category	70	20 to 30	6	9%
		31 to 40	10	14%
		41 to 50	15	21%
		>50	39	56%
Years held EPP	66	0 to 3	41	62%
		4 to 6	9	14%
		7 to 9	5	8%
		≥10	11	17%
Practicing using EPP	71	41%	-	-
Mean Hours Per Week using EPP	25	9.3 (Std. Dev. 12.47)	-	-
Income from EPP	27	≤10,000	18	67%
		10,001 to 20,000	4	15%
		20,001 to 30,000	3	11%
		30,001 to 40,000	1	4%
		40,001 to 50,000	0	0%
		>50,000	1	4%
Level of Education	67	Certificate	2	3%
		Associate	22	33%
		Bachelors	39	58%
		Masters	4	6%

*Not every respondent answered every question. The number of respondents who answered each question is indicated in the second column. The percentages may not total to 100% due to rounding.

were discussed and adjusted, with both authors in agreement regarding the classification. If at least 3 respondents provided similar responses, an additional category was created. If a response was reported in less than 3 instances, it was categorized as "other." Statistical analysis was completed using SPSS version 20 (IBM) and included descriptive statistics and chi-square analyses. Chi-square analysis using the Freeman-Halton extension of the Fisher exact test was used to determine if statistically significant differences existed among those respondents who reported practicing utilizing the EPP and those who did not, particularly in regards to practitioner age, number of years since graduation, type of dental hygiene degree, and length of time holding the EPP. The level of significance was set at 0.05.

Results

Responses were collected from 71 EPDHs, yielding a 39% response rate. The majority of responding EPDHs (56%, n=39) are 51 years of age or older, and most (66%, n=41) have held their EPP for 3 years or less. Respondent demographics are presented in Table I. Forty-one percent (n=29) of respondents report that they are currently practicing using their EPP. An additional 20% (n=15) indicated that they had plans to begin using their EPP in the future. The mean number of hours per week spent practicing using the EPP was 9.3 (SD=12.47).

Table II: Qualifying Populations under ORS 680.205 for Which Responding EPDHs Provide Care (n=30)

Population Treated by Practicing EPDHs	n
Residential Care Facilities	21
Primary and Secondary Schools	13
Homebound Adults	5
Populations deemed "limited Access" by dental board	5
Community Health Clinics	4
Nursing Homes	3
Foster Homes	2
Age (due to age are unable to receive regular dental hygiene treatment)	1
Correctional Facilities	1
Youth Centers	1
Nursery Schools or Daycares	1
Mental Health Residential Programs	0
Facilities for mentally ill patients or persons with mental retardation	0
Infirmity or disability	0

*Total number greater than number of practicing EPDHs because respondents could provide more than one response.

Figure 1: Average Annual Income from Practice Using EPP (n=27)

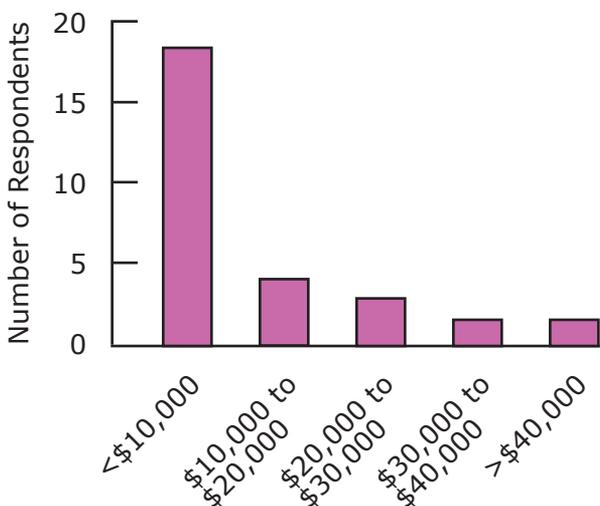


Figure 2: Rate of Reimbursement from Third Party Payers for Services Provided by EPDH (n=23)

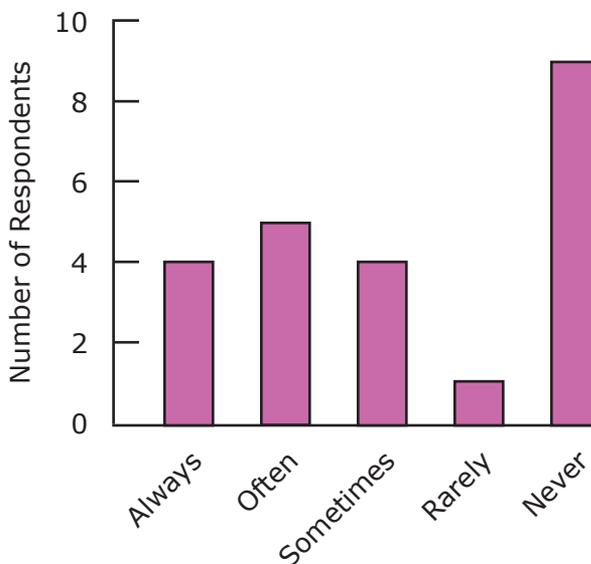


Table III: Total Number of Services Provided as Reported by Responding EPDHs (Time Period of 1 Month)

Procedure	Procedure Code	Number Provided
Adult Prophylaxis	D1110	254
Child Prophylaxis	D1120	1003
Adult Fluoride	D1204	106
Child Fluoride	D1203	901
Fluoride Varnish	D1206	1994
Scaling and Root Planing (SRP) ≥4 teeth/quadrant	D4341	56
SRP 1-3 Teeth/quadrant	D4342	24
Periodontal Maintenance	D4910	83
Full Mouth Debridement	D4355	45
Full Mouth Series of Radiographs (FMX)	D0210	3
4 Bitewing Radiographs (BWX)	D0274	0
2BWX	D0272	0
Panoramic Radiograph (Pano)	D0330	0
Sealants	D1351	885
Soft Denture Reline	D5730, D5731, D5740, D5741	19
Oral Hygiene Instruction (OHI)	D1330	1744
Comprehensive Periodontal Examination	D0180	162

Respondents who were currently practicing utilizing their EPP were asked to indicate in what manner their patient population qualified under ORS 680.205 as having limited access to care. The most frequently identified populations were patients in residential care facilities (n=21) and primary and

secondary schools (n=13). A complete listing of participants' qualifying patient populations is presented in Table II.

Sixty-six percent (n=18) of practicing EPDHs reported making less than \$10,000 per year from

Table IV: Average Number of Services Provided Per Month as Reported by Individual Responding EPDHs

Procedure	Mean (Standard Deviation)	Maximum
Adult Prophylaxis (n=25)	7.72 (11.2)	50
Child Prophylaxis (n=26)	37.00 (116.2)	500
Adult Fluoride Treatment (n=25)	2.8 (6.4)	30
Child Fluoride Treatment (n=25)	28.2 (106.1)	500
Fluoride Varnish (n=25)	75 (206.8)	1000
Scaling and Root Planing >4 teeth per quadrant (n=25)	1.3 (3.6)	15
Scaling and Root Planing 1 to 3 teeth per quadrant (n=25)	0.7 (2.1)	10
Full Mouth Debridement (n=25)	1.3 (4.1)	10
FMX (n=25)	0.1 (0.4)	2
4 BWX (n=25)	0 (0)	0
2 BWX (n=25)	0 (0)	0
Panoramic Radiograph (n=25)	0 (0)	0
Periapical Radiograph (n=25)	0.9 (4.0)	20
Sealant (n=25)	35.4 (103.4)	500
Soft Denture Reline (n=24)	0.1 (0.4)	2
Oral Hygiene Instruction (n=26)	60.2 (121.8)	500
Comprehensive Periodontal Examination (n=25)	5.0 (10.1)	50

their EPP practice (Figure 1). The majority of practicing EPDHs (70%, n=19) own and use portable equipment. Forty-one percent (n=12) of practicing EPDHs advertise for their services, and 36% (n=10) have reported difficulty in obtaining needed supplies.

Respondents who were currently practicing using the EPP were asked to indicate how often they had been successful in obtaining reimbursement from Oregon Health Plan (OHP) or other insurance plans. Thirty-nine percent (n=9) of those who answered responded that they had never been successful (Figure 2). Respondents were also asked to indicate the number of services they provided in an average month in their role as an EPDH. Child prophylaxes, child fluoride, fluoride varnish and sealants were the most frequently reported services among practicing EPDHs. The sum total of average monthly services provided by all respondents is presented in Table III. The average number of services provided per month by individual responding EPDHs is presented in Table IV. Most practicing EPDHs reported working ≤ 10 hours per week. Table V displays the average number of hours per week worked as reported by practicing EPDHs. The largest proportion of practicing EPDHs who answered the question (48%, n=12) indicated

Table V: Reported Hours per Week Spent in EPDH Practice

Hours per Week in EPDH Practice	Respondents (n=25)	
	n	Percent
≤ 5	12	48
6 to 10	7	28
11 to 20	2	8
21 to 30	0	0
31 to 40	4	16
>40	0	0

that they worked ≤ 5 hours per week, followed by 28% (n=7) who indicated that they worked 6 to 10 hours per week.

One of the open-ended survey questions asked practicing EPDHs to report the most commonly seen oral care needs that they were unable to meet, but would be able to meet if the scope of practice were expanded. Responses included temporary restorations, extractions (adult and pediatric), fissurotomy prior to sealants, and denture adjustments (Figure 3).

Bivariate analysis using the Chi-square test with

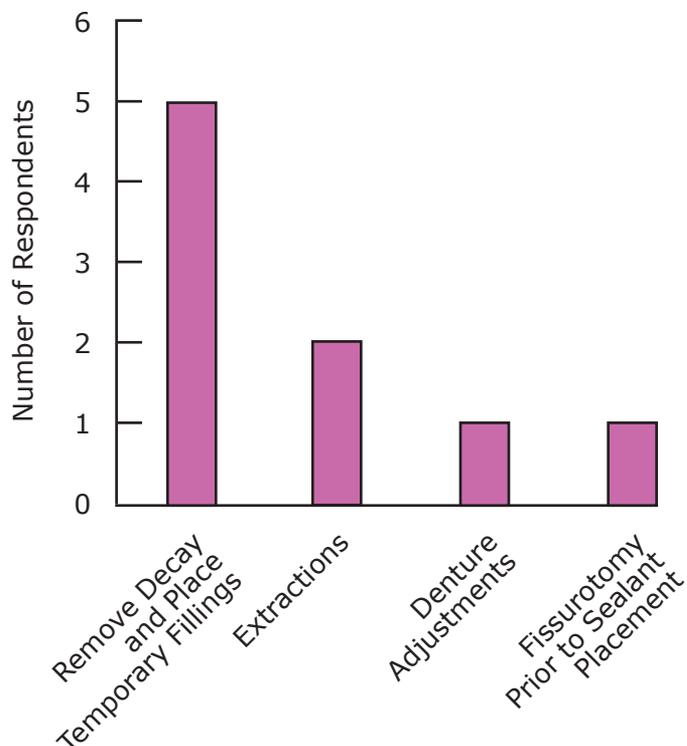
the Freeman-Halton extension of the Fisher exact test was conducted to see if there were any statistically significant differences among those currently practicing using an EPP and those who were not. Areas analyzed included age, number of years since graduation, education level and number of years holding the EPP. No statistically significant differences were found.

Discussion

This is the first time that the amount of services provided by the EPDH workforce in Oregon has been quantified. The most frequently identified patient population served was “residential care facilities” with primary and secondary schools following behind it. Despite this result, child prophylaxis (D1120), child fluoride (D1203), fluoride varnish (D1206) and sealants (D1351) were the most numerous of the reported services, with relatively lower numbers of adult prophylaxes (D1110) and quadrants of scaling and root planing reported. These findings suggest that Oregon EPDHs have the most success providing care for pediatric patients. The apparent discrepancy between the most frequently served population (residential care facilities) and the most frequently provided services may be due to the nature of the survey questions. The question regarding patient populations was open ended, so the results lack some definition in this area. For example, were the reported “residential facilities” those in which pediatric patients reside, for the elderly or infirm, for patients with mental or physical disabilities, or a combination of all of these? Or is it perhaps that treating children in schools simply provides EPDHs with large numbers of patients resulting in relatively large numbers of these types of services? Is it easier for practicing EPDHs to get established working in the school system than it is to obtain the acceptance and cooperation needed to work in medical or other facilities? Is it potentially easier to be reimbursed for pediatric services? Due to this uncertainty, it appears that the most reliable measure of impact is the type of service provided, not the population served.

The prevalence of pediatric services in the results of this study represents a potential departure from the existing literature. Kushman et al conducted a study to evaluate practice characteristics of independently practicing dental hygienists in California who were participating in the California Health Manpower Pilot Project 139 (HMPP 139) which ran from 1987 to 1990. Their results indicated that the practices were primarily centered on preventive care measures (prophylaxes,

Figure 3: Reported Additional Patient Care Needs Outside of EPDH Scope of Practice (n=9)



fluoride applications, sealants and exams), but authors did not delineate between pediatric and adult services.¹⁴ Astroth and Cross-Poline reported that among dental hygienists in independent practice in Colorado, more preventive services were provided for adults than for pediatric patients.¹⁵ The independent practice models in Colorado and in California under the HMPP 139 differ from the Oregon practice model in that Oregon’s model limits the settings and populations that may be served. This may account for the differences seen in the types of care provided. The California HMPP 139 facilitated an experimental environment in which independent practice dental hygiene could be evaluated. Dental hygienists were permitted to set up businesses to provide dental hygiene care independently, and could provide all services allowed under general supervision. No stipulations were made about populations that could receive care.¹⁶ In Colorado, dental hygienists are permitted to practice independently as well as own and operate their own business or practice.¹⁵

The practice act in Oregon permits EPDHs to serve many populations that have been deemed “underserved.” As presented in Table II, there are many populations that EPDHs are permitted to serve, but no respondents indicated that they work with these communities (e.g., patients with mental illness or in clinics operated or staffed by

nurse practitioners, physician assistants, or midwives). This may indicate that barriers exist in gaining access to these types of clinics, or that current permit holders are unaware that some of these populations qualify to be served by EPDHs. Even though significant services are being provided by Oregon EPDHs, the current findings indicate that current EPP-holders in Oregon may not be practicing to the full extent of their permitted abilities, which potentially lessens their impact.

There is considerable room for growth for independent practice in dental hygiene in Oregon. Copen and Bell investigated perceived barriers to pursuing independent practice among EPDHs in Oregon.¹⁷ With the majority of practicing EPDHs indicating that they work less than 10 hours per week, many more individuals could be served if EPDHs practiced in this manner full time. Many of the respondents hold an EPP but do not utilize it to practice in this realm. Permit holders face several barriers, and among non-practicing EPDHs, the most commonly reported reasons for not pursuing EPDH practice were "currently working in a different setting" and "lack of business knowledge." Insurance reimbursement and inability to make a living wage were two of the reported barriers among practicing and non-practicing EPDHs, and likely also contribute to this low utilization of the EPP.¹⁷ To clarify, if EPDHs are unable to attain reimbursement from third party payers, patients typically pay for services out of pocket. Since the completion of this study, new legislation passed in Oregon that requires any services that would be paid to a dentist through insurance plans must also be paid to an EPDH providing the same services. This has the potential to increase the ability of EPDHs to make a living wage. In addition, practicing EPDHs cited difficulty in obtaining a collaborative agreement or cooperative facility in which to practice.¹⁷ Some practicing EPDHs report difficulty obtaining supplies. This difficulty comes from several areas: some items (for example an emergency medical kit) require a DEA number to be purchased (this is a number assigned to medical providers by the Drug Enforcement Administration that is required for prescription writing), some vendors are reluctant to sell to people who are not an established dental office and some items are prohibitively expensive if they are not purchased in bulk (however, if they are purchased in too large a quantity, they expire before they can be used). To address this last difficulty, some EPDHs will place orders as a group, and then subdivide the bulk items.

Coordinated Care Organizations (CCOs) are a relatively new addition to the health care sys-

tem in Oregon. In June 2011, House Bill 3650 was signed into law, creating the framework for a state-wide system of health care networks that cover patients under the OHP which is the state Medicaid plan. CCOs are designed to address physical, mental and dental health with the intent that patients will have a better safety net to help ensure better overall health outcomes.¹⁸ The full implementation of dental care organizations into the CCO framework has yet to occur. Once dental care is fully integrated into CCOs, it may be easier for EPDHs to work in a full time capacity and in different settings since dental care is required within the CCOs. It seems that an EPDH would be a logical fit for this new health care model. Hypothetically, the integration of EPDHs into these organizations would spread the dental safety net even farther.

The question of the need for a mid-level provider in Oregon cannot adequately be addressed by this survey alone. One may argue that while EPDHs are providing services to many people, there are still many more patients in need of care, particularly restorative care, which could be provided by a mid-level dental provider. Oregon is currently undergoing a shift in its health care system as CCOs are being integrated, with the full implementation of dental care yet to come. Currently there are 15 CCOs operating in Oregon.¹⁸ Would a mid-level dental provider be more effective in filling the access to care gap that exists in Oregon, particularly if they were easily integrated into CCOs? The addition of basic restorative services to the traditional catalogue of dental hygiene services would allow for more dental needs to be met. If a mid-level provider model became the most effective way to provide dental care though CCOs in Oregon, EPDHs may no longer be necessary. However, the ease of integration of a mid-level provider into CCOs, or even in independent practice in Oregon, may be difficult to foresee at this point in time. With the implementation of the health insurance exchanges of the Affordable Care Act (ACA), this question may remain difficult to answer. The ACA requires each state to establish a health insurance "marketplace" or "exchange," which is an online marketplace where individuals can purchase health insurance. Participating insurance coverage providers will make their plans available on the exchanges for public consumption.¹⁹ As the dental insurance plans are made available through the exchanges, the dental coverage playing field will shift, and it is likely that there will be changes in the number of patients who are served by OHP. There may be a change in the number of children who are eligible for guaranteed dental services. Adult dental care is

not included in Oregon's Essential Health Benefits benchmark plan,²⁰ therefore adults who qualify for Medicaid and others with lower incomes will still face financial difficulties in obtaining dental health care. It may be difficult to determine whether there is a need for a mid-level dental provider until the implementation of the ACA has happened and CCOs are well established. The effect of the ACA on the success of EPDHs will remain unknown until implementation has occurred.

Some limitations were inherent in the current study. The response rate was lower than anticipated, but respectable when compared to typical response rates of mail-based surveys (26 to 49%).²¹ Due to the response rate, results may not be generalizable to the entire population of EPDHs, but only to the participants. A larger response rate would have provided more information and improved generalizability. While the survey contained questions specifically designed for EPDHs who were not currently practicing in that role, authors believe that recipients who weren't currently using their EPP may not have declined because they thought the survey did not apply. If these recipients did not read far enough through the survey, they would not have seen the directions to skip the bulk of the survey and answer only a few questions. Clearer instructions in the cover letter may have proven beneficial in increasing the response rate. Another limitation was found with the question regarding whether or not the permit holder was currently practicing using the permit. The only options included in the survey instrument were "yes" and "no," and there was no follow up to ask if the participant had plans to begin using it in the future. Several respondents indicated in the open response section at the end of the survey that even though they were not currently using their EPP, they had plans to do so. Had an option been included to capture this subset, authors may have a better idea of anticipated future usage rates. A third limitation to this study was that authors were not able to establish survey performance reliability. The survey has been administered only one time, so test-retest reliability could not be determined. In order to keep the survey to a minimal length, no redundant questions were included to evaluate internal

reliability. To facilitate data entry and consistency of information, every survey mailed was identical, so no alternate-form reliability was established.

Plans for future research include continued outcomes assessment of EPDHs to monitor the amount of services that are being provided. In addition, authors plan to poll program directors in states that allow independent practice to determine whether or not programs include specific curricular innovations to help prepare students for independent practice.

Conclusion

To a limited extent, the services provided by EPDHs have now been quantified. While less than half of respondents indicated that they were currently practicing using the EPP, practicing EPDHs reported providing significant numbers of services to underserved populations in Oregon, which demonstrates that the provider model is effective. Most of the services provided were pediatric services, which indicates that EPDHs have had the most success in accessing and serving this group of patients. However, there is considerable room for growth as demonstrated by the low number of average hours worked per week by EPDHs. In addition, there are as yet many eligible populations who are not routinely being served by EPDHs. Continual outcomes assessment is needed to determine future need for independent practice dental hygienists and the need for the implementation of mid-level dental providers in Oregon, specifically after the full implementation of CCOs and the ACA.

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Assuring Dental Hygiene Clinical Competence for Licensure: A National Survey of Dental Hygiene Program Directors

Lucinda M. Fleckner, RDH, MS; Dorothy J. Rowe, RDH, MS, PhD

Introduction

Performing a clinical examination to obtain an initial dental hygiene license continues to receive national attention due to questioning the validity, reliability and ethical issues of this process.¹

The one-time clinical examination for dental hygiene licensure may not be a valid assessment of clinical competency. Inconsistencies between the student's performance at an accredited dental hygiene program and performance on this clinical examination concern educators. Both dental hygiene and dental educators have witnessed some of their most clinically competent students fail the clinical examination, and the passing of students less competent, based on their performance during the program.^{2,3} A 2001 study of dental hygiene program directors concluded that competence for initial licensure is best determined through continual assessment over time rather than a one-time examination.¹

The one-time clinical examination may also not be reliable to assess competency. Oral conditions of humans are so variable making it impossible to standardize the level of treatment difficulty across the student candidates.⁴ Another concern is the increasing difficulty identifying patients who meet the clinical criteria of the state and regional tests.

The use of a live patient in the one-time clinical examination raises ethical issues and continues to be the greatest source of dissatisfaction with the licensure examination.⁵ The arguments raised against using

Abstract

Purpose: To conduct a national survey of dental hygiene program directors to gain their opinions of alternative assessments of clinical competency, as qualifications for initial dental hygiene licensure.

Methods: A 22 question survey, comprised of statements eliciting Likert-scale responses, was developed and distributed electronically to 341 U.S. dental hygiene program directors. Responses were tabulated and analyzed using University of California, San Francisco Qualtrics® computer software. Data were summarized as frequencies of responses to each item on the survey.

Results: The response rate was 42% (n=143). The majority of respondents (65%) agreed that graduating from a Commission on Dental Accreditation (CODA)-approved dental hygiene program and passing the national board examination was the best measure to assure competence for initial licensure. The addition of "successfully completing all program's competency evaluations" to the above core qualifications yielded a similar percentage of agreement. Most (73%) agreed that "the variability of live patients as test subjects is a barrier to standardizing the state and regional examinations," while only 29% agreed that the "use of live patients as test subjects is essential to assure competence for initial licensure." The statement that the one-time state and regional examinations have "low validity in reflecting the complex responsibilities of the dental hygienist in practice" had a high (77%) level of agreement.

Conclusion: Most dental hygiene program directors agree that graduating from a CODA-approved dental hygiene program and passing the national board examination would ensure that a graduate has achieved clinical competence and readiness to provide comprehensive patient-centered care as a licensed dental hygienist.

Keywords: dental hygiene, licensure, clinical competence, education

This study supports the NDHRA priority area, **Professional Education and Development:** Critically appraise current methods of evaluating clinical competency (dental hygiene graduation competencies, standardized national board testing, clinical board examinations).

live patients include delaying necessary treatment on a patient waiting for the licensure examination, potential risks of treating a live patient in a highly

stressful environment, patient discomfort with the duration of the exam, the liability of inappropriate treatment and the high expense of compensating board patients.^{4,6} A 1999 national survey of dentists reported the following ethical issues related to their clinical licensure examinations: no arrangement for indicated follow-up care for their patient (23.9%), unnecessary radiographs (32.5%), coercion of patient into an inappropriate treatment choice (13.7%), and premature or overly aggressive patient treatment (19.3%).⁷

Because of these issues, the American Dental Association (ADA) House of Delegates adopted resolution 64H, which called for elimination of the use of human subjects for testing competency of dentists for state licensure by 2005.⁸ Although this resolution passed the House of Delegates by a clear majority, a satisfactory replacement for initial licensure examination for dentistry has not been demonstrated. Traditional clinical examinations for dental hygiene also continue to be scrutinized.

The purpose of this study was to conduct a national survey of dental hygiene program directors to gain their opinions of alternative assessments of clinical competency, as qualifications for initial dental hygiene licensure.

Methods and Materials

This cross-sectional survey was conducted as approved by the Institutional Review Board of the University of California, San Francisco (UCSF). The study population consisted of directors of all the Commission on Dental Accreditation (CODA)-approved entry-level U.S dental hygiene programs. Addresses were obtained from the American Dental Hygienists' Association (ADHA).⁹

The 22 question survey, designed by the researchers, was comprised of statements using a Likert scale, an item that asked for additional suggestions/comments, and questions pertaining to the respondents' degree, title and program demographics. In order to standardize respondents' understanding of competency, the researcher included a definition from the ADHA in the survey. The ADHA defines competency as the skills, understanding and professional values of an individual ready to begin practicing dental hygiene.¹⁰ A pre-test was conducted on a convenience sample of 3 dental hygiene program educators in 2 CODA-approved entry-level dental hygiene programs, to test the survey questions for content validity and clarity. Revisions were made based on the feedback received, prior to conducting the survey.

The survey was administered with the assistance of UCSF Qualtrics® computer software.¹¹ The 341 dental hygiene program directors in the U.S. were invited to participate in this study. They were contacted via electronic mail with a cover letter explaining the purpose of the study, informed consent and a customized link to the survey instrument. The online survey was programmed to send 3 reminders to non-responders without identifying the responders' e-mail addresses.

Data analysis was conducted with the assistance of UCSF Qualtrics® computer software. The number of responses was tabulated for each question. Additional comments were recorded. Simple descriptive statistics were calculated and data summarized as percentages of responses to each item from the survey.

Results

Of the 341 dental hygiene program directors who were contacted to participate in this survey, 143 responded, resulting in a response rate of 42%. After 4 mailings, 132 respondents had completed the survey. Because not all respondents answered every question, the number of responses to each question varies.

The institutional settings of the respondents' programs represented every type of dental hygiene program settings, with the most numerous (56%) setting being a public community or junior college. A university or 4 year college not affiliated with a dental school was the setting for 20%, a 4 year college affiliated with a dental school 13%, with the remainder (14%) being situated in a technical college or institute, vocational school, or other type (responses totaled more than 100% because some respondents indicated more than one). Almost all (98%) of the respondents were program directors of dental hygiene programs. Most (79%) of the respondents were dental hygienists with a master's degree and 7% were dentists. Each of the regional testing agencies was represented among the respondents. The Western Regional Examining Board was the clinical examination taken by most (36%) of the respondents' students.

The respondents' levels of agreement to 8 statements regarding the best measures of assuring clinical competence for initial dental hygiene licensure are exhibited in Table I. All 8 statements included the core qualifications of graduating from a CODA-approved dental hygiene program and passing the national board examination. Of the 8 statements, the majority (65%) of respondents agreed that in addition to core qualifications the best measure was

Table I: Agreement Level of Respondents to 8 Statements Regarding the Best Measures of Assuring Clinical Competence for Initial Licensure

The best measure of assuring clinical competence for initial licensure includes: graduating from a CODA- approved dental hygiene program and passing the national board examination AND	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Number of Respondents
No further qualifications	30%	33%	13%	20%	4%	132
Successfully completing community off-site rotations, supervised by a clinical faculty member	8%	17%	39%	29%	7%	132
Passing a case-based computer- simulated examination	6%	20%	29%	36%	8%	132
Passing a dental ethics and jurisprudence examination	18%	25%	31%	24%	5%	132
Providing documentation of successful completion of all competency evaluations in a student-constructed portfolio	17%	29%	23%	24%	7%	132
Successfully completing all programs' competency evaluations	24%	41%	19%	10%	7%	131
Passing a case-based computer- simulated exam, providing documentation of successful completion of all competency evaluations in a student -constructed portfolio and passing a dental ethics and jurisprudence examination	26%	23%	27%	18%	7%	128
Passing a standardized (state-board like) clinical examination, administered by state registered dental hygiene examiners at students dental hygiene program site	12%	20%	18%	35%	15%	130

"successfully completing all program's competency evaluations." "No additional qualifications" was selected by a similar percentage of respondents. However, when responses of "agreed" and "strongly agreed" were separated, a greater percentage (30%) of respondents selected "strongly agreed" for the statement "no additional qualifications" than the percentage (24%) that strongly agreed to the statement, which added, "successfully completing all program's competency evaluations" to the core qualifications. More than one-third of the respondents disagreed with the addition of either "passing a case-based computer-simulated examination" or the addition of "passing a standardized clinical examination, administered by state registered dental hygiene examiners at students' dental hygiene program site." "Successfully completing community off-site rotations, supervised by a clinical faculty member" elicited the greatest percentage of ambivalent (neither agree nor disagree) responses (39%).

Most respondents (73%) agreed to the statement, "the variability of live patients as test subjects is a barrier to standardizing the state and regional examinations" (Table II). Correspondingly, only 29% agreed that the "use of live patients as test subjects is essential to assure competence for initial licensure."

The statements that the one-time state and regional examinations "have low validity in reflecting the complex responsibilities of the dental hygienist in practice" and "do not test a candidate's ability to treat a patient in a clinical practice condition" were agreed upon by the majority of respondents (Table III). Very few (5%) strongly agreed that these one-time examinations "are reliable and valid for assuring clinical competence for initial licensure."

The respondents' rankings of their 6 preferred measures of clinical competence, in addition to

Table II: Agreement Level of Respondents to Statements Regarding the Use of Live Patients as Test Subjects for Initial Dental Hygiene Licensure

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Number of Respondents
The use of live patients as test subjects is essential to assure clinical competence for initial licensure	14%	15%	18%	31%	23%	130
The use of live patients as test subjects to assess the potential lack of competence for initial licensure could be detrimental to the test subject	14%	37%	22%	19%	7%	129
The variability of live patients as test subjects is a barrier to standardizing the state and regional examination	38%	35%	11%	12%	5%	130

Table III: Agreement Level of Respondents to Statements Regarding the One-Time State and Regional Clinical Examinations

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Number of Respondents
The one-time state and regional examinations						
Do not test a candidate's ability to treat a patient in a clinical dental practice condition	38%	35%	12%	12%	3%	130
Have low validity in reflecting the complex responsibilities of the dental hygienist in practice	38%	39%	10%	10%	2%	130
Can be subjective when determining an acceptable patient for the test subject	34%	37%	14%	14%	1%	129
Are reliable and valid for assuring clinical competence for initial licensure	5%	10%	19%	37%	29%	128

graduating from a CODA-approved dental hygiene program and passing the national board examination, are displayed in Table IV. "The successful completion of program's competency evaluations" was ranked number one by 50% of the respondents and number two by 24% of the respondents. The least popular option was off-site community rotations, supervised by a clinical faculty member, ranking number five and number six by most respondents.

The additional suggestions and comments mostly reiterated the results that we have stated. The only new suggestion was a one-year residency in addition to the core qualifications.

Discussion

The purpose of this study was to conduct a national survey of dental hygiene program directors to gain their opinions of potential alternative assessments of clinical competency, as qualifications for initial dental hygiene licensure. The results dem-

onstrate that the majority of respondents strongly agreed that the best measures of assuring clinical competence for initial dental hygiene licensure is graduating from a CODA-approved dental hygiene program and passing the national board examination. Completing all of the program's competency evaluations, in addition to the qualifications stated above, was also frequently selected as a best measure to assure competence. Program directors may have agreed that this was an important addition to the other two measures of assuring clinical competence to emphasize the importance of competency evaluations in a program's requirements for graduation. Most respondents also agreed that the variability of live patients as test subjects is a barrier to standardizing the state and regional examinations and that the one-time examinations have low validity in reflecting the complex responsibilities of the dental hygienist in practice.

Graduating from an accredited program and passing a standardized examination are common

Table IV: Respondents' Rankings of Their Preferred Measure of Assuring Clinical Competence, in Addition to Graduating From a CODA-Approved Dental Hygiene Program and Passing the National Board Examination

Additional qualifications	#1	#2	#3	#4	#5	#6
Student-constructed portfolio providing documentation of competencies	14	27	17	24	15	17
Case-based computer simulated examination	12	18	22	30*	23	14
Standardized clinical examination at each program (similar to state boards), conducted by state registered dental hygienist examiners	27	13	20	7	17	22
Dental ethics and jurisprudence examination	2	19	27*	28	20	23
Off-site community rotations supervised by a clinical faculty member	2	12	18	18	31*	32*
Successful completion of program's competency evaluations	64*	31*	13	10	5	2

Values represent the number of respondents selecting the specific measure of assuring clinical competence for a specific rank (#1 to #6).

*Refer to the highest number of responses to the specific ranking.

requirements for initial licensure of other health care professionals. In nursing the requirements for initial licensure include earning a degree from a nursing program that is accredited by the Accreditation Commission for Education in Nursing (ACEN) and passing a computer-administered multiple choice National Council Licensure Examination for Registered Nurses test. Nursing measures clinical competence by assessments of increasingly difficult skill sets, related to the implementation of patient care, during the consecutive semesters of the nursing programs.^{12,13} Assessing clinical competency throughout the program was also popular with our respondents.

Competency statements, which detail the expected abilities of a dental hygienist entering the profession, were developed by the American Dental Education Association (ADEA). These statements have been beneficial when assessing the competence of dental hygiene students and maintaining and improving the quality of dental hygiene curricula. Dental hygienists must be competent in 5 domains for entry into the profession: core competencies, health promotion/disease prevention, community, patient/client care, and professional growth and development.¹⁴

The CODA accreditation process of entry-level dental hygiene programs assures that the programs will comply with all the defined standards. These standards are based on sound educational principles that ensure quality educational opportunities. Stan-

dards also specify the graduates' required competence in various dental hygiene services. Awareness of these stringent educational standards may have influenced the respondent's decision that graduating from a CODA-approved dental hygiene program is adequate to ensure clinical competence.^{15,16} The results of a 2001 study were very similar to ours in that the dental hygiene program directors believed that clinical competence is best determined throughout the program, with strict adherence to competency standards mandated by the accreditation process.¹

The dental hygiene national board examination has been included in each of the qualifications from which the respondents were to select. The dental hygiene national board examination assesses the students' theoretical and applied knowledge in the basic biomedical, dental, dental hygiene clinical sciences and community health. The dental hygiene national board examination also reflects the clinical practice of the dental hygienist by including patient case studies.¹⁷ The educational standards of the program are indirectly evaluated by considering the pass rate of the program's students. With a continual low pass rate, the quality of the program would be a concern.

The survey offered the respondents the opportunity to select qualifications, in addition to graduating from a CODA-approved dental hygiene program and passing the national boards. Successfully completing all programs' competency evaluations

was the only additional qualification, which received significant support. Student-constructed portfolios have been introduced in dental hygiene education as a means for students to document successful completion of competency evaluations.¹⁸ However, less than half of the respondents selected that as an additional measure of assuring clinical competence. Incorporation of constructing portfolios into the program's requirements comes with the challenges of being labor intensive for the students and for the faculty who evaluate the portfolios.¹⁹ With the passage of Assembly Bill 1524, dental students in California have the option of taking a school-based licensure examination, which entails building a portfolio of completed clinical experiences and competency evaluations in 7 subject areas throughout their final year of dental school.²⁰ The use of computer technology was also not popular with the respondents of the current study, as evidenced by the low agreement with passing a case-based computer-simulated examination. The state of Minnesota has been using a non-patient, computer-based simulation, titled the objective structured clinical examination (OSCE), to evaluate both clinical and theoretical knowledge. The examination utilizes patient cases with medical and dental histories, radiographs, intra-oral photographs, study models, and/or patient records. Candidates rotate through standardized stations on a timed circuit, with a different, impartial examiner at each station.²¹⁻²³

Even though the clinical licensure examinations are a long-standing tradition, many studies collectively provide evidence that both dental and dental hygiene educators question the validity of a one-shot clinical licensure examination.^{7,24-26} Inconsistencies between a student's performance in an accredited dental hygiene program and performance on these clinical examinations concern educators. Both dental hygiene and dental educators have witnessed some of their most clinically competent students fail the clinical examination,^{2,3} and the passing of students less competent, based on their performance during the program.³ Validity is best determined through an accumulation of competencies, as compared to a one-shot, one-day examination with many variables.^{25,27} It is interesting to note that the results of our research and those of a comparable study in 2001 are very similar. In both these studies the majority of dental hygiene program directors believed that clinical competence is best determined throughout the program, rather than from a single examination.¹

The general consensus of program directors was negative regarding the use of live patients as test subjects. This agrees with the policy statements from the major dental hygiene and dental organiza-

tions. The ADHA supports research to "identify and implement a valid, reliable alternative to the use of human subjects in clinical licensure examinations."²⁸ The ADA supports the "elimination of human subjects/patients in the clinical licensure examination process and encourages all states to adopt methodologies that are consistent with this policy."²⁹ In 2011, the ADEA House of Delegates passed a "resolution for the elimination of live patient examinations for dental licensure by 2015."³⁰

Profiles, trends and changes in dental hygiene education and practice have been reported for 19 countries.³¹ The method of regulation (i.e., licensure) varied by the country, with the most predominant method being proof of graduation from a recognized dental hygiene educational program with no further credential (i.e., qualification) being required. Thirty-seven percent of the 19 countries used this method of regulation.³¹

The suggestion of the completion of a 1 year residency, similar to the model for dental licensure, may not be appropriate for dental hygiene.³² Dental hygiene education has significantly shorter curriculum requirements than dentistry; some programs are only of 18 month duration. So, an additional year may not be acceptable to individuals associated with those programs. However, it is interesting to note that more dental students are considering the 1 year Advanced Education in General Dentistry programs as a pathway to dental licensure.³³

One limitation of this study is the low response rate. Some program directors may not have responded due to their being inundated with a large number of surveys from students of baccalaureate degree completion and master degree programs. The low response rate may also be a reflection of this being an Internet survey, rather than a mailed survey. Studies have demonstrated that Internet surveys tend to have lower response rates than mailed ones.^{34,35} Internet surveys have increased in popularity due to their ease of administration. However, much is unknown as to their effectiveness and effect on response bias, particularly in the population of health care professionals.^{36,37}

Conclusion

Licensure issues continue to be in the forefront of concerns for dental hygiene educators. The dental profession appears to be moving toward licensure methods that would be based on evaluation of students by the educational institution. The results of our study support this view for dental hygiene licensure: that the emphasis must be on the assessment of the student's performance throughout

the program, rather than on a one-time clinical examination for licensure. Because the stringent educational standards of CODA maintain the quality of dental hygiene programs, graduating from a CODA-approved dental hygiene program and passing the national boards should be sufficient for graduates to have achieved clinical competence and readiness to provide comprehensive patient-centered care as a licensed dental hygienist.

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The Cultural Climate of Southwest Dental Colleges: Dentistry and Dental Hygiene

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Introduction

Minority populations are increasing in the U.S.¹ Clear evidence exists that there are disparities in health care among these diverse populations within the U.S.² Minorities need and demand culturally appropriate health care services.³ Culturally competent care is critical for gaining patient trust, and health care providers must practice effective communication skills to engage patients of all cultural backgrounds for the delivery of appropriate care.⁴ To better serve these populations, health profession schools are being asked to diversify their student bodies, personnel and climate by such organizations as the Institute of Medicine and the Commission on Dental Accreditation.^{2,5}

Why is Cultural Climate Important?

Cultural climate is defined as the culture of the institution in terms of how open and accepting it is of diverse groups of people, ideas, opinions and beliefs (Table I).⁶⁻⁹ Why is cultural climate important in an educational institution? First of all, ethnic diversity in higher education settings is associated with better educational experiences for all students.¹⁰ Also, cultural competence cannot be achieved in a homogeneous environment but requires the "in-depth exchange of ideas and beliefs across gender, racial, ethnic, cultural and socioeconomic lines."⁵ Conversely, continual exposure to a hostile climate can negatively impact a student's academic achievement and psychological health.¹¹

Increasing student diversity creates a richer multicultural environment which can improve

Abstract

Purpose: The purpose of this study was to identify the cultural climate of southwestern dental colleges, from the perspective of dental hygiene and dental students.

Methods: The Cultural Attitudes and Climate Questionnaire was used to measure cultural climate. It contained 57 items related to campus experiences, cultural comfort, diversity awareness, racial pressures, fair treatment, respect, lack of support, patient care and overall satisfaction. The survey was administered to 508 dental and dental hygiene students at 5 dental colleges.

Results: The response rate was 41% (n=239/508). Students reported not experiencing racial conflict or pressures (71 to 90%), being treated fairly and with respect (86 to 90%) and being comfortable interacting with and treating other cultures (70 to 91%). They also practiced culturally appropriate behaviors (54 to 92%). Those reporting diversity training (77.8%) were more likely to engage in 3 of the 6 awareness practices (p<0.033). Although all groups agreed their educational experience was rewarding (89.5%), African-Americans reported a significantly lower level of agreement than Whites (p=0.003) and Asians (p=0.008). Among all groups, satisfaction with their educational experience was significantly correlated with fair treatment (rho=0.441 to 0.511, p<0.001) and respect for other cultures (rho=0.391 to 0.441, p<0.001).

Conclusion: The students generally reported a positive cultural climate. Improvements could be made by focusing on fair treatment, respect for cultures and the African-American experience. Cultural competence training could be key to improving cultural climate, as positive outcomes from training were identified.

Keywords: cultural climate, academic success, dental, dental hygiene, diversity, cultural competence, training

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Investigate how diversity among populations impacts the promotion of oral health and preventive behaviors.

learning.¹² Chang and Le did a study in 2010 with Asian-American and Hispanic youths and found that perceived school multiculturalism had a significantly positive relationship (p<0.05) with ethnocultural empathy and academic achievement. Thus, the way students perceived the diversity climate at their school increased their empathy for diverse individuals and improved academic achievement.¹³

In 2010, Simmons et al surveyed college students regarding the campus cultural climate and their acceptance of ethnic and racial diversity.¹⁴ The results were that appreciating positive interactions with other ethnic groups increased their acceptance of diversity, emphasizing the importance of interactions with different groups.

A cultural climate that supports diversity also facilitates achievement of cultural competence. In 2004, Novak et al measured dental students' perspectives on the importance of diversity and diversity training at seven different U.S. schools.¹ They found that exposure to diversity and perceptions of competence to serve diverse patient populations were positively correlated. The students stressed that it was important to have a diverse composition of students, faculty and patient population, and a curriculum that prepared them to work with diverse ethnic and racial backgrounds. Similarly, Whitla et al¹⁰ and Hung et al¹⁵ found that medical students believed diversity and cultural competence were important to their development as clinicians.

What is the Current Cultural Climate?

The current cultural climate at health professional programs has not been thoroughly explored. In 2007, Hung et al surveyed medical students at one school to determine the racial/ethnic diversity and cultural competence of the campus.¹⁵ While most of the URM students felt that the school had succeeded in creating an encouraging cultural climate, a small portion did not feel that the university truly valued diversity. Most students felt that the lack of diversity at their school impaired the retention and recruitment of minority students.

Two studies in dental hygiene programs have shown a deficiency in cultural climates. They used the Cross-Cultural Adaptability Inventory that measures cross-cultural skills in four dimensions: emotional resilience, flexibility/openness, perpetual acuity and personal autonomy. In 2004, Magee et al used the Cross-Cultural Adaptability Inventory in 8 dental hygiene programs (n=188). The overall score of the dental hygiene students was lower than the Cross-Cultural Adaptability Inventory norm group, suggesting the need for cultural competence training.¹⁶ In 2009, DeWald and Solomon used the Cross-Cultural Adaptability Inventory to track dental hygiene cross-cultural skills over the course of the program, at initial orientation, at the end of the first year and the end of the second year (n=30).¹⁷ No significant improvement was identified in cross-cultural effectiveness over the course of the 2 year curriculum.

Table I: Definitions

Terms	Definition
Culture	The beliefs, customs and arts, etc., of a particular group. Also, a way of thinking, behaving, or working that exists in a place or organization. 6
Cultural Climate	The culture of the institution in terms of how open and accepting it is of diverse groups of people and diverse ideas, opinions and beliefs.
Cultural Competence	A skill gained through training that helps one learn culturally appropriate actions towards diverse groups, including race, ethnicity, gender, age, sexual orientation or religion.
Diversity/Cultural Competence Training	Coursework or study to enhance knowledge of diversity and cultural differences. The latter term is becoming more acceptable among trainers.
Ethnic Group	A group of people who retains common customs, language and social views. ⁷
Minority	Any non-White individual or ethnic group, unless specifically stated otherwise.
Race	A group of people classified together on a basis of common history, nationality or geographic distribution with an emphasis on physical characteristics and underlying genetics. ⁸
Underrepresented Minority (URM)	In the U.S., this refers to the racial/ethnic groups African Americans, Hispanic, Native Americans (American Indians, Alaskan Natives, Native Hawaiians) and Pacific Islanders. ⁹

Several studies suggest that cultural competence education at dental schools could be improved. In 2006, Saleh et al assessed the extent of cross-cultural education in U.S. dental schools.¹⁸ Only 29 of the 54 schools reported having formal training in their curriculum. They also found a lack of understanding about how to best incorporate cross-cultural education into the curriculum. Hewlett et al conducted a study in 2007 with fourth-year dental students to determine if the time spent on cultural training was sufficient to achieve competence in caring for patients of diverse cultural/racial backgrounds.¹⁹ Twenty-five percent reported that the

time spent was inadequate. Female, URM, Asian/Pacific-Islander or unmarried students were more likely to report that the time was insufficient. In 2008, Wagner and Redford-Badwal surveyed dental students regarding their knowledge of cultures and using culturally appropriate practices in oral health care.²⁰ They found that students believed using culturally appropriate practices was important, but they had insufficient knowledge about the groups they would treat in practice.

In general, minority college students report a less positive cultural climate. In 2000, Ancis et al assessed African-American, Asian-American, Latino/Latina and White students at a large, mid-Atlantic university.¹¹ African-American students reported significantly more experiences with racial conflict and unequal treatment by faculty and staff. They also experienced more racial separation compared to Asian-American and White students. Both African-American and Asian-American students reported significantly more racism from faculty than White students.

Minority medical students have similar experiences. In 2004, Dyrbye et al surveyed 3 medical schools in Minnesota to examine possible differences in quality of life between minority and non-minority students.²¹ Minority students reported a lower sense of accomplishment, and experienced bias, discrimination, stereotyping, isolation, depression and burnout. They specifically reported more major illnesses, trouble finding child-care and isolation from their family support systems. In 2007, Odom et al identified lack of financial and social support, hardships with standardized testing, and ethnic/racial discrimination as barriers for minority medical students. Conversely, they identified strong support, professional exposure and financial assistance as mediators for their personal and academic success.²²

Limited research has been done on the cultural climate in dental schools. Thus, the purpose of this study was to identify the cultural climate of southwestern dental colleges, for both dental and dental hygiene students, and what factors affect this climate. The specific research questions of this study were:

1. What is the cultural climate in southwestern dental schools, including diversity training?
2. Are there differences among racial/ethnic groups about the cultural climate?
3. Are some cultural climate factors associated with satisfaction with the dental school experience?

Methods and Materials

Population and Sample

The target population of this study was all fourth-year dental students and senior dental hygiene students attending dental colleges in the Southwest U.S. The study focused on these students because they were close to graduation and had the most experience with their school environments. Once invited, 5 of the 6 dental schools in the region elected to participate in the study. Each of these schools had both a dental and dental hygiene program, which allowed the identification of the cultural climate from both perspectives. The total population surveyed consisted of 181 senior dental hygiene students and 402 fourth-year dental students. Of this population, 239 completed the voluntary survey, yielding a response rate of 41%.

Instrument and Administration

This study used a modification of the Cultural Attitudes and Climate Questionnaire developed and validated by Helm, Sedlacek and Prieto.²³ In 1998, they surveyed 566 students at a large, east coast university with this instrument. Factor analysis identified 11 scales with high alpha levels ranging from 0.55 to 0.70, with an overall reliability of 0.81.

This study used the following 11 scales:

1. Demographics
2. Campus experiences
3. Cultural comfort
4. Diversity awareness
5. Racial pressures
6. Fair treatment
7. Respect for other cultures
8. Lack of support
9. Patient care
10. Overall satisfaction
11. Cause of unfair treatment

The alpha levels for each of 11 scales ranged from $\alpha=0.732$ to 0.968, with an overall mean of 0.870, indicating a high level of reliability. Using a 5-point Likert-type response, respondents reported their level of agreement with 56 statements. The last question was open-ended and allowed participants to add any additional information related to cultural climate.

A committee of 3 experts in survey design, data analysis and cultural diversity reviewed the survey instrument. After approval by the institutional review board at Texas A&M Health Science

Table II: Demographics of Participants

	DH2		D4		Total	
	Number	Percent	Number	Percent	Number	Percent
Race/Ethnicity						
Black	8	3%	6	3%	14	6%
Hispanic	23	10%	13	5%	36	15%
White	92	39%	60	25%	152	64%
Asian or Pacific Islander	17	7%	14	6%	31	13%
Native American	4	1%	1	<1%	5	2%
Other	0	0%	1	<1%	1	<1%
Total	-	-	-	-	239	100%
Gender						
Male	12	5%	44	18%	56	23%
Female	132	55%	51	21%	183	77%
Total	-	-	-	-	239	100%
Primarily Grew Up in the U.S.?						
Yes	129	54%	84	35%	213	89%
No	14	6%	11	5%	25	11%
Total	-	-	-	-	238	100%
Total Participants, Overall						
	144	60%	95	40%	239	100%

Center Baylor College of Dentistry (expedited IRB 2012-31), the survey was pilot tested. No changes were made to the survey instrument, because the pilot study verified ease and clarity of the questionnaire. The survey and consent protocol were distributed by administrators at each school. Completion and return of the survey constituted informed consent.

Data Analysis

Following data collection, results were coded and entered into SPSS software program for statistical analyses. Descriptive statistics, including frequencies and cross tabulations, were used to identify the cultural climate of the schools. Kruskal-Wallis and Mann Whitney U tests were used to determine differences between groups about the cultural climate. Spearman's correlation was used to examine associations between aspects of cultural climate and overall satisfaction. In order to protect against Type I errors when running a large battery of tests, the alpha level was set at $\alpha=0.001$ rather than $\alpha=0.05$. Cronbach's alpha tests were used to measure the reliability of the survey sections. Open-ended comments were transcribed and analyzed qualitatively for emergent themes.

Results

Demographics

Table II illustrates the demographics of the study participants. Of the 239 respondents, 60% were senior dental hygiene students and 40% were fourth-year dental students. The majority were White (64%), followed by Hispanic (15%), Asian or Pacific Islander (13%), Black or African American (6%), and Native American (2%). These categories represent the collapsing of 11 unambiguous categories based on ancestry. The majority were female (77%) and grew up in the U.S. (90%). The age range was 21 to 56 years of age, with a mean of 27.2 years and a standard deviation of 5.2 years.

The racial/ethnic make-up of the dental respondents mirrored that of the 5 southwestern U.S. schools from which they were drawn and were not significantly different than the dental hygiene respondents ($X^2=2.969$, $p=0.709$).²⁴ Overall, they were 37 and 36% non-White, respectively. The White group was slightly over-represented in the sample and the Asian group is somewhat under-represented. The 3 URM groups were remarkably well represented. None of these

Table III: Campus Experiences

Please indicate with a √ the extent to which you believe each of the following is present at your school	"Never" or "Seldom"	"Sometimes"	"Often" or "Almost Always"	Total
Racist atmosphere in the clinic	214 (94%)	12 (5%)	3 (1%)	229 (100%)
Racist atmosphere in the classroom/lab	213 (91%)	11 (5%)	9 (4%)	233 (100%)
Interracial tensions in the classroom	208 (90%)	13 (6%)	10 (4%)	231 (100%)
Racial conflict on campus	205 (89%)	19 (8%)	7 (3%)	231 (100%)
Students are resentful of others whose race and ethnicity is different from their own	192 (84%)	18 (8%)	20 (8%)	230 (100%)
Racial and ethnic separation on campus	161 (76%)	38 (18%)	13 (6%)	212 (100%)

Table IV: Cross and Intra-Cultural Comfort

Please indicate how comfortable you feel in the following situations at your school	"Very Uncomfortable" or "Uncomfortable"	"Neutral"	"Comfortable" or "Very Comfortable"	Total
Being with people whose racial or ethnic backgrounds are the same as my own	16 (7%)	10 (4%)	209 (89%)	235 (100%)
Being with people whose racial or ethnic backgrounds are different from my own	19 (8%)	17 (7%)	203 (85%)	239 (100%)
Going to see a faculty member of my own race or ethnicity	16 (7%)	18 (8%)	191 (85%)	225 (100%)
Speaking with others about my racial or ethnic background	18 (8%)	23 (10%)	193 (82%)	234 (100%)
Being in situations where I am the only person of my racial or ethnic group	34 (14%)	37 (16%)	165 (70%)	236 (100%)
Saying what I think about racial and ethnic issues	64 (27%)	11 (5%)	161 (68%)	236 (100%)

small differences were significant ($X^2=2.056$, $p=0.725$).

Cultural Climate

For Tables III to VIII, the 5-point Likert-type scale was collapsed into a 3-point scale. As illustrated in Table III, a preponderance of students felt racial conflict/tension was rarely present on their campus. Students responded "never" or "seldom" to interracial tensions in the classroom (90%), racial conflict on campus (89%), and racial and ethnic separation (76%). Most students were also not resentful of others whose race and ethnicity were different from their own (84%).

As seen in Table IV, students reported being quite comfortable with cross and intra-cultural situations. They reported being the most comfortable with people whose racial background was different/ the same as their own (85 and 89%),

and going to see a faculty member of their own race (85%). They reported being the least comfortable saying what they thought about racial and ethnic issues (68%), and when they were the only person of their racial or ethnic group (70%).

As seen in Table V, the majority of students did not report experiencing racial pressures. Only 10% of the students agreed that they needed to minimize various characteristics of their racial/ethnic culture (such as language and dress) to be able to fit in at their dental school and were pressured to participate in ethnic activities. Slightly over one-fourth (27%) did agree that there were expectations about their academic performance because of race or ethnicity.

The majority of the students believed they were treated fairly. Students reported fair treatment ("fairly" or "very fairly") from classroom faculty

Table V: Racial Pressures

Please indicate to what extent you agree with the following statements.	"Strongly Disagree" or "Disagree"	"Neutral"	"Agree" or "Strongly Agree"	Total
I feel I need to minimize various characteristics of my racial/ ethnic culture (for example: language and dress) to be able to fit in here	176 (76%)	33 (14%)	22 (10%)	231 (100%)
I feel pressured to participate in ethnic activities at this school	165 (71%)	45 (19%)	22 (10%)	232 (100%)
I feel I am expected to represent my race and ethnic group in discussions during class	135 (58%)	55 (24%)	43 (18%)	233 (100%)
I feel there are expectations about my academic performance because of my race or ethnicity	129 (55%)	43 (18%)	64 (27%)	236 (100%)

Table VI: Lack of Support

Please indicate how often you have difficulty getting help or support from	"Never" or "Seldom"	"Sometimes"	"Often" or "Almost Always"	Total
Classroom faculty	152 (64%)	17 (7%)	70 (29%)	239 (100%)
Students	148 (62%)	25 (10%)	66 (28%)	239 (100%)
Clinical faculty	147 (62%)	24 (10%)	68 (28%)	239 (100%)

(90%, n=216), clinical faculty (86%, n=206) and other students (86%, n=206). Over 84% of students reported that race/ethnicity, gender, age, sexual orientation and religion were not ("never" or "seldom") the cause of unfair or insensitive treatment at their school.

Students felt there was a high level of respect shown for other cultures. Respect by faculty for students of different racial and ethnic groups was reported by 91% of students (n=215). Students reported "often" or "almost always" for the occurrence of friendship between students of different racial and ethnic groups (87%, n=207) and respect by students for other students of different ethnic groups (87%, n=206).

As seen in Table VI, the majority of students did not report much difficulty in getting support from faculty or students. Students reported not ("never" or "seldom") having difficulty receiving help or support from classroom faculty (64%), clinical faculty (62%) or other students (62%). On the other hand, about 30% did report difficulty getting support from the 3 groups.

Students indicated they were comfortable treating patients the same as their own race/ethnicity, gender, religion, sexual orientation and age (90 to 92%, n=213 to 220) and different from their own (88 to 91%, n=206 to 214). Gen-

erally, treating patients "different from my own" received lower scores than "same as my own," but these differences were not statistically significant.

Thirty-nine students provided comments regarding cultural competence and/or the diversity climate at their dental school. The 3 most common themes were:

1. No discrimination exists at their institution (n=13)
2. Discrimination against minority students does exist (n=6)
3. Preferential treatment exists for minority students (n=5)

As the largest number of comments was about discrimination not being present at their school, this supports the quantitative results of this study.

Diversity Awareness and Training

The frequency of diversity training at dental schools, shown in Figure 1, was 83% for dental hygiene students, 71% for dental students and 78% overall. As shown in Table VII, students "agreed" or "strongly agreed" that they understood racial/ethnic differences (92%) and had stopped using language that might be offensive

Table VII: Diversity Awareness

Please indicate your behavior (practice) and whether your experience here at the dental school has changed (improved) your behavior	"Strongly Disagree" or "Disagree"	"Neutral"	"Agree" or "Strongly Agree"	Total
I understand racial and ethnic differences My dental school experience has changed (improved) the above behavior	2 (1%) 34 (15%)	16 (7%) 75 (34%)	219 (92%) 114 (51%)	237 (100%) 223 (100%)
I stop myself from using language that may be offensive to others My dental school experience has changed (improved) the above behavior	13 (6%) 31 (15%)	24 (11%) 84 (40%)	183 (83%) 96 (45%)	220 (100%) 211 (100%)
I initiate contact with people who are not of my cultural or ethnic background My dental school experience has changed (improved) the above behavior	13 (6%) 33 (15%)	34 (14%) 91 (41%)	190 (80%) 98 (44%)	237 (100%) 222 (100%)
I recognize culturally biased behavior My dental school experience has changed (improved) the above behavior	23 (10%) 33 (15%)	32 (14%) 87 (40%)	176 (76%) 96 (45%)	231 (100%) 216 (100%)
I discuss topics related to cultural awareness with friends My dental school experience has changed (improved) the above behavior	20 (9%) 40 (18%)	65 (28%) 85 (39%)	146 (63%) 95 (43%)	231 (100%) 220 (100%)
I handle negative language used by another in such a way as to try to educate the other person My dental school experience has changed (improved) the above behavior	27 (12%) 32 (15%)	74 (34%) 110 (50%)	120 (54%) 76 (35%)	221 (100%) 218 (100%)

Behaviors in bold were significantly associated with whether or not the student had training ($p \leq 0.003$).

Table VIII: Overall Satisfaction

Please indicate to what extent you agree with the following statements	"Strongly Disagree" or "Disagree"	"Neutral"	"Agree" or "Strongly Agree"	Total
Overall, my educational experience here has been a rewarding one	8 (3%)	17 (7%)	213 (90%)	238 (100%)
I feel as though I belong in the dental /dental hygiene school	8 (3%)	19 (8%)	212 (89%)	239 (100%)
I would recommend this school to siblings or friends as a good place to go for dental/dental hygiene school	13 (5%)	18 (8%)	208 (87%)	239 (100%)
The school provides an environment for free and open expression of ideas, opinions and beliefs	19 (8%)	32 (13%)	188 (79%)	239 (100%)

to others (83%). The lowest majority at 54% "agreed" that they handled negative language used by another in such a way as to try to educate the other person.

In general, students believed that they were culturally aware in their thinking and behavior, but that their dental school experience did not contribute to this (<50% agreed). However, Mann Whitney U tests indicated that the trained students were more likely to agree that

they engaged in the following behaviors: discussing topics related to cultural awareness with friends ($p=0.020$), stopping themselves from using language that might be offensive to others ($p=0.002$) and handling negative language used by another in such a way to try to educate the other person ($p=0.032$).

Overall Satisfaction with Cultural Climate

Table VIII illustrates that students generally

Figure 1A: Frequency of Diversity Training Among Dental Students

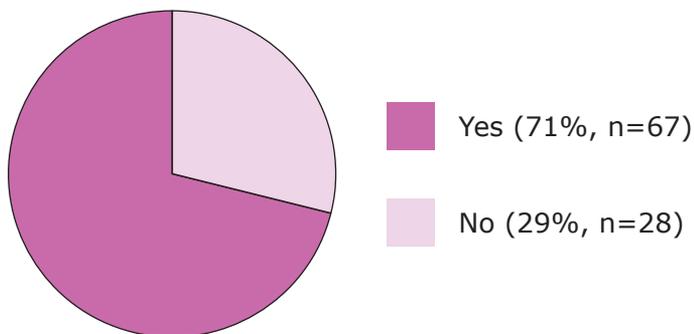
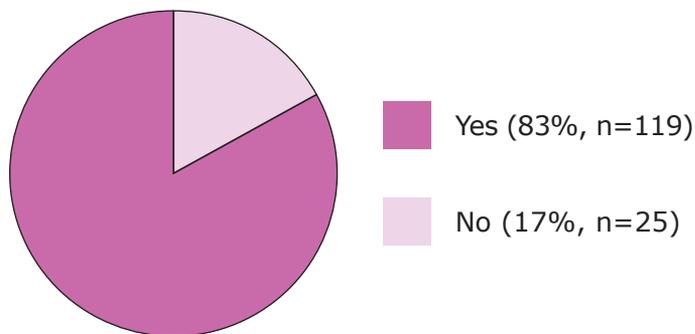


Figure 1B: Frequency of Diversity Training Among Dental Hygiene Students



Total percent of training among both groups – Yes: 78%, No: 22%

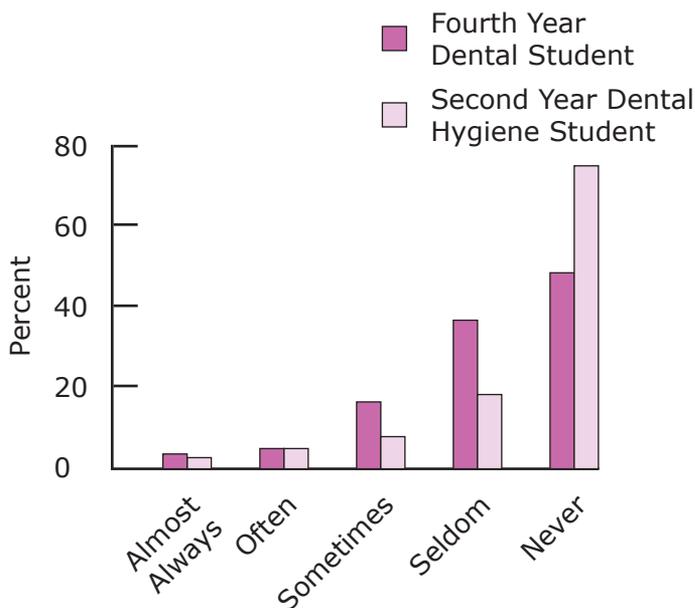
“agreed” that their college climate was positive. They agreed (“agreed” or “strongly agreed”) that their educational experience was rewarding (90%), they felt a sense of belonging in their school (89%) and the school provided an environment for free and open expression of ideas, opinions and beliefs (79%).

Differences among Groups about Cultural Climate

The Mann Whitney U test indicated a significant difference ($p < 0.001$) between the dental and dental hygiene students regarding the extent of racial conflict on campus. As illustrated in Figure 2, dental hygiene students reported significantly less racial conflict on campus (76% “never”) than dental students (50% “never”). Among all the students, there was no significant gender difference regarding perceptions of racial conflict (Mann Whitney U test, $p = 0.582$).

African-American students reported somewhat less positive experiences than the other student groups. As seen in Figure 3, a Kruskal-Wallis test indicated a significant difference among the ethnic groups regarding their agreement as to whether their educational experience was rewarding ($p = 0.047$). Mann-Whitney U tests showed that African-Americans reported a significantly lower level of agreement than Whites ($p = 0.003$) and Asian-Americans ($p = 0.008$). The other between group differences did not approach significance ($p > 0.30$), except for African-Americans reporting marginally less agreement than Hispanics ($p = 0.062$). Also, compared to Whites and Asian-Americans, African-American students reported having significantly greater difficulty getting help from clinical and classroom faculty and other students ($p \leq 0.024$).

Figure 2: Racial Conflict According to Program

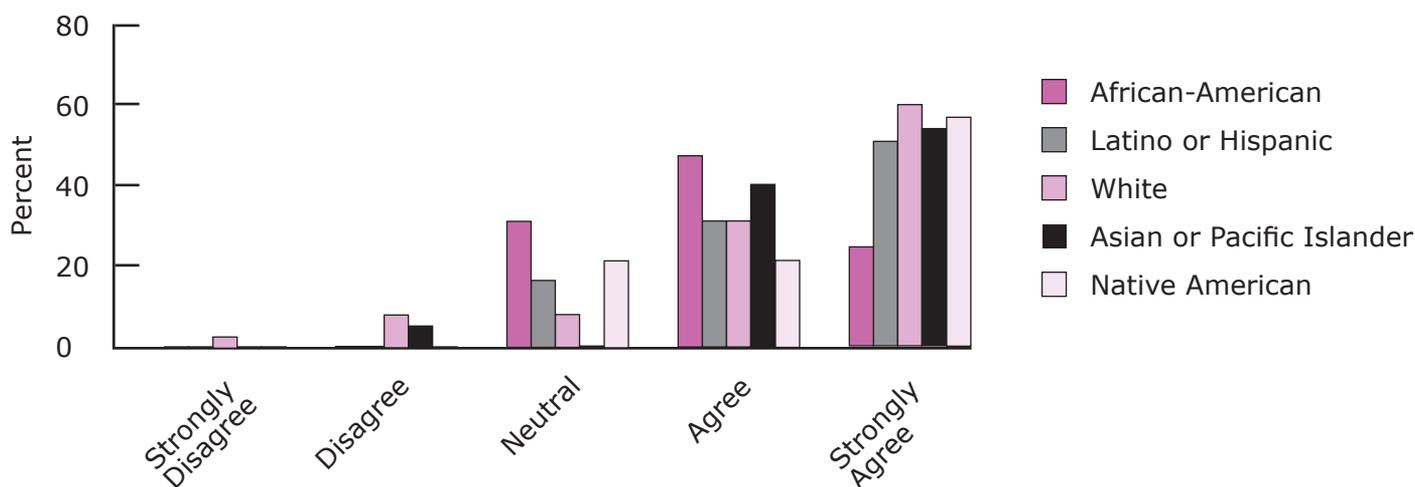


Dental hygiene students reported significantly less racial conflict than dental students ($p < 0.001$).

Factors Influencing Satisfaction with Cultural Climate

Spearman’s correlations indicated that overall satisfaction with the educational experience was significantly correlated with fair treatment by classroom faculty ($\rho = 0.487$, $p < 0.001$), clinical faculty ($\rho = 0.511$, $p < 0.001$) and other students ($\rho = 0.441$, $p < 0.001$). Significant correlations with overall satisfaction were also found with respect for other cultures; specifically, respect by faculty for students of different ethnic groups ($\rho = 0.391$, $p < 0.001$), respect by students for other students of different ethnic groups ($\rho = 0.441$, $p < 0.001$) and friendship between students of different ethnic groups ($\rho = 0.422$, $p < 0.001$).

Figure 3: Overall Satisfaction According to Race/Ethnicity



For the question “overall my educational experience here has been a rewarding one,” responses for African-American students differed significantly from those of Whites and Asian-Americans ($p \leq 0.008$). Differences between pairs of other ethnic groups were not significant ($p > 0.05$).

Discussion

Cultural Climate

In this study, the dental and dental hygiene students generally reported a positive cultural climate at their southwestern dental schools. They rarely experienced racial tension or pressures, were treated fairly and with respect, got the support they needed and were comfortable interacting with people of different race/ethnicity and culture. The students also reported that their schools provided them with free expression of their ideas and beliefs and that they “belonged” at their school. Overall, their educational experience was rewarding to them. The overwhelming majority did not believe that race/ethnicity caused unfair treatment. These researchers had anticipated other factors might cause unfair practices. However, none of the factors evaluated – religion, sexual orientation, age or gender – were perceived as causing insensitive or unfair treatment to any great degree.

Diversity Training

In terms of diversity awareness, students highly agreed they practiced the behaviors of culturally competent individuals. Although almost 80% of the students reported having diversity training at their present school, they did not believe their school experiences contributed to their diversity awareness behaviors. However, this study showed that their training probably did influence their behaviors, such as stopping themselves from using offensive language and using negative language as an opportunity to educate people about cultural awareness. Diversity training does seem to be

making a positive impact on the cultural climate of southwestern dental schools.

Differences Among Groups about Cultural Climate

There were some differences in how the cultural climate was perceived by various groups. African-Americans reported a significantly less rewarding experience than Whites and Asians and had more difficulty getting help. Other studies have reported that African-American students have a less positive experience than other groups on campus.^{11,25,26} This may be a phenomenon of our broader society rather than just dental schools, but it still needs to be addressed. Also, dental hygiene students experienced less racial conflict than dental students. This cannot be explained by the proportion of minority students in the 2 programs, because these were similar. It also cannot be explained by gender differences, because, across programs, there were no significant differences between males and females regarding the perception of racial conflict. Therefore, this must be due to program differences rather than gender. Possibly some strategy or positive behaviors are in the place in dental hygiene programs that need to be identified and introduced into dentistry.

A small number of students believed preferential treatment was given to minorities at their college, favoring them over White students. The view was expressed that the increasing diversity of the classes and the focus on cultural competence was giving minority students an unfair advantage. Hopefully, these attitudes will change with training and the passage of time.

Factors Influencing Satisfaction with Cultural Climate

These researchers sought to identify cultural climate factors that positively influenced satisfaction with the dental school experience. This information could help schools focus their efforts on improving their cultural climates. The highest significant correlation in this study was between fair treatment from faculty and students and having a rewarding educational experience. Significant associations were also found between respect for other cultures by faculty and students and a rewarding educational experience. Helm, Sedlacek and Prieto, developers of the Cultural Attitudes and Climate Questionnaire, also found overall satisfaction was significantly correlated with respect for other cultures and that fair treatment by students and faculty members had the highest correlation with overall satisfaction among all racial/ethnic groups.²³ Fair treatment and respect for all cultures should be a focus of cultural competence training.

Recommendations

The research findings indicate that these southwestern dental colleges are doing well at providing a positive environment for their students. However, maintaining or improving the cultural climate is an ongoing process. Formally assessing cultural climate with an instrument like the Cultural Attitudes and Climate Questionnaire could assist these and other colleges in achieving a highly inclusive environment.²³ Dental schools also need to continue diversity/cultural competency training for their students, as well as for faculty and staff, since diversity training was associated with the increased practice of some culturally appropriate behaviors. Other studies of dental students have also shown improvement in knowledge and self-awareness following cultural competence training.^{17,27} These results stress the importance of training and the need to assess its impact on student behavior. Schools should investigate the best ways to incorporate diversity/cultural competence training into their curricula and share best practices with each other.

We can suggest a few promising approaches for cultural competence training. Since cultural competence is primarily about communication, a method called "nonviolent" or "collaborative" communication is suggested. Though not well researched in this context, this conflict resolution method is based on the premise that all people have the capacity for compassion and only resort to harmful behavior when they do not have more

effective strategies for meeting needs. The training teaches how to identify and express one's needs, hear the same from others and develop strategies for meeting needs across cultures.²⁸ Also, the U.S. Office of Minority Health is developing an online training course for oral health professionals for release in 2014.²⁹ Beyond assessing knowledge, students should be assessed for behavior changes, such as their confidence in providing care for a diverse population and working in a diverse health care team, and their willingness to treat URM, poor and underserved populations after graduation.

Future research could assess cultural climate in other parts of the U.S. as this study only examined southwestern dental colleges. It could also address how to improve the experience of African-American students in dental colleges. The best approaches for faculty, students and staff achieving cultural competence through diversity/cultural competence training should also be further explored.

Conclusion

Regarding the research questions, southwestern dental schools appeared to be doing well at providing a positive cultural experience for their students, especially the dental hygiene programs. There was not any obvious racial conflict or strife. Diversity/cultural competence training did increase the practice of culturally appropriate behaviors and is probably key to improving cultural climate. African-American students generally viewed the cultural climate as less positive than other ethnic/racial groups and fair treatment, respect for other cultures and comfort in cross-cultural interactions were associated with satisfaction with the dental school experience.

Ultimately, creating a positive cultural climate for dental and dental hygiene students will increase the willingness and competence of the graduates to treat a diverse population and so increase access to dental care in this country. These practitioners will also touch thousands of lives over the course of their careers and teach tolerance by example. In a world where bigotry and associated behaviors, such as bullying and hate crimes, have not diminished and seem to be intensifying, there is a great need for culturally competent oral health care practitioners who contribute to a more tolerant and healthier world.

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A Study of Statistics Anxiety Levels of Graduate Dental Hygiene Students

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Introduction

Dental hygienists pursuing advanced degrees face a multitude of challenges. Those seeking a Master of Science in Dental Hygiene from programs in the U.S. must complete at least one research methods course.¹ Research methods courses necessitate that students develop skills in understanding the application of statistical methodology.² These skills are an important component of graduate dental hygiene education as they are essential for effective engagement in evidence-based practice, the art of integrating clinical research into decision-making about patient care.^{3,4} However, for many graduate students, statistical concepts are confusing and anxiety provoking.⁵⁻⁸ Onwuegbuzie and Wilson suggested that from 67 to 80% of graduate students in the behavior and social sciences experience statistics-related anxiety when confronted with statistical content, when interpreting and applying statistics in problem situations, or when evaluating statistics in contexts.⁷

Statistics Anxiety

Statistics Anxiety has been defined as an unpleasant cognitive and psychological reaction that manifests itself "when an individual experiences anxiety as a result of encountering statistics in any form, at any level."⁸ Statistics Anxiety is a situation-specific temporary feeling "characterized by worry, intrusive thoughts, mental disorganization, tension, and physiological arousal"⁹ that has a debilitating effect on learning and achievement in statistics courses and in research methodology.^{2,10-14} Six Statistics Anxiety factors were identified in a seminal study by Cruise et al:⁵

1. Worth of statistics
2. Interpretation anxiety
3. Test and class anxiety
4. Computational self-concept
5. Fear of asking for help
6. Fear of statistics teachers

Prior to the Cruise et al. study, researchers looked at Statistics Anxiety as being synonymous with mathematics anxiety.^{5,10,15} Studies have found that Statistics Anxiety has a connection with mathematics preparation and background.^{7,10,15,16} None-

Abstract

Purpose: In light of increased emphasis on evidence-based practice in the profession of dental hygiene, it is important that today's dental hygienist comprehend statistical measures to fully understand research articles, and thereby apply scientific evidence to practice. Therefore, the purpose of this study was to investigate statistics anxiety among graduate dental hygiene students in the U.S.

Methods: A web-based self-report, anonymous survey was emailed to directors of 17 MSDH programs in the U.S. with a request to distribute to graduate students. The survey collected data on statistics anxiety, sociodemographic characteristics and evidence-based practice. Statistics anxiety was assessed using the Statistical Anxiety Rating Scale. Study significance level was $\alpha=0.05$.

Results: Only 8 of the 17 invited programs participated in the study. Statistical Anxiety Rating Scale data revealed graduate dental hygiene students experience low to moderate levels of statistics anxiety. Specifically, the level of anxiety on the Interpretation Anxiety factor indicated this population could struggle with making sense of scientific research. A decisive majority (92%) of students indicated statistics is essential for evidence-based practice and should be a required course for all dental hygienists.

Conclusion: This study served to identify statistics anxiety in a previously unexplored population. The findings should be useful in both theory building and in practical applications. Furthermore, the results can be used to direct future research.

Keywords: dental hygienists, statistics, anxiety, evidence-based practice, graduate education

This study supports the NDHRA priority area, **Professional Education and Development:** Assess how educators are socializing students to research.

theless, scholars have come to the conclusion that it is a related, yet distinctly different concept from mathematics anxiety.^{5,10,15}

A number of studies have looked at Statistics Anxiety in certain populations. Onwuegbuzie reported African-American graduate students have higher levels of Statistics Anxiety than do their Caucasian counterparts.¹⁷ Some studies reported women have higher Statistics Anxiety than do men,^{18,19} yet other studies have failed to support these findings.²⁰ Also, the age of students has been reported as having an association, with older students experiencing more Statistics Anxiety than younger students.²¹

Appropriately, adult learning theory supports the idea that instructional practices that actively engage learners while taking into account affective environmental factors can mitigate statistics anxiety.²² Among pedagogical factors shown to influence Statistics Anxiety are timed versus untimed exams,²³ on-campus versus online courses⁶ and shorter versus longer courses,²⁴ wherein the latter resulted in lower levels of Statistics Anxiety in each case. Other research indicated using computers in teaching statistics lessens anxiety and promotes positive attitudes toward statistics.²⁵ Further, inclusive teaching strategies designed around sensitivity to Statistics Anxiety, instructor attentiveness in combination with real-life applications, and instructor immediacy with feedback were shown to reduce Statistics Anxiety.²⁶⁻²⁸ Conversely, insensitive instructor behavior and harsh grading practices increased Statistics Anxiety.⁶

Statistics Anxiety Measures

An extensive literature review on Statistics Anxiety assessment discovered 4 main instruments that have been developed specifically to measure Statistics Anxiety. They are the Statistical Anxiety Rating Scale,⁵ the Statistics Anxiety Inventory,¹⁰ the Statistics Anxiety Scale²⁹ and the Statistics Anxiety Measure.¹¹ The most widely used is the Statistical Anxiety Rating Scale because it is an instrument with documented validity and reliability.^{7,30}

Statistics Anxiety and Graduate Dental Hygiene Students

To date, there are no published studies that have explored the levels of Statistics Anxiety in graduate dental hygiene students. Only one investigation involving health professionals was found in the literature. In a 1978 study, Wolfe examined anxiety toward statistics and stereotypical

beliefs about statistics among nursing students.³¹ Therefore, the present study examining levels of Statistics Anxiety among graduate dental hygiene students was warranted.

In light of increased emphasis on evidence-based practice in the profession of dental hygiene, it is important that today's dental hygienist comprehend statistical measures to fully understand research articles and, thereby, apply scientific evidence to practice.^{3,32-35} Accordingly, this study sought to determine the state of knowledge regarding Statistics Anxiety in graduate dental hygiene students in the U.S.

Methods and Materials

The study was an exploratory, cross-sectional survey of Statistics Anxiety levels among dental hygiene graduate students in the U.S. using the Statistical Anxiety Rating Scale instrument. Of 22 graduate dental hygiene programs listed in the American Dental Hygienists' Association (ADHA) website, 17 offered a Master of Science degree in dental hygiene (MSDH).³⁶ Students in these programs constituted the target group for this study.

Data Collection Procedure

Prior to initiation of the study, an exempt status application was approved by the institutional review board of The University of Texas Health Science Center at San Antonio. An invitation to participate in the research study was emailed to the directors of the 17 MSDH programs. The invitation explained the purpose of the study and requested program directors to forward the electronic link to the web-based survey and consent form to students enrolled in Fall 2013 MSDH programs. The program directors were further asked to send an email reply to the recruitment letter stating the number of students to whom they sent the survey link for response rate calculations. Three weeks after the initial email solicitation, a second email recruitment letter was sent to non-responding program directors. No identifiable information about the program directors' universities or colleges was used in the study.

The emailed recruitment letter provided instructions to access the online cover letter and consent form and to complete the survey. Students were informed that participation in the study was voluntary and anonymous, they could skip items, and they could decline to participate or stop responding at any time without penalty. The survey was distributed using SurveyMonkey®

Table I: Statistical Anxiety Rating Scale Factors, Number of Items, Score Ranges and Corresponding Sample Items

Factor	Number of Items	Score Range	Description and Sample Item
Worth of Statistics	16	16 to 80	A person scoring high on this factor sees no value in learning statistics. "I feel statistics is a waste."
Interpretation Anxiety	11	11 to 55	A person scoring high on this factor has difficulty interpreting statistical data. For instance, when "Making an objective decision based on empirical data."
Test and Class Anxiety	8	8 to 40	A person scoring high on this factor is very anxious about being in a statistics course and taking exams. For instance, when "Studying for an examination in a statistics course."
Computation Self-Concept	7	7 to 35	A person scoring high on this factor has anxiety about statistics because it involves mathematical calculations. "I could enjoy statistics if it weren't so mathematical."
Fear of Asking for Help	4	4 to 20	A person scoring high on this factor experiences anxiety when seeking help from the professor or other students. For instance, when "Asking my statistics teacher for individual help with material I am having difficulty understanding."
Fear of Statistics Teachers	5	5 to 25	A person scoring high on this factor sees statistics teachers as impersonal and intimidating. "Statistics teachers are so abstract they seem inhuman."

software and was available for completion online for approximately 4 weeks. Secure Sockets Layer encryption was used to provide encrypted survey links and survey pages. Students' responses were encrypted, stored in a SurveyMonkey® account and downloaded through an encrypted format.

Data Collection Instrument

The web-based survey collected data on Statistics Anxiety, sociodemographic features and evidence-based practice (EBP). The survey was uploaded to SurveyMonkey® and accessed by students through the emailed URL link.

Levels of Statistics Anxiety were assessed using a web-based version of the Statistical Anxiety Rating Scale. The Statistical Anxiety Rating Scale was developed in 1980 by Cruise and Wilkins.⁵ It consists of 51 self-report items with responses gathered on a 5-point Likert scale (from none to high) for the 6 factors described in Table I. The first 23 items indicate how much anxiety a respondent would experience in each situation. The remaining 28 items indicate level of agreement with statements related to statistics. In either instance, higher scores indicated higher Statistics Anxiety.

The validity of the Statistical Anxiety Rating

Scale was determined in 2 ways. Face validity was obtained by presenting the 6 factors and their items for review to a group consisting of 5 statistics professors and 5 doctoral students. Construct validity was obtained through principal component factor analysis with varimax rotation. Reliability was assessed using Cronbach's alpha, point multi-serial correlations, and test-retest estimates. Cronbach's alpha coefficients ranged from 0.65 to 0.96. Multi-serial correlations fell between 0.59 and 0.91. Test-retest estimates ranged from 0.67 to 0.83.

Each factor, composed of a subset of items, measured a distinct aspect of Statistics Anxiety. The Statistical Anxiety Rating Scale total score was calculated as the sum of the responses on the 51 items. Each factor score was calculated as the sum of the responses to items composing that factor. Cruise et al provided percentile rank charts for the factor scores.⁵

Sociodemographic data included personal characteristics as well as enrollment status, program delivery method and previous experience with mathematics and statistics courses. Additionally, students were asked to indicate their degree of agreement with 5 statements on EBP on a 5-point Likert scale, with 5 showing the strongest level of agreement. The sociodemographic survey items

and the EBP statements were developed by one of the researchers specifically for this study.

Data Analysis

Survey responses and frequency summaries for sociodemographic and EBP data were extracted from SurveyMonkey®. Statistical Anxiety Rating Scale data were summarized and analyzed using Microsoft Excel 2010; incomplete data were excluded. The statistical significance level was set at $\alpha=0.05$. Bonferroni corrections were used to adjust for multiple comparisons.³⁷

Cronbach’s alpha, a measure of internal consistency reliability, was computed for each of the factor scores.³⁸ Descriptive statistics for the Statistical Anxiety Rating Scale total and factor scores were calculated. Median percentile rank equivalent scores³⁹ were calculated by comparing the median factor scores in the present study to the percentile rankings given in the graduate percentile chart in the Cruise et al study.⁵ The median percentile rank equivalent scores provided a means to assess students’ levels of Statistics Anxiety, as measured by the Statistical Anxiety Rating Scale factor scores.³⁹ For instance, a median percentile rank equivalent score of 60 would indicate that at least half of the graduate dental hygiene students in the present study scored higher than 60 percent of the graduate students in the norm group on that dimension of statistics anxiety. Pearson’s correlation coefficients were used to determine whether relationships existed between the Statistical Anxiety Rating Scale total score and continuous demographic variables.

Results

Sample

The response rate for the survey could not be determined with certainty because only 8 of the 17 program directors sent back email replies to the recruitment letter. Of those, only 7 provided the number of students who received the survey link. The link was sent to 80 students from those 7 programs. Seventy-eight students submitted the online survey. One survey contained incomplete Statistical Anxiety Rating Scale data and was eliminated, resulting in 77 usable surveys.

Sociodemographic Data

The sociodemographic data showed that the students were 97.4% female, 88.3% non-Hispanic, 92.1% White and 61.3% married. Further, 52.6% of the students were working full-time, 79.0% were

Table II: Internal Consistency Coefficients for Statistical Anxiety Rating Scale Factor Scores in the Present Study

Factor	Number of Items	Cronbach’s Alpha
Worth of Statistics	16	0.90
Interpretation Anxiety	11	0.84
Test and Class Anxiety	8	0.76
Computation Self-Concept	7	0.76
Fear of Asking for Help	4	0.66
Fear of Statistics Teachers	5	0.64

enrolled in graduate school part-time and 84.4% were enrolled in predominantly online MSDH programs.

The mean age was 36.4 years and ranged from 23 to 58 years for the 54 students who responded to the age question. Statistical Anxiety Rating Scale total and factor scores were not statistically different between students who reported their ages and those who did not ($p>0.05$). Therefore, all analyses were performed on the combined sample.

Seven students reported they had not taken any, while 90.9% had taken at least 1 college-level statistics course and, on average, in the previous 2.5 years. Fifty percent had taken 2 college-level math or statistics courses.

Statistical Anxiety Rating Scale Data

As reported in Table II, Cronbach’s alpha for the 6 Statistical Anxiety Rating Scale factors in this study ranged from 0.64 to 0.90. The value 0.64 for the factor Fear of Statistics Teachers and 0.66 for the factor Fear of Asking for Help are based on 5 and 4 items, respectively. Nunnally pointed out that the value of Cronbach’s alpha is “a direct function of the number of test items,” with fewer items yielding lower coefficients.³⁸

Table III displays descriptive statistics for the Statistical Anxiety Rating Scale total and factor scores and the mean percentile rank equivalent median percentile rank equivalent scores. The median percentile rank equivalent scores ranged from 45 to 69. The scores indicated students’ median

Table III: Descriptive Statistics and median percentile rank equivalent scores for the Statistical Anxiety Rating Scale Factors in the Present Study

Factor	Mean	SD	Median	Minimum	Maximum	Median Percentile Rank Equivalent Score
Worth of Statistics	32.9	13.0	31	16	72	60
Interpretation Anxiety	28.5	9.1	29	11	48	69
Test and Class Anxiety	25.9	6.6	26	9	39	61
Computation Self-Concept	15.0	5.9	15	7	30	55
Fear of Asking for Help	8.6	4.0	8	4	18	66
Fear of Statistics Teachers	10.3	3.8	10	5	23	45
Total	121.1	33.0	119	60	194	N/A*

*Cruise et al. does not provide percentile values for Statistical Anxiety Rating Scale total scores⁵

Table IV: Summary of Responses to EBP Statements

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Question	Number (Percent)*				
I am learning about evidence-based practice in my MSDH program. (n=77)	1 (1.3%)	0 (0.0%)	5 (6.5%)	7 (9.1%)	64 (83.1%)
Knowledge and skills of statistics are essential to evidence-based practice. (n=77)	1 (1.3%)	1 (1.3%)	4 (5.2%)	13 (16.9%)	58 (75.3%)
Evidence-based practice will be useful in my profession as a dental hygienist. (n=77)	1 (1.3%)	2 (2.6%)	3 (3.9%)	12 (15.6%)	59 (76.6%)
Statistics will be useful in my profession as a dental hygienist. (n=76)	2 (2.6%)	7 (9.2%)	9 (11.8%)	19 (25.0%)	39 (51.3%)
Statistics should be a required course for all dental hygienists. (n=76)	4 (5.3%)	6 (7.9%)	10 (13.2%)	19 (25.0%)	37 (48.7%)

*Percents might not sum to 100% due to rounding

score for Fear of Statistics Teachers was at the 45th percentile and Interpretation Anxiety was at the 69th percentile when compared to graduate students in the Cruise et al study.⁵

No significant correlations were found between the Statistical Anxiety Rating Scale total score and age of students, number of college-level math or statistics courses taken, or number of years since college-level statistics was last taken ($p > 0.05$).

EBP Data

The summary of EBP data in Table IV shows

92.2% of the students agreed statistical knowledge and skills are essential to evidence-based practice, and 73.6% agreed statistics should be a required course for all dental hygienists.

Discussion

Representativeness of Sample

The sample of 77 dental hygiene graduate students in this study represented 8 of the 17 MSDH programs in the U.S. The students are predominantly non-Hispanic, White and female, characteristics that mirror the national distribution of

ethnicity, race and gender of dental hygiene students as given in the 2013 ADHA fact sheet.¹

Statistics Anxiety

The study findings indicated that Statistics Anxiety exists in graduate dental hygiene students. Median percentile rank equivalent scores for the Statistical Anxiety Rating Scale data revealed that this population has low to moderate Statistics Anxiety.³⁹ On 5 of the 6 Statistical Anxiety Rating Scale factors (Worth of Statistics, Interpretation Anxiety, Test and Class Anxiety, Computation Self-Concept and Fear of Asking for Help), the median percentile rank equivalent scores of graduate dental hygiene students in this study indicated their statistical anxiety levels exceeded those of graduate students in the Cruise et al study.⁵ However, no Statistical Anxiety Rating Scale factor reached a median percentile rank equivalent score above the 69th percentile. Most of the students having had one or more statistics courses, fairly recently, might account for this finding. Research has shown that previous experience with statistics reduces statistics anxiety.¹³

Of serious concern is that the level of Interpretation Anxiety in dental hygiene graduate indicates this population could struggle with making sense of scientific research. This finding's direct relation to EBP underscores its importance.^{3,34} Interpretation Anxiety could hinder the use of statistics in one's professional career.³

The Statistics Anxiety results for dental hygiene graduate students are similar to those found in other studies that included a combination of graduate students in education, nursing, personal financial planning, exercise sports sciences, mass communications and forensic science,²⁸ and in education only.⁴⁰ Other researchers have reported moderate to high levels of Statistics Anxiety in graduate students from the social and behavioral sciences.^{2,41-43} Future empirical studies might be undertaken to compare Statistics Anxiety levels between dental hygiene graduate students and graduate students from other disciplines.

Unlike results in previous studies, neither age, math and statistics background, time since last statistics class or program delivery method (online, campus-based) emerged as significantly related to Statistics Anxiety in this study.^{7,21} No statistically significant relationships between Statistics Anxiety and employment status (full-time, part-time) or enrollment status (full-time, part-time) were found. Gender differences were not

investigated. Future studies could examine these variables in the context of a broader sample.

Evidence-Based Practice

Over 90% of students surveyed agreed that statistical knowledge and skills are essential to evidence-based practice and should be a required course for all dental hygienists. The responses indicated that participants recognized the vital role statistics plays in their profession, particularly its relevance to evidence-based practice.

Implications

The study has a number of implications. Statistics Anxiety is a potential barrier to professional growth for dental hygiene graduate students after program completion. To critically appraise scientific research, dental hygienists need to feel comfortable delving into the statistical aspects of studies.^{3,34} Working with other health professionals also could be hindered by Statistics Anxiety. "Understanding the language of statistics gives all health care providers a common language despite the differences between the professions."³⁴

For administrators and faculty in MSDH programs, the findings suggest course content and teaching practices should reflect awareness that some students in the program might be dealing with Statistics Anxiety. Faculty who teach research methods or statistics courses could use the Statistical Anxiety Rating Scale at the beginning of the semester to assess graduate students' Statistics Anxiety levels, and then work closely with students identified as having elevated statistics anxiety.³⁹

This study attempted to gather information about an understudied population. While some research has been done on dental hygiene graduate students on local levels, studies at the national level are scarce. This population is important to the profession as its members most likely will become the future faculty that will teach and influence undergraduates and graduates thereby shaping the profession.

Finally, most of the students surveyed were in programs delivered primarily online.³⁶ Intervention studies that seek to identify ways to develop statistical proficiency in online environments without triggering statistics anxiety are warranted. In addition, an empirical study investigating statistics anxiety in health professionals could generate a larger sample to conduct more sophisticated analyses.

Limitations

By design, this study was an exploratory investigation, so causative factors could not be determined. One limitation of the study is that it relied on information reported on the ADHA website. The programs that were explicitly MSDH programs were not easily discernible. Therefore, students who accessed the survey were instructed to exit the survey if they were not in an MSDH program.

The researchers assumed that students comprehended the survey items and answered accurately and truthfully, to the best of their ability. However, because the study used a self-report survey with Likert-type choices, the responses were vulnerable to undesirable respondent behaviors. Such behaviors include giving socially-desirable responses, tending to select similar options, tending to agree with statements, giving random responses, and not completing the survey.^{38,45}

To enhance response quality, the survey was disseminated through program directors and presented as a voluntary, anonymous online survey, in which students could skip items.⁴⁶⁻⁴⁸

Conclusion

This study served to identify Statistics Anxiety in a previously unexplored population. The purpose of the study was to measure Statistics Anxiety in dental hygiene graduate students and thereby increase Statistics Anxiety awareness for stakeholders. Knowledge of dental hygiene graduate students' Statistics Anxiety could be used by MSDH program directors and faculty to assess the need for tailored courses and teaching methods that promote

student success with statistical concepts and thus enhance their abilities to comprehend and engage in scholarly research. Students could use the information to manage personal graduate experiences that require the understanding and application of statistics and to seek out helpful resources and extra assistance as needed.

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Knowledge, Attitudes and Practices of Dental Hygienists Regarding Caries Management by Risk Assessment

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Introduction

Dental caries is still one of the most prevalent chronic diseases in the U.S.¹ According to the National Health and Nutrition Examination Survey 2004, 92% of adults age 20 to 64 have experienced dental caries in their permanent teeth.² The Centers for Disease Control and Prevention currently report that over 19% of children ages 2 through 19 years have untreated dental caries.³ Dental caries continue to pose a substantial problem despite the continual development of new means to prevent and treat the caries process.

The most recent attempt to control dental disease is to assess caries risk factors and manage caries, based on preventive and curative clinical procedures. One protocol, termed Caries Management by Risk Assessment (CAMBRA), is an evidence-based approach to preventing, reversing and, when necessary, repairing early damage to teeth.⁴⁻⁷ The practice of CAMBRA involves calculating the patient's risk factors for caries development, and prescribing preventive treatment based on risk levels categorized as low, moderate, high or extreme caries risk.^{8,9} The protocol includes obtaining information about the patient by means of a questionnaire, intraoral examination, dental radiographs and other tests, that can be performed by a licensed oral health care provider such as the dental hygienist. As a preventive oral health care specialist, the dental hygienist is the ideal provider to perform much of CAMBRA protocol.^{7,10-13}

CAMBRA has been shown to reduce caries risk, as was suggested in a 2 year clinical trial of anti-caries, therapies targeted according to risk assess-

ment.¹⁴ Furthermore, it has been suggested that CAMBRA would be economically viable in private practice.^{13,15}

While following CAMBRA protocol in clinical dental care has shown promise in reducing caries risk, implementation in private practice has met resistance.¹⁶⁻¹⁸ Performing some type of caries risk as-

Abstract

Purpose: The purpose of this study was to survey dental hygienists to determine their knowledge, attitudes and practices regarding the implementation of caries risk assessment, particularly caries management by risk assessment (CAMBRA), in private dental practices.

Methods: A 17 item survey was developed to evaluate dental hygienists' knowledge, attitudes and practices related to CAMBRA and perceived barriers to CAMBRA implementation in private dental practice. Surveys were mailed to a randomized sample of 1,000 dental hygienists licensed to practice in California. Responses were tabulated for each respondent, and the response frequency for each survey item was calculated. Respondents' comments to the open-ended question were compiled, according to themes.

Results: The response rate was 18%. Only 66% of the respondents were familiar with the term CAMBRA, although 89% agreed with its underlying principles of risk assessment. CAMBRA protocol had been implemented in 40% of the respondents' employment sites. Respondents disagreed that time (45%) and cost of products (68%) were barriers to implementation. Many did not know their employers' knowledge or attitudes about CAMBRA and its implementation, as evidenced by a "don't know" response range of 29 to 48% for the 4 relevant statements. Respondents' comments included both successes and barriers implementing CAMBRA.

Conclusion: CAMBRA protocol has not been widely implemented in private practice, although the current data do not indicate insurmountable barriers. Broader dissemination may be feasible if dental hygienists would obtain more comprehensive knowledge of evidence-based risk assessment protocols and would assume a leadership role in implementing CAMBRA protocols and procedures in private dental practices.

Keywords: caries management by risk assessment, dental caries prevention and control, dental hygienist, risk assessment

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Investigate how dental hygienists identify patients who are at-risk for oral/systemic disease.

assessment has been more widely adopted than implementing CAMBRA protocol that includes using a special form, documenting the outcomes and providing an individualized caries management plan, based on the patient's caries risk status.¹⁸⁻²⁰

Reasons for this lack of CAMBRA implementation have not been well documented. However, discussions in current literature and anecdotal comments suggest the involvement of multiple barriers.^{21,22} Dental hygienists are in a good position to recognize these barriers, as they are usually the dental personnel who implement preventive protocols. Their perceptions may shed light on why CAMBRA has not been more widely adopted in private practice.

The purpose of this study is to survey dental hygienists to determine their knowledge, attitudes and practices regarding the implementation of caries risk assessment, particularly CAMBRA, in private dental practices.

Methods and Materials

This prospective, cross-sectional study was approved by the institutional review board of the University of California, San Francisco. The study population consisted of dental hygienists licensed, and in good standing, to practice in California from 1972 to present. A randomized sample of 1,000 subjects was selected from a population of 15,320 by a computerized randomization process performed by R&D Data Corporation. This private company brokers files of names, license numbers and addresses of individuals licensed through the California Department of Consumer Affairs. Assuming a 40% response rate, a sample size of 400 respondents was statistically determined, based on the expectation that 50% of the dental hygienists would not have familiarity with CAMBRA, and using a confidence level of 95% with a total width of 0.10 (+0.05). For recruitment mailing addresses of the subjects were also obtained from the R&D Data Corporation.

The 17 item survey, evaluating dental hygienists' knowledge, attitudes and practices related to CAMBRA, was composed of 1 item on CAMBRA familiarity (yes/no response option), 11 items on CAMBRA concepts and implementation (4 point Likert-type response options ranging from strongly agree to strongly disagree, plus don't know), 1 open-ended item about barriers/facilitators related to CAMBRA implementation in the respondents' practice settings and 4 demographic items. The survey was pretested on a convenience sample of 5 practicing dental hygienists for clarity of content. Modi-

fications were made to improve comprehension of questions.

After survey pretesting and refinement, the survey was mailed to the 1,000 randomly selected California-licensed dental hygienists along with a recruitment cover letter, a letter of consent explaining the study purpose, risks and benefits, and a self-addressed, postage-paid return envelope. Return of the survey indicated consent to participate in the study. Surveys were coded to ensure subject confidentiality, while permitting follow-up of non-respondents. Follow-up mailings were sent to non-respondents 3 weeks following the initial mailing.

Responses to the surveys were tabulated for each respondent, using Microsoft Excel, and the response frequency for each survey item was calculated. Some items were examined in terms of the respondents' familiarity with CAMBRA. Comments from respondents to the open-ended question were compiled, according to themes.

Results

Two mailings of the survey resulted in a response rate of 18% (178 respondents). Of the 178 respondents, 173 completed the survey and only their responses were included in the analysis.

Demographic Characteristics

Most of the respondents reported that they were employed in general practice, but over half were employed ≤ 30 hours per week (Table I). A small percentage was not practicing, and 35% were members of the American Dental Hygienists' Association (ADHA). The respondents' years of graduation were distributed similarly in intervals from 1972 to present.

Of the 173 respondents, 66% reported that they were familiar with the term CAMBRA. Examining the demographic characteristics of the respondents on the basis of their familiarity with CAMBRA provided additional information (Table II). The majority of ADHA members, those currently working, and those having graduated within the past 20 years, were familiar with CAMBRA.

Knowledge, Attitudes and Implementation

Respondents rated their level of agreement with statements addressing various aspects of caries risk assessment and CAMBRA (Table III). Most of the respondents agreed that "assessment of caries risk for a patient can predict whether or not that

Table I: Demographic Characteristics of Respondents (n=173)

	Percent
Practice Characteristic*	
General dental practice	91%
Pediatric dental practice	7%
Other specialty practice	14%
Public health dental hygiene	4%
Year of Graduation from Dental Hygiene Program**	
2005 or later	23%
1994-2004	27%
1983-1993	20%
1972-1982	29%
Hours practicing dental hygiene per week**	
Greater than 30 hours	36%
Less than or equal to 30 hours	57%
Currently not practicing	8%
ADHA Member	
Yes	35%
No	65%

*Respondents allowed to select more than one response

**Percentages may not equal 100 due to rounding of numbers

patient develops caries in the future," but only 70% agreed that "CAMBRA improves caries prevention in clinical dental practice." Among the respondents who reported familiarity with the term CAMBRA, the percentage that agreed with the above statement was higher (81%). Very few of the respondents disagreed that "the dental hygienist would be an ideal candidate for implementation of CAMBRA."

Respondents rated their level of agreement with statements describing the extent of implementation of CAMBRA or other caries risk assessment in the practice in which they worked the greatest amount of time (Table IV). Fewer than half reported that the office followed CAMBRA protocol. Two-thirds of all respondents reported that they assess caries risk, but in a form other than that of CAMBRA.

Barriers to CAMBRA Implementation

More respondents disagreed than agreed with the barriers to CAMBRA implementation, which were listed in the survey (Table III). Less than one-third of the total respondents agreed that there was not

Table II: Familiarity with CAMBRA Based on Demographic Characteristics

Demographic Characteristic	Total number of respondents (n)	Respondents familiar with CAMBRA (n) (Percent*)
All Respondents	173	114 (66%)
ADHA Member	59	47 (80%)
Full time (>30 hours/week)	13	5 (38%)
Part time (<30 hours/week)	98	62 (63%)
Not currently working	62	47 (76%)
Graduated from dental hygiene program: 2005 or later	40	32 (80%)
Graduated from dental hygiene program: 1994 to 2004	46	33 (72%)
Graduated from dental hygiene program: 1983 to 1993	35	19 (54%)
Graduated from dental hygiene program: 1972 to 1982	49	28 (57%)

*Percentage of the "CAMBRA-familiar" respondents, based on the total number of respondents for the specific demographic characteristic.

enough time during a dental hygiene appointment to include CAMBRA. Of those familiar with CAMBRA, 36% agreed and 51% disagreed that CAMBRA would pose a time barrier. Nearly one-quarter of all respondents did not know whether CAMBRA protocol would pose a time barrier. Only 25% of the total respondents agreed with the statement that: "most patients would not accept the cost of prescription dentifrices or other out-of-pocket expenses."

Most respondents disagreed with the listed barriers that were related to their employers' opinions (Table III). Few respondents agreed with the statements that their employer was not familiar with CAMBRA, was interested in CAMBRA but did not know how to implement it, and was not convinced that CAMBRA would reduce risk of caries. Also, very few reported that their employer believed that "CAMBRA will reduce profitability of restorative work". To note, 29 to 48% of all the respondents reported that they did not know their employers' knowledge or attitudes regarding CAMBRA. Respondents familiar with CAMBRA reported lower percentages (21% to 36%) of not knowing their

Table III: Respondents' Attitudes Regarding CAMBRA

Dental hygienists' attitudes regarding CAMBRA	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
Assessment of caries risk for a patient can predict whether or not that patient develops caries in the future (n=171)	34%	55%	6%	0%	5%
CAMBRA improves caries prevention in clinical dental practice (n=171)	30%	40%	3%	0%	27%
The dental hygienist would be an ideal candidate for implementation of CAMBRA (n=171)	40%	43%	5%	<1%	12%
There is not enough time during a dental hygiene appointment to include CAMBRA (n=161)	7%	22%	34%	11%	26%
Most patients would not accept the costs of prescription dentifrices or other out-of-pocket expenses (n=166)	4%	21%	55%	13%	8%
My employer is not familiar with CAMBRA (n=165)	8%	15%	32%	16%	29%
My employer is interested in CAMBRA but does not know how to implement it (n=164)	1%	9%	34%	14%	42%
My employer is not convinced that following CAMBRA protocol is effective at reducing risk of caries (n=166)	2%	7%	27%	14%	48%
My employer believes that CAMBRA will reduce profitability of restorative work (n=165)	3%	4%	34%	20%	39%

Percentages may not equal 100 due to rounding of numbers.

employer's knowledge and attitudes (i.e., more respondents knew their employer's knowledge and attitudes).

Respondents' Comments on Successes and Barriers

In this study, 39% of the total respondents answered the open-ended question: "Please explain or include additional information about any barriers or successes you have encountered practicing or implementing CAMBRA." Twenty respondents reported success with CAMBRA. Following are representative examples of their responses:

- "...patients have really embraced our caries-prevention program and do not seem deterred by the out-of-pocket expense for products."
- "Education and communication with my patients has been a key component of CAMBRA success."
- "I had great success implementing CAMBRA into my practice. It was well received by all my patients."

The respondents' expressions of challenges to CAMBRA implementation have been organized according to 5 themes. The numbers of respondents with responses related to that theme and representative responses are listed below:

1. Lack of internal support (n=19): "Getting the whole team on board has been a barrier...I'm trying to change that." "Mainly there is... a team-work barrier."
2. Lack of communication with employer/dentist (n=11): "Never worked (34 years) in an office that mentioned CAMBRA." "We have not discussed CAMBRA in our office, I really don't know if the dentist is familiar with it or if he feels it is not effective."
3. Lack of patient acceptance or compliance and confusion with products (n=10): "We have purchased products and weren't very successful with compliance from our patients." "Barriers are patient compliance and follow-through."
4. Time (n=8): "Time is our biggest challenge." "Having the time during the already busy hygiene schedule."
5. Cost (n=8): "The cost was a big deterrent." "The biggest issue for our patients are cost and compliance." "The only barrier that I encountered was the price...It was not affordable for every patient to use and see the benefit."

Discussion

This study surveyed dental hygienists to determine their knowledge, attitudes and practices regarding the implementation of caries risk assessment, particularly CAMBRA, in private dental

Table IV: Caries Risk Assessment Practices In Private Dental Offices of Respondent

	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know
Our office follows CAMBRA protocol (n=168)	12%	30%	36%	6%	16%
Our office assesses caries risk, but in a form other than that of CAMBRA (n=165)	10%	57%	21%	5%	7%

practices. The results indicated that only two-thirds of the respondents were familiar with the term CAMBRA, although most agreed with its underlying principles of caries risk assessment. CAMBRA protocol had been implemented in only 40% of the respondents' dental offices. Most respondents did not agree that time and cost of products were barriers to implementation, and many were not aware of their employers' knowledge or attitudes about CAMBRA and its implementation.

CAMBRA protocol was not widely known among the respondents, as approximately one-third of them reported no familiarity with the term CAMBRA. However, most of the respondents, who were ADHA members, were familiar with CAMBRA. The authors speculate that these ADHA members may be more likely to perceive dental hygiene in terms of the professional model, which was described by Darby and Walsh.²³ Relevant examples of this model are that dental hygiene actions are knowledge based, and the dental hygienist implements self-generated preventive care regimens. Accordingly, these dental hygienists would be interested in furthering their knowledge of evidence-based preventive care, such as CAMBRA. Furthermore, as ADHA members, they may have greater opportunities to attend ADHA component and national meetings, to read the *Journal of Dental Hygiene and Access*, and to receive information about continuing education courses. Most of the respondents who had graduated in recent years were also familiar with CAMBRA. They probably would have been introduced to CAMBRA or some other form of caries risk assessment in their dental hygiene educational programs.

CAMBRA is one of several recognized caries risk assessments. Other caries risk assessment systems include the Caries Risk Assessment Tool (CAT), proposed by the American Academy of Pediatric Dentistry (AAPD)²⁴ and designed for infants, children and adolescents; the American Dental Association (ADA) caries risk assessment forms;²⁵ and the Cariogram™, which uses computer software to display a graphical representation of an individual's caries risk.²⁶

In this study, more than half of the respondents reported that their office is assessing caries risk in a form other than that of CAMBRA. It is unknown

whether they are using one of the previously described protocols or informal judgment, based on clinical expertise and experience. One might also speculate that they may be using an abbreviated form of CAMBRA, or some, but not all, of CAMBRA protocol. According to the findings of the U.S. Dental Practice-Based Research Network, 69% of the surveyed dentists assess caries risk for individual patients in some way, but of those 69%, only 17% use a special form.¹⁹ Another U.S. survey found that 72% of the responding dentists performed some type of caries-risk assessment, but only 27% documented the outcome and only 51% provided a management plan based on the patient's risk status.²⁰ These studies illustrate how dental practices are using elements, but not all aspects, of the CAMBRA protocol. Reports of CAMBRA demonstration projects have stated that CAMBRA protocol had to be modified to meet the specific needs of the practices.²¹ These modifications to CAMBRA have been aimed at reducing cost to patients, enhancing patient compliance and improving efficiency of procedures.^{13,20}

Respondents may have had varied interpretations of the phrase, following CAMBRA protocol. Reports in the literature have described a variety of instructional guidelines for implementing CAMBRA procedures in clinical dental practice.^{5-12,16} The original practice of CAMBRA requires the oral health practitioner to follow a prescribed form, which allows the practitioner to categorize a patient's caries risk status based on disease indicators, risk factors and protective factors.^{8,9} These formalized assessment tools assure that caries risk assessment is not subjective and dependent on possibly limited knowledge and skill level of the practitioner.²² Prescribed guidelines have been used by predoctoral students, as they were being taught the protocols of the CAMBRA-based risk assessment in order to standardize patients' caries risk in an educational setting.^{16,20,27,28}

Practical barriers to CAMBRA implementation, which have been suggested in the literature, include time to complete the multiple steps of CAMBRA protocol, and cost to the patient of caries-prevention products.^{17,21,22} Agreement was mixed among respondents in this study regarding whether CAMBRA poses a time barrier in dental prac-

tice. The percentage of respondents, familiar with CAMBRA, who agreed there was a time barrier, was more than the percentage of the total respondents. However, it was surprising that approximately half of those familiar seemed to disagree. Perhaps, for these respondents, some tasks, such as administering the questionnaire or testing salivary bacterial challenge, were performed by other staff members. More likely, the respondents may have been using an abbreviated form of CAMBRA protocol.

More than half of the respondents felt that cost to the patient was not a barrier to CAMBRA implementation. Comments of several respondents supported these data. On the other hand, almost one-third did agree that the expense of the products would affect implementation. The details of the dental practices, where respondents are employed, are unknown; this latter group of respondents may be serving patients of lower economic status. In general, lower socio-economic individuals have the highest caries risk and incidence, and would benefit greatly from CAMBRA. However, they would most likely experience a financial burden with this protocol. A limitation of this study is the failure to include in the survey questions regarding the economic status of the respondents' patient population, such as the percentage of Medicaid-covered patients. These data may have offered interesting insight into the feasibility of CAMBRA implementation.

The products are expensive, relative to the traditional oral care products. Fluoride dentifrices that contain 1.1% fluoride cost 3 to 4 times greater than over-the-counter dentifrices. Xylitol-containing lozenges or gums, when used at the recommended dose of 6 grams per day,²⁹ would cost approximately 1 to 3 dollars per day. Chlorhexidine rinse, prescribed for daily use 1 week per month,²⁹ is sold in pharmacies for 3-times the cost of traditional mouth rinses. The authors speculate another reason why the preventive products may impede CAMBRA implementation might be patients' confusion by the number of products and associated instructions.

The majority of respondents did not consider their employers to be substantial barriers due to the employers' lack of knowledge of CAMBRA and acceptance of its effectiveness, or due to the financial impact on the practice. However, a surprising percentage of respondents did not know their employer's knowledge and attitudes about CAMBRA. This suggests a lack of communication about preventive treatment philosophies between the dental hygienists and the dentist(s) with whom they work. Respondents who were familiar with CAM-

BRA appeared to know more about their employers' knowledge and attitudes than those unfamiliar. This finding may reflect better communication in general between this group of respondents and their employers.

In spite of the respondents' limited knowledge of employer's opinions, the majority of them disagreed that their employers believed that following CAMBRA protocol would reduce the profitability of restorative work. This finding seems to indicate that these respondents have confidence in their employers' rationale regarding the patients' needs for restorative care. Reduction in profitability of restorative work might not necessarily be considered a negative aspect. Preventive procedures and minimally invasive restorative techniques could generate profit in private dental practice, as well as develop a large base of patients, who are satisfied with their preventive care.^{13,15,16} Recent developments in insurance codes for CAMBRA-associated procedures may provide the practitioner with reasonable financial impetus for this increased focus on preventive care.³⁰

The most frequent barriers reported in open-ended questions were the lack of communication with and support from their employers and other staff members. Many of these respondents indicated that they were challenged with lack of support and collaboration when attempting to adopt more proactive preventive protocols. This perceived lack of support may be another reason why implementation of CAMBRA into private dental practices is limited. In order to implement such a protocol into an already busy and established routine, complete understanding and strong support of CAMBRA and the prevention-oriented treatment model by all team members are essential.¹⁶

While these results provide useful information about dental hygienists' knowledge, attitudes and practices regarding CAMBRA, there are limitations to this study. A low (18%) response rate was obtained, and inherent with a low response rate is the lack of knowledge of the non-respondents. In this study the non-respondents may have been those dental hygienists who were not familiar with CAMBRA or other caries risk assessments. They may have chosen not to participate because of their lack of knowledge or interest. Thus, the number of dental hygienists familiar with CAMBRA in this study may have been greater than in the general population of dental hygienists, thereby creating a response bias.

Another limitation to the results may be the unforeseen ambiguity of terminology. The interpre-

tation of the phrase and familiarity with CAMBRA may have varied among the respondents, from recognition of the phrase to knowing all aspects of CAMBRA procedures. Also, the phrase and extent of CAMBRA implementation may have had differing meanings to respondents, from simply recommending patients to use preventive products, to performing all details of CAMBRA protocol. While these data create a challenge for the investigators to interpret, comments to the open-ended question often clarified the respondents' interpretation of these terms.

Conclusion

Results of this study indicate that CAMBRA was not widely known among respondents. To provide optimal oral preventive care, dental hygienists need to have comprehensive knowledge about evidence-based risk assessment protocols, such as CAMBRA. They could obtain this information by attending continuing education courses or meetings of the dental hygiene association or by reading journal articles on the topic. Many dental hygiene educational programs are incorporating CAMBRA theory and protocols into their curriculum so future dental hygiene graduates hopefully will be better informed.

The reasons why more dental offices have not implemented CAMBRA into their practices are still unclear. Most respondents did not agree that time, cost of products, and their employers' knowledge and attitudes about CAMBRA and its implementation were barriers. Without significant barriers, implementing CAMBRA would be feasible but a leader would be needed to develop and establish protocols and procedures. Dental hygienists need to assume this leadership role. As indicated by the majority of our respondents, the dental hygienist would be the ideal candidate to implement CAMBRA protocols and procedures in private dental practices.

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The Use of Fluorescence Technology versus Visual and Tactile Examination in the Detection of Oral Lesions: A Pilot Study

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Introduction

The importance of oral cancer screening is widely documented in the literature.¹ Oral cancer prevalence continues to increase every year, with an estimated 41,380 new oral cancer cases in 2013.² Over 7,890 of those cases are expected to include a negative prognosis or death from the disease.² In the U.S. alone there are 275,193 cases living with oral cancer, and the average 5 year survival rate for those people is 62.2%.² Late detection of oral cancer (when the cancer has reached stage III or IV) is a contributing factor in high morbidity and mortality rates.³ Several factors contribute to the late detection of cancerous lesions such as not conducting a comprehensive intraoral and extraoral oral cancer screening and the difficulty to detect early precancerous and cancerous lesions. Because of the difficulty in oral cancer early detection, lesions are often detected in advanced stages and show evidence of invasion and metastasis, which results in disfigurement from invasive treatments. Late diagnosis of the disease is unfortunate because oral cancer patients have an 80 to 90% survival rate when lesions are detected early (pre-malignant lesions, or when the lesion is on stage I) (Table I).² Early diagnosis of oral cancer results in minimally invasive procedures and better prognosis.⁴ Pre-malignant lesions, stage I and II oral cancers can remain undetected until symptoms present clinically.^{4,5} According to the National Cancer Institute, the

Abstract

Purpose: This study compared the effectiveness of the VELscope® Vx versus visual and tactile intraoral examination in detecting oral lesions in an adult, high risk population.

Methods: The pilot study compared the intra oral findings between 2 examination types. The sample was comprised of 30 participants who were addicted to either cigarettes or a dual addiction (cigarettes plus hookah). High risk population was defined as males who were current cigarette smokers or had a dual addiction. Two trained and experienced licensed dental hygienists conducted all examinations. Throughout the study, all visual and tactile intraoral examinations were conducted first by one dental hygienist first, followed by the VELscope® Vx fluorescence examinations by the second dental hygienist. All subjects received an inspection of the lips, labial and buccal mucosa, floor of the mouth, dorsal, ventral and lateral sides of the tongue, hard and soft palate, and visual inspection of the oropharynx and uvula. Both evaluations took place in 1 visit in the Dental Hygiene Research Center at Old Dominion University and external sites. All participants received oral cancer screening information, recommendations, referrals for tobacco cessation programs and brochures on the 2 types of examinations conducted.

Results: Participants were considered high risk based on demographics (current smokers and mostly males). Neither visual and tactile intraoral examination nor the VELscope® Vx examination showed positive lesions. No lesions were detected; therefore, no referrals were made. Data indicated the duration of tobacco use was significantly higher in cigarette smokers (14.1 years) than dual addiction smokers (5 years) ($p > 0.005$). The average numbers of cigarettes smoked per day were 13.5 compared to 14.2 cigarettes for dual addiction smokers.

Conclusion: Results from this study suggest the visual and tactile intraoral examination produced comparative results to the VELscope® Vx examination. Findings from this study support that the VELscope® Vx is still considered an adjunct technology and cannot be used exclusively for oral cancer screening.

Keywords: oral cancer, VELscope® Vx, dual addiction, oral potentially malignant lesions

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Investigate how dental hygienists use emerging science to reduce risk in susceptible patients (risk reduction strategies).

Table I: Five-Year Oral Cancer Relative Survival Rate, Based on the Data from the National Cancer Institute, SEER Program, NIH

Site	Stage			
	I	II	III	IV
Lip	96.3%	82.7%	56.7%	48.1%
Tongue	70.7%	58.6%	47.3%	36.7%
Floor of the mouth	72.5%	60.1%	35.8%	29.7%
Gingiva and other soft tissue	80.9%	62.2%	45.1%	40.0%

highest survival rate in early cancerous lesions is for stage I lip cancer (96.3%), whereas the lowest survival rate is for stage II tongue cancer (58.6%).⁵ According to Healthy People 2020, detecting oral and pharyngeal cancers at the earliest stages (stage I and II) is a critical objective.⁶ In 2007, 32.5% of the oral and pharyngeal cancers detected were at their earliest stages.⁶ This suggests that by the year 2020 the percentage of oral and pharyngeal cancers diagnosed at early stages should reach a 10% improvement.⁶ Since oral cancer is mostly detected in late stages, almost one-half of oral cancer survivors are at risk of developing local or regional recurrence and/or distant metastasis.⁷ In addition, up to 90% of treatment failures are for local and regional recurrences.⁷

Early cancer or premalignant lesions can mimic benign lesions, appearing as asymptomatic, white lesions (Leukoplakia) or red lesions (Erythroplakia). The surgical removal of leukoplakia is only obligatory when the dysplasia is diagnosed as moderate to severe. On the other hand, erythroplakia transforms to squamous cell carcinoma or carcinoma in situ in 90% of the cases. However, some of the red and white lesions do not always progress into malignant lesions.^{3,5} Safe, cost effective technologies could improve diagnosis and early treatment, and would decrease mortality rates while minimizing disfigurement.⁴ Research shows long-term effects of late diagnosis, including aggressive treatments and disfigurement, xerostomia, chewing and swallowing difficulties, dental caries, and depression.¹ Currently, the only accurate differential diagnosis is through scalpel biopsy and histologic examination which are gold standard diagnosing procedures but severely invasive and expensive.³

Intraoral and extraoral visual and tactile examination is still the standard of care for oral cancer screening. Traditional oral cancer screening includes taking an updated medical and dental history to identify risk factors including tobacco use (smoking or smokeless), alcohol consump-

tion, HPV infection, frequent exposure to ultraviolet light, poor nutrition and genetic factors.⁸ The National Institute of Dental and Craniofacial Research developed an oral cancer screening protocol for the clinicians to use with every patient as a part of the regular periodic appointment.⁸ The examination consists of 2 parts: extraoral examination, intraoral soft tissue examination. The extraoral examination includes visual and palpatory inspection of the face, ears, neck and the regional lymph nodes areas. Comprehensive intraoral soft tissue examination requires a visual and palpatory evaluation of the lips, labial mucosa, right and left buccal mucosa, gingiva, the dorsal, ventral and lateral sides of the tongue, the floor of the mouth, the hard and soft palate, and the oropharynx and uvula. Practicing dental hygienists and dentists are using mixed oral cancer screening protocols or none at all.⁸ There is little guidance for dental hygienists or dentists who are interested in improving their oral cancer detection because of the lack of standardization regarding the benefits of traditional oral cancer screenings versus optical or technology-based imaging in early detection of oral cancer. The similarity in appearance between benign and premalignant oral lesions makes it difficult to rely on the traditional oral cancer screening.

The Oral Cancer Foundation supports research and development of technology-based techniques and devices that are non-invasive to detect initial, asymptomatic cell change as soon as possible.⁹ Technology-based devices capabilities include increased ability by oral health care professionals to identify, contrast (abnormal versus abnormal), and monitor submucosal and dysplastic changes not visible during a visual oral cancer screening. While these screening devices do not differentiate between malignant and benign lesions, when used in conjunction with a traditional oral cancer screening, they may assist oral health professionals in recognizing abnormal lesions or oral potentially malignant lesions at earlier stages.¹

Oral cancer screening tools such as the VEL-

Table II: Oral Cancer Screening Devices

Product Name	Company	Dispensing Method	Unique Features
VELscope® Vx	LED Dental Inc.	<ul style="list-style-type: none"> • Lighted device • Emits blue-light • Clinician views oral cavity through the VELscope® Vx lens 	<ul style="list-style-type: none"> • Cordless, portable • Digital camera attachment • Uses blue light to simulate natural fluorescence • No solutions used
Identafi®	DentalEZ group StarDental	<ul style="list-style-type: none"> • Hand-held mirror emits 3 different type of light modes • Safe blue light, white light and amber light into the oral cavity • Clinician views tissue discoloration using the three modes 	<ul style="list-style-type: none"> • Cordless, portable • Ability to examine tissue vasculature • No solutions used
ViziLite® Plus	ZILA Pharmaceutical Inc.	<ul style="list-style-type: none"> • Uses low energy blue-white light source • Clinician activates the light source by bending the vial container then insert it to a holder 	<ul style="list-style-type: none"> • Cordless, portable • Requires, with Microlux/DL, a pre-rinse for 30 seconds • Can be used in conjunction with TBlue (Tuludine blue-based dye)
Microlux™/DL	AdDent Incorporated	<ul style="list-style-type: none"> • Produces blue-white LED light source • Clinician views white lesions 	<ul style="list-style-type: none"> • Cordless, portable device • Requires, with ViziLite® Plus, a pre-rinse for 60 seconds

scope® Vx, LED (Dental Inc, Burnaby, BC, Canada); Identafi® (StarDental, Lancaster, PA); ViziLite® Plus with TBlue, ZILATM (Fort Collins, Colo.); and the Microlux™/DL, (AdDental Inc, Danbury, Conn.), are technology-based devices available for use in private practice and public health settings (Table II). Technology-based devices include hand-held operating systems that use several chemiluminescence, blue-white LED and autofluorescence to penetrate epithelial tissue; light based systems enhance the visual inspection of intraoral tissues and help distinguish healthy areas versus oral potentially malignant lesions occurring at the submucosal layers and therefore not readily visible to the naked eye. Each device has individual defining features aimed to detect submucosal cell change or rapid destructive cell mutation and determine whether the lesion has metastasized to underlying connective tissue. This is a limitation of visual oral cancer screening examinations. More research is needed to support the use of technology-based screening tools for early detection of oral cancer in the general (low-risk) populations.¹⁰⁻¹³ Also, current literature does not support exclusive use of technology-based screening protocols in reducing mortality rates in smokers.¹²

VELscope® Vx is a non-magnifying, wide-field imaging device. The original VELscope® was primarily approved by the FDA on April, 2006 to be used as an adjunct oral mucosal examination device. In November 2010, the newer genera-

tion VELscope® Vx was approved by the FDA for the same purposes (Figure 1).¹⁴ The new VELscope® Vx is easier to carry, allows for broader intramural imaging and is cordless (utilizing a 12 hour battery). It does not require a dimmed light and can be used under incandescent light. VELscope® Vx has a higher intensity for a better visualization; an external camera attachment was added to facilitate a photo documentation of suspicious lesions during exams. Researchers choose the new generation VELscope Vx because of these advances in the technology and to provide research on the most current device.

The Identafi® system uses 3 light modes: a white light mode, a

Figure 1: Visual Enhanced Lesion Scope (VELscope® Vx)



Source: picture provided by LED dental Inc., the manufacturer of the VELscope® Vx

fluorescent violet mode and an amber reflectance mode. Identafi® fluorescent light makes an abnormal lesion appear dark brown or black, and healthy tissue reflect as blue fluorescence areas. ViziLite® Plus with TBlue system uses a low energy blue white light source, which requires a 30 second acetic acid pre-rinse that dehydrates the tissue. Normal tissue appears healthy pink, while abnormal tissue appears as acetowhite in color.

MicroLux™/DL system uses a blue-white LED light source. It uses a bright light, illumination technology, but is currently recognized specifically for better discovery of keratotic lesions that might not be discovered using the chair-side light. Abnormal tissue will appear as acetowhite, while normal tissue will appear as a healthy pink in color. The VELscope® Vx elicits a green, homogeneous fluorescence of normal tissue (Figure 2). A reduction in the green fluorescence indicates abnormal tissue.¹⁵ However, the abnormality may indicate either pathological conditions (such as precancerous or cancerous lesions) or variation from normal structures (such as Linea alba in the buccal mucosa).

Unlike other types of light-based systems, the VELscope® Vx does not require a pre-rinse and does not contain a lesion-marking solution. The VELscope® Vx allows for the adaptation of a digital camera, which aids in monitoring and accessing submucosal parameters of suspicious lesions. In addition to the recommendations from the Oral Cancer Foundation,⁹ Marzouki et al¹⁶ concluded that "the VELscope may add sensitivity to the clinical examination and be a useful adjunct in high-risk patients."

Under the VELscope® Vx light dysplastic and malignant cells will appear as a dark area of abnormality as they interrupt and cause a loss of fluorescence.¹³ Preliminary studies showed that the sensitivity and specificity of the VELscope® Vx were both higher than 90%.^{10,11,16} The evidence support the effectiveness of the VELscope® Vx in identifying extended borders of known lesions but there is not enough evidence to support or refute its effectiveness in detecting early oral cancer lesions in general populations.^{10,11}

VELscope® Vx and other screening devices have high false positive rates.¹⁰ The positive and negative predictive values of the VELscope® Vx were found to be around 42 and 98%, respectively.^{3,16} For the ViziLite® Plus with TBlue, the sensitivity was found to be a median of 85%, the median specificity was 67%. The positive predictive value was 85% and the negative predictive

Figure 2: Tissue Appearance under the VELscope® Vx



Source: Photographs used by permission. Taken at the Dental Hygiene Research Center, Old Dominion University.

value was 83%.³ Therefore, the literature recommend the use of these devices may be useful as opportunistic screening protocol with high risk populations, where the pretest probability of oral cancer is above 10%.¹⁰

This study supports the need for more research using new technologies. According to a systematic review conducted by Kujan et al, no evidence exists to suggest that other methods of screening, toluidine blue, fluorescence imaging or brush biopsy, are effective as a diagnostic tool.^{10,12} VELscope® Vx is of particular interest because there are limited studies examining the effectiveness of the VELscope® Vx as an oral cancer screening tool in high risk populations. Unlike other technologies, the device has minimal contraindications; per manufacturer's instructions, individuals taking medications that cause photosensitivity or predisposed to photosensitivity are contraindicated for use of the VELscope® Vx because of the blue-white fluorescent light emitted by the device.¹⁰

High risk populations include those who smoke tobacco - smoking has been firmly established as a direct causal link to oral cancer.¹⁷ The risk of oral and oropharyngeal cancer increases with regular alcohol consumption.¹⁷ The Healthy People 2020 report identified tobacco and alcohol consumption as priorities for the prevention of cancer.⁶ According to the American Cancer Society, 7 out of 10 oral cancer patients are heavy drinkers.¹⁸ Since tobacco is one of the most common modifiable known risk factor of oral cancer, cigarette smokers were chosen in this study as the target population.

Methods and Materials

A convenience sample of 30 cigarette smokers or dual addiction (cigarette and hookah) smokers from the state of Virginia, Hampton Roads area (Norfolk, Virginia Beach, and Chesapeake) were recruited. Recruitment flyers were distributed electronically through the university faculty and staff email announcement. Recruitment flyers were also posted at various locations in the local community.

The inclusion criteria included participants 18 years of age or older and people who smoke cigarettes only or in combination with other type of tobacco use (hookah smoking). People who used other forms of smoking habits (without cigarette smoking) and individuals who were photosensitive were excluded from participation. Data collection took place on the campus of Old Dominion University, Norfolk, Virginia and at 3 local senior citizens nursing homes. Written informed consent was obtained from each participant. Translators trained in medical and dental terminology were made available to individuals with limited English proficiency.

Prior to data collection, the study was approved by Old Dominion University institutional review board. All participants completed a health information and medical history form. Demographic data included age, gender and ethnicity/race. The health history included questions to determine risk for oral cancer to include history of cancer or cancer treatments, HPV infection and current medications. Smoking and alcohol habits were calculated according to the frequency of tobacco and alcohol use: the number of cigarettes/packs, the number of times smoking hookah and the number of alcohol drinks consumed were calculated per day, per week or per month. The duration of smoking in years was also collected. At the completion of the study, all participants received recommendations regarding tobacco cessation and information on the two examinations performed.

Each participant received both a visual and tactile intraoral examination and a VELscope® Vx examination to assess oral potentially malignant lesions. Two licensed dental hygienists served as investigators - one investigator conducted the visual and tactile intraoral examination and the second examiner conducted the VELscope® Vx examination. The examination sequence was standardized for all study participants - visual and tactile intraoral examination was conducted first by investigator A, while investigator B conducted the VELscope® Vx examination second. All investigators were educated and trained on the use of the

VELscope® Vx and the interpretation of findings by a professional expert from LED Dental Inc, the manufacturer of the VELscope® Vx. Investigators also viewed a video tutorial on the proper use of VELscope® Vx technology and how to interpret findings. Because one examiner conducted each type of examination, no inter-rater calibration was necessary during the study. However, intra-rater reliability was measured for each investigator using test-retest reliability.

Clinical findings were recorded using 6 data collection forms - 3 for visual and tactile intraoral examination and 3 for the VELscope® Vx examination. Examination sequences were standardized according to size, shape, color and texture of the lesion. The sequence of the visual and tactile intraoral examination included bi-digital evaluation of the lips, labial mucosa, right and left buccal mucosa, visual inspection of the gingiva, bi-digital palpation and visual inspection of the dorsal, ventral and lateral sides of the tongue, digital palpation of the floor of the mouth, visual inspection and digital palpation of the hard palate, visual inspection of the visible portion of the soft palate, and visual inspection of the oropharynx and uvula. The VELscope® Vx examination followed the same sequence without palpation.

Statistical Analysis

To determine demographic and medical health risk behaviors in individuals who smoke tobacco, t-test were measured. This test analyzed the significant difference between cigarette smokers and dual addiction smokers by comparing the number of cigarettes smoked per day, number of alcoholic drinks consumed per month and length of time smoking per year. The significance level was set at 0.05.

Results

Thirty participants with a mean age of 42 years were enrolled. Seventeen participants were cigarette smokers and 13 participants reported dual addiction (Table III). Cigarette smokers consisted of 76.5% males (n=13) and 23.5% females (n=4). For the dual addiction smokers, 77% were males (n=10) and 23% (n=3) were females. Fifteen participants identified their ethnicity as Asian, 10 Caucasian, 3 African-American, 1 Hispanic and 1 Native American (Table III).

In participants who smoked cigarettes, the average length of time smoking was 14.1 years, whereas the average length of time smoking for dual addiction smokers was 5 years (Table IV).

Table III: Demographics

Smoking Habit	Ethnicity					Age		Gender	
	AA	A	H	NA	C	19 to 34	>34	Male	Female
Cigarette smoking n=17	2	8	0	0	7	11	6	13	4
Dual Addiction n=13	1	7	1	1	3	13	0	10	3
Total n=30	3	15	1	1	10	24	6	23	7

Key: AA=African American; A=Asian; H=Hispanic/Latino; NA=Native American; C=Caucasian
Dual Addiction=Cigarette + hookah smoking

Table IV: Health Determinants

Smoking Habit	Length of Time Smoking (Years)		Number of Cigarettes Smoked per day		Number of Alcoholic Drinks per month	
	Mean + SE	p-value	Mean + SE	p-value	Mean + SE	p-value
Cigarette Smoking n=17	14.1 + 3.11	0.005	13.2 + 2.56	-	5 + 1.79	-
Dual Addiction n=13	5 + 0.89	0.005	14.5 + 2.92	-	13.9 + 7.63	-

Key: Dual Addiction= Cigarette + hookah smoking

The number of alcohol drinks consumed per month for tobacco cigarette smokers was an average of 5 drinks. For dual addiction smokers, the average was 13.9 drinks per month. The number of cigarettes per day for tobacco cigarettes only smokers was an average of 13.2 cigarettes, whereas dual addiction smokers reported an average of 14.5 cigarettes per day (Table IV). Results demonstrated a statistically significant difference in the average length of time smoking (in years) between the cigarette smokers (14.1 years) and the dual addiction smokers (5 years).

Results showed there was no statistically significant difference between cigarette smokers and dual addiction smokers in the average number of alcoholic drinks per month (5 for cigarette smokers and 13.9 for dual addiction). The average number of cigarettes smoked per day did not show a statistically significant difference between the 2 groups (13.2 for cigarette smokers and 14.5 for dual addiction) (Table IV).

There were no statistically significant differences in the oral potentially malignant lesions detected in cigarette or dual addiction smokers by the VELscope® Vx when compared to visual and tactile intraoral examination. No lesions were identified in either group; therefore, results showed no differ-

ences between findings in either group. Although the study protocol included taking intraoral photographs and referral to Eastern Virginia Medical School for biopsy, no lesions were detected using either type of examination; therefore, no intraoral photographs or referrals were made.

Discussion

This study was conducted to determine if the VELscope® Vx examination lead to improved detection of early stage lesions in submucosal tissues. While results of the 2 examination types indicated no statistical difference, the majority of participants reported 1 or more high risk behaviors for oral cancer. Demographic information gathered supports current literature on high risk populations and an increase in the number of younger populations who become habitual smokers and also developing alcohol addiction and dual-addiction smoking habits (specifically those who smoke both cigarettes and hookah).¹⁹ All participants in this study presented 1 or more health risk behaviors, or factors for developing potentially malignant oral lesions.

This pilot study enrolled a small sample size and results should be interpreted within that context. Mostly males were enrolled in this study,

and less than one-third were females.^{17,20} Although the risk of oral cancer is increasing in females, the research suggest overall males account for the majority of smokers.¹⁷ Participants who consume alcohol in combination to smoking have an added risk of oral cancer; 7 out of 10 oral cancer patients are heavy drinkers, according to the American Cancer Society.¹⁸ The literature identifies black populations as a high risk racial group who smoke cigarettes.^{17,20} In this very specific group population, Asians were the majority of cigarette and dual addiction smokers.

The outcome of this study may have also been influenced by a short observational period. Patient recruitment efforts were limited to a 3 month time period, contributing to a small non-representative sample size of 30 subjects. Both examination types were conducted in 1 appointment. This research study was limited to 1 year; this did not allow time for scheduling periodic oral cancer screening appointments to observe any tissue changes. Limited funding and time impeded the development of a cohort study to investigate changes or alterations in the oral soft tissues throughout a long period of time in high risk populations.

The sample size used in this study was small and therefore limited the results. The age range of the majority of the sample was between 19 to 34 years, which indicates a young lower risk population. Almost two-thirds of the cigarette smokers enrolled were under 34 years old and none of the dual addiction smokers were above 34 years old. The research identifies adults above 55 years old as the highest risk age group.^{17,20} In this study, 13 of the 30 participants recorded dual addiction. The literature indicates hookah smoking is becoming a trend within adolescents and young adults,¹⁹ and this study supports that fact.

The lack of concern and education about oral cancer may have had an influence on the outcomes and participation of this study. Research suggests that the level of cancer concern ranges from low to moderate in general and high risk populations.²¹ There are no consistent findings concerning whether cancer worry in high-risk populations exceeds that for the general population.²¹ Overall, there is a lack of education on the importance of oral cancer screening. Paulis suggests dental hygienists have an important role in educating their patients regarding routine comprehensive intraoral and extraoral examination of the head and neck area for oral cancer early detection.²²

The VELscope® Vx was initially approved by the FDA in 2006 to “enhance the identification and visualization of oral mucosal abnormalities that may not be apparent or visible to the naked eye, such as oral cancer or premalignant dysplasia.”¹⁴ The results of the present study did not show a significant difference between the VELscope® Vx examination and the visual and tactile intraoral examination, thus supporting the importance of the thorough traditional intraoral and extraoral examination. The lack of the extraoral examination and the comprehensive palpatory examination of the head and neck and may have had an influence on the outcomes. The VELscope® Vx technology is an optical device that is only used intraorally; its limitation includes the lack of comprehensive soft tissue palpatory examination. This emphasizes the continued need for a thorough traditional visual and palpatory intraoral and extraoral examination of the head and neck, as well as the thyroid area.

Future studies should include a cohort research study design that includes a broader spectrum of high risk groups. For example, the inclusion criteria may include individuals having one or more oral cancer high risk parameters. Recruitment and time needed to conduct the research was limited and future studies should also consider longitudinal research design. This would allow for a greater representation of high risk population. To observe the effectiveness of the VELscope® Vx in the detection of the early lesions at subclinical levels, the cohort research study design should include scheduling periodic oral cancer screenings of the same participants every 6 months over a longer period of time that extends to several years.

Conclusion

In this particular study, no lesions were identified in either group. The absence of findings supports the need of further high-quality research evaluate very carefully the effectiveness of the 2 tested protocols in identifying the presence of oral potentially malignant lesions. This study did not produce statistically significant data to support or refute the use of the VELscope® Vx for use as an exclusive oral cancer screening device in cigarette smokers or those with dual addiction smoking habits. Therefore, the importance of conventional oral cancer screening is still significant especially that it includes intraoral and extraoral visual and tactile examination of the head and neck areas. Then, based on the given data, the use of adjunctive technologies, such as the VELscope® Vx is kept as the clinician’s choice.

Since the early diagnosis of oral cancer is the key for better prognosis and higher survival rates, more efforts should be made to enhance the effectiveness of the current technology-based adjunctive devices, including the VELscope® Vx, as oral cancer screening tools.

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