



Tobacco and Oral Health: A Call to Action

In 1989, a visionary in the dental profession, Dr. Robert Mecklenburg, secured funding from the National Institutes of Health to create the National Dental Tobacco Free Steering Committee. As the name implied, the committee's purpose was to encourage oral health organizations and its members to enhance their role in advocacy for a tobacco-free society. I was so fortunate to have been named the ADHA and eventually the ADEA's representative during the committee's 10 year existence. During one of our meetings, Dr. C. Everett Koop, the Former U.S. Surgeon General, addressed the National Dental Tobacco Free Steering Committee. I have always remembered his inspirational words as he called upon the oral health professions, particularly dental hygiene, to take the lead in tobacco prevention and cessation activities for our nation. He based his statement on our ability to motivate patients along with having approximately an hour of precious time to teach patients during clinical dental hygiene treatment.

Between 1990 and today, ADHA and ADEA have included CE courses at their respective annual sessions and have published journal and Web site articles. ADEA created the Tobacco Free Special Interest Group, and ADHA developed their practice-based cessation model, "Ask Advise Refer." The ADA's Commission on Dental Accreditation (CODA) responded by including tobacco use prevention and cessation questions on the Dental Hygiene National Board Examination and included tobacco prevention and cessation among the CODA accreditation standards. Leading textbooks in dental hygiene teach dental hygiene students how to create and implement successful programs. Driven by such textbooks, national board questions, CODA standards and professional ethics, dental hygiene educational programs have strengthened tobacco prevention and cessation information throughout the curricula in hopes that future dental hygiene practitioners would consider this as much a part of practice as teaching oral plaque removal.

At the time of inception of our committee, tobacco use was our nation's number one preventable public

health problem. Unfortunately, it remains in the top 3 today. Recently, the Centers for Disease Control released data stating that cigarette smoking, which has declined over the past 10 years, is still estimated to cause 1 in 5 deaths each year, or 443,000 deaths annually in the U.S. (including deaths from secondhand smoke). According to TobaccoFreeKids, total annual public and private health care expenditures caused by smoking is \$96 billion.¹

But have we done enough? Considering that dental hygiene undergraduate programs have had competency statements related to tobacco use in place for at least 10 years, one would assume that dental hygienists' formal knowledge and self confidence related to counseling tobacco patients would increase, thus increasing this service in day-to-day practice. However, there remains a paucity of literature published over the past 10 years related to dental hygienists taking the lead in tobacco prevention and cessation activities, either in public clinics or private practice. The literature has suggested that the identical barriers, reimbursement and lack of confidence that influence dentists' hesitation to implement tobacco prevention and cessation activities continue to discourage us from implementing this most needed patient service.² Leaders in all dental hygiene related organizations must continue to educate and encourage future and practicing oral health team members to provide tobacco prevention and cessation for each patient.

Hopefully, this edition of the *Journal of Dental Hygiene* will serve as a call to action. To quote Dr. Christoph Ramseier from his 2009 article in the *International Journal of Dental Hygiene*, "second to regular mechanical plaque control, tobacco use cessation has become the most important measure for the treatment of periodontal diseases."³ I concur with Dr. Ramseier, and would like to add prevention and treatment of most oral diseases.

Sincerely,

Nancy Williams, RDH, EdD

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Book Reviews

Minimally Invasive Treatment, Arrest, and Control of Periodontal Diseases

By: Per Axelsson, DDS, Odont Dr
Quintessence Pub Co, 2009
312 pages, hard cover
ISBN: 978-0867153651
Cost: \$148

Review by: Tabitha Tavoc, RDH, PhD

Minimally Invasive Treatment, Arrest, and Control of Periodontal Diseases is the fifth volume of Dr. Axelsson's 6 volume series on preventive dentistry. This five-chapter, 278 page textbook is written with an European/Scandinavian point of view. It discusses minimally invasive scaling, root planing and debridement, initial intensive therapy for healing of infectious inflamed periodontal tissues, supplemental therapy for healing of infectious inflamed periodontal tissues, repair and regeneration of lost periodontal tissues and needs-related periodontal preventive and maintenance care. The book details periodontal techniques that may not be found in a typical dental hygiene periodontal textbook. For example, the author devotes 20 pages to the treatment of furcation-involved teeth in addition to a section on periodontal surgery for accessibility and reduction of deep residual pocket.

Axelsson's easy-to-read textbook includes an abundance of clinical photographs (in color), radiographs, figures and tables. The images are of excellent quality and very useful in enhancing the reader's understanding of the book's content. Furthermore, the textbook offers over 20 short periodontal cases, including case scenario, treatment provided, outcomes, clinical photographs and radiographs. Both educators and practitioners would appreciate the evidence-based recommendations on minimally invasive scaling, root planing and debridement methods outlined in chapter 1. Additionally, the end-of-chapter list of advantages and disadvantages related to various types of instruments or systems used for the removal of calculus and plaque could be a useful quick-reference for those interested in purchasing new instruments or equipment.

Dental hygienists employed in a periodontal private practice will find chapters 3 and 4 very practi-

cal. Difficult periodontal concepts are clearly explained. Chapter 3 discusses supplemental therapy for healing of infectious inflamed periodontal tissues. The use, modes of action, application and effects of various local and systemic antibiotics are carefully explained. Microbial species associated with various forms of periodontitis are also outlined, and the author makes evidence-based recommendations for systemic antibiotic therapy for diagnoses based on either microbial testing or clinical assessments. Chapter 4 is updated and covers the assessment of periodontal repair and regeneration, wound healing related to repair and regeneration, in addition to methods and materials for repair and regeneration of lost periodontal tissues. For example, various bone replacement grafts are discussed in addition to the classical guided tissue regeneration technique. More recent and contemporary regenerative approaches are also discussed.

Given the quality of the textbook, as mentioned above, volume 5 of Axelsson's series as a reference for senior dental hygiene students, dental students, dental hygienists working in a periodontal practice and both dental and dental hygiene educators.

Ethics and Law in Dental Hygiene, 2nd Edition

By: Phyllis L. Beemsterboer, RDH, MS, EdD
Saunders Elsevier, 2010
St Louis, Missouri
254 pages, soft cover
ISBN 978-1-4160-6235-6
Cost: \$44.95

Review by: Zina F. Johnston, DDS; Christian W. Johnston, JD

In the second edition of Ethics and Law in Dental Hygiene, dental hygienist and academician Phyllis L. Beemsterboer, RDH, EdD, along with other well-qualified contributors, offers a comprehensive guide to the relatively modern field of dental hygiene ethics and law. Throughout the book, Beemsterboer and her team of dental hygienists, educators, dentists, physicians and attorneys from throughout the United States delicately balance covering the chosen topics with an appropriate breadth while offering practical guidelines and advice for the dental hy-

giene professional. *Ethics and Law in Dental Hygiene* is a volume well suited for use in the classroom as well as the dental hygienist's practice.

The book is structured as a textbook, complete with easy to understand diagrams, chapter summaries and references at the end of each chapter. Nevertheless, the discussion of the selected topics is succinct enough to allow the reader to quickly grasp the relevant issues.

The first section of the book is devoted to ethics in the dental hygiene profession. The chapter titles themselves offer a decent synopsis of the covered topics: *Ethics and Professionalism, Ethical Theory and Philosophy, Ethical Principles and Values, Social Responsibility and Justice, Codes of Ethics and Ethical Decision Making in Dental Hygiene and Dentistry*. The chapter on decision-making effectively applies the principles presented in the preceding chapters. Specifically, Beemsterboer presents a 6 step model for decision-making, noting that "[the process of decision making is dynamic, evolving as additional information comes into play." This decision-making model is illustrated by a circular diagram, and includes identifying the ethical problem, collecting information, stating the options, applying ethical principles to the options, making the decision and implementing the decision.

Although it is unfortunate that the dental hygiene professional must be concerned with numerous legal issues, the prudent hygienist is well-informed regarding these legal issues. To this end, the second section of the book offers an excellent overview of the sundry legal issues facing dental hygienists. In particular, the chapters in this section address *Society and the Dental Practice Act, Dental Hygienist – Patient Relationship, Dental Hygienist – Dentist–Employer Relationship and Risk Management*. Certainly, it is beyond the scope of this book to outline all the laws regulating the practice of dental hygiene in every jurisdiction, but the book manages a decent overview and offers sound advice: "The professional obligation of dental hygienists is to be intimately familiar with the laws and regulations of the state where they practice." Everyday legal issues and conflicts that hygienists may face are appropriately covered in the chapters on dental hygienists' relationships with patients and employers, including a concise overview of various laws affecting the treatment of a patient as well as laws prohibiting discrimination in the workplace. Additionally, the chapter on risk management provides an adequate, albeit

non-comprehensive, overview of risk management principles pertaining to dental hygiene practice. The succinct discussion of documentation in the dental record contained on pages 157 through 160 ought to be mandatory reading for all dental hygiene and dental students and provides astute advice as to what dental professionals can proactively do to manage their own risks and decrease their professional liability exposure.

The final and perhaps most useful section of the book is, for the most part, new to the second edition and is entitled "Simulations and Applications." This section primarily consists of "Case Studies, Testlets and Activities." The 25 case studies in particular provide the dental hygiene student with real-world examples of ethical and legal dilemmas that may be faced in practice. Discussing these scenarios in a hypothetical context and safe classroom environment will certainly better prepare students to face such challenges on their own. Further, the 4 "testlets" and 20 activities provide additional hands-on opportunities for the dental hygiene student to develop problem-solving skills. Finally, the included appendix (codes of ethics), bibliography and selected readings list, glossary and comprehensive index at the conclusion of this section take a useful book and make it readily usable as well.

The additions to the second edition of this treatise are both timely and valuable because of their practicality. Specifically, the chapter on "Social Responsibility and Justice," which addresses access to health care, is new to the second edition. The second edition is a complete revision and the chapters have been updated, including a decent discussion of HIPAA. Also, the revised codes of ethics are fully set forth in the appendix.

As is the case with almost any textbook, *Ethics and Law in Dental Hygiene* may be criticized for its brevity and lack of exhaustive coverage of each of the chosen topics. Still, the converse of this criticism is what gives the book its value. Beemsterboer and her collaborators manage to cover their chosen topics with enough detail to be informative and educational without becoming cumbersome in the delivery of confusing minutiae.

In *Ethics and Law in Dental Hygiene*, Beemsterboer has produced both a solid textbook and a valuable and practical resource that will be welcomed in the dental practice as well as the academic library or dental hygiene classroom.

Innovations in Technology

Blog Enabled Peer-To-Peer Learning

Kami Hanson, RDH, MEd, PhD

Introduction

Issues related to community oral health comprise about 12% of the content on the Dental Hygiene National Board Examination.¹ Of that content, a large portion of a student's understanding of community oral health issues centers on their ability to plan and evaluate a dental hygiene public health program. Given a community case history and/or specific instances of certain tasks, students are expected to identify the phase of service planning in which these tasks would be completed. The specific phases of community service planning include: Assessing a community oral health need, planning an oral health program to meet that need, implementing the program and evaluating the program for success.²⁻⁴ This process of planning a community dental hygiene service requires a student have an understanding of the developmental phases and knowledge to successfully complete each phase. This researcher's experience has been that community service planning and other oral health curriculum are traditionally taught in a classroom setting and assessed with multiple choice testing. However, to gain an in-depth understanding of a concept, educators must move beyond passive lectures and testing.⁵ Faculty members must explore instructional strategies and encourage hands-on learning and active engagement of students in construction of new knowledge.^{6,7} Unfortunately, these types of experiences can be challenging to implement given the time and physical constraints of traditional academic settings.⁶

The purpose of this project was to simulate a hands-on learning experience for planning a com-

munity dental hygiene service utilizing computer technologies, such as sites and resources found on the Internet and online journaling (referred to as web logs, weblogs or blogs), as tools to go beyond the time and physical constraints of a 1 credit hour course in a classroom setting. Emergent computer technologies are also the best way to gain access

Abstract

Purpose: The purpose of this project was to simulate development of a community oral health plan using technology-based tools at the students' disposal. The specific research questions were: Will students use the Internet to identify community oral health issues and develop solutions to address the issues? Will blogs be a good tool to discuss and engage students in conversation with each other and to connect them with community oral health resources? How will blogging impact future academic and personal communications for the student?

Methods: Dental hygiene students (n=30) participated in a community oral health course for 7 weeks. Students were asked to create a blog on which they would post weekly assignments and respond to 2 of their peer's blogs each week. Methods for data collection were post-treatment survey (15 items) analyzed for descriptive statistics and an analysis of written blog content according to a counting and coding scheme.

Results/Conclusion: Students used the Internet to identify issues and problem solving scenarios. Blogs were a good tool to engage students in discussions on oral health issues and peer-to-peer learning. Qualitative discourse analysis revealed evidence of critical thought and discourse throughout blog posts. Students referenced the Internet in blogs, while specific instances of resource sharing and provision of solutions to peers were less common. Students felt blogging encouraged them to engage with one another. Twenty percent of participating students have extended their use of blogging for both academic and personal purposes.

Keywords: Blogging, Internet, computer-mediated communication, dental hygiene education

This study supports the NDHRA priority area, **Professional Education and Development:** Evaluate the extent to which current dental hygiene curricula prepare dental hygienists to meet the increasingly complex oral health needs of the public.

to information quickly and disseminate content uniformly. As a result, the overall goal for this project was to evaluate the students' use of Internet resources and blogs (for journaling) as they developed individual oral health promotion service plans for specific communities. The specific research questions were:

1. Will students use the Internet to identify community oral health issues and then develop solutions to address those issues?
2. Will blogs be a good tool to discuss and engage students in conversation with each other and to connect them with community oral health resources?
3. How will blogging impact future academic and personal communications for the student?

It was hypothesized that the use of emergent technologies would have a positive impact on student use of the Internet as a resource for oral health issues. The use of blogs would provide a venue for conversations to take place to enable peer-to-peer learning and resource sharing, and students would accept blogging as a valid tool to use for further academic and personal communications.

Review of the Literature

A blog is an online personal journal with reflections, comments and hyperlinks provided by the writer, and is generally written in an informal voice.⁸ Journal entries are often published in reverse chronological order so the most recent post appears first.⁸ Blogs allow people to engage in "knowledge sharing, reflection and debate," as well as draw people together who are interested in "constructing knowledge around a common topic."⁹⁻¹¹ Activities such as working with others, critical inquiry and reflection, communication and articulation of knowledge, understanding and skills, managing and how to learn and self and peer assessment are outcomes promoted by and referred to as peer-to-peer learning.¹²⁻¹⁴ Peer interactions are considered a pedagogical structure promoting independent and collaborative learning that will endorse high-level cognitive processes.¹²

Most blogging software (such as Blogger™, Movable Type® and LiveJournal™) automatically formats posts for writers, allows readers to comment on posts that they find interesting and provides archiving of old posts.¹⁵ The writer does not need computer-programming skills to publish online. This has enabled a flood of new voices contributing to discourse on a wide variety of topic.^{16,17}

Shared knowledge is an emergent product of discourse among individuals engaged in joint activity.¹⁸ Educators who want to encourage learners to engage in collaborative discourse have seen how blogs can enrich the learning experience for students.⁹ With blogging, students are able to craft a thought and engage in discussion on topics in a way the traditional classroom setting does not allow.¹⁹

Activities, such as engaging, reflecting, solving problems and bringing learning to life, are activities of adult learning consistent with critical thinking, self-learning, self and social awareness, empathy and transformative learning.^{9-12,20} Transformational learning involves 3 phases: critical reflection of one's assumptions, discourse to validate the critically reflective insight and action to bring about change.^{18,19} Because the use of blogging has the potential to encourage activities described in those phases, it could be an environment where students can begin the process of transformative learning.²¹ Specifically, opportunities for critical thought and critical discourse are supported with blogging.²¹ Critical thought, as defined by Mezirow, is when new information is learned that causes the learner to challenge preconceived ideas.²⁰ Critical discourse occurs when that learner conscientiously alters their conceptual framework and voices their new ideas or reflective insight.^{13,20}

Previous research has been conducted on blogging for a community of learners. Barab et al designed an online architectural framework to support observations, discussions and reflections amongst peers.²² Their purpose was realized in a community of learners observing each other's practice through downloaded video, discussion of theory and ideas, with reflection on their practice. One caveat seemed crucial – the level of experience gained was directly related to the design of the community or network of commentary (blogs). Instructional design, recommendations, assignments, processes and interactions impact the success of educational application of blogging.

In a separate study, Bouldin, Holmes and Fortenberry used blogging to enable reflective learning on course concepts in a communications class.¹¹ Evidence suggested achievement of the educational objective, and students were expected to improve communication skills and attitudes. Through self-assessment and reflection in their blogging, students were able to identify areas for improvement and further development. Post-survey outcomes revealed blogging on course concepts allowed them to relate what they learned to real life situations, and that blogging has provided them with a higher level of retrieval of information learned.

The purpose of this project was to simulate development of a community oral health plan using technologic tools at the student's disposal. The specific research questions were: Will students use the Internet to identify community oral health issues and develop solutions to address the issues? Will blogs be a good tool to discuss and engage students in conversation with each other and to connect them with community oral health resources? How will blogging impact future academic and personal communications for the student?

Methods and Materials

Design of this project was intended to facilitate collaboration and sharing of online resources among students, encouraging epistemic shifts leading to action – an outcome of transformative learning. A convenience sample of junior dental hygiene students (n=30), enrolled in a 7 week course on community oral health concepts, participated as research subjects. Students signed participant consent forms and were told their grade would not be adversely affected if they did not consent to having their blog content analyzed. The research project did receive institutional board approval and was considered exempt. The subjects were predominantly female (90%), ranging between 20 to 32 years of age, with minimal experience with online technology. None of the students reported having experience setting up a blog or blogging.

The course design included the use of the Internet and online blogs. Students were directed to use the Internet to identify a community need and conceptualize a service project to address this need. After setting up their own blogs, students blogged on information learned via Internet research, their intended target population and community need, and outlined the service project that they conceptualized. Students engaged in conversations via blogs, which was meant to stimulate thinking and discussion on topics related to community oral health. Course requirements included posting assignments to personal blogs and commenting on peer's blogs. No guidelines were given for the content of a peer comment, just that each student had to comment on the posts of 2 peers each week.

Data Collection and Analysis

Research data were derived from a mixed quantitative/qualitative analysis of the posts and comments on the blogs and a post-survey of research participants. The post-survey was designed to assess the students' opinion regarding whether the blogging experience addressed the research questions. There were 15 items on the survey, 5 address-

ing each research question. Students answered on a Likert scale of strongly agree to strongly disagree. Questions receiving an average response of "agree" or "strongly agree" were said to indicate support for the research question.

Qualitative Analysis

A coding scheme was developed according to Herring's research on discourse analysis.^{16,17} Data were analyzed and counted for evidence of critical thought, critical discussion, epistemic shifts, evidence of peer-to-peer sharing of resources and solutions. A team of 3 researchers used a constant comparative approach to conduct the analysis of blog posts.²³ Each completed thought was either counted as critical thought, critical discussion, action, impact, epistemic shifts, a personal post or evidence of peer-to-peer sharing of resources and solutions. Each completed thought coded was done so exclusively, as an incidence of 1 node. Therefore, a single comment could not be an incidence of 2 or more nodes. A hash mark was entered onto a spreadsheet to indicate the frequency of the identified node. This process allowed researchers to identify important interactions and building of activity networks amongst peers.

Coding Scheme and Nodes Defined

Critical thought was identified when new information gained by the student was discussed, and there was evidence of assimilating the new knowledge with the student's personal understanding, or schema model.²⁰ Additionally, critical discussion took place when these new ideas were put into words and discussed on individual blogs. A hash mark for action would be made if a student commented on action they would take as a result of the information gained in this research process. Impact and epistemic shift had to do with comments demonstrating an influence on the student while utilizing emergent technologies (impact) and shift in personal paradigms as a result of this influence (epistemic shift). Incidences of when students posted personal information were tracked, as where any time students provided hyperlinks to Internet Web sites or helpful resources or solutions.

Calibration

Researchers were calibrated before they analyzed journal content. Calibration methods included the provision of literature, which explained and supported the coding scheme and the spreadsheet, as well as definitions of each identified node, and a calibration session, where researchers worked together to identify examples of textual incidences of

all nodes to be recorded on the spreadsheet. Additionally, examples of critical thought, critical discussion and epistemic shifts from student blogs that corresponded with nodes were identified. A second calibration session was held once again during the data collection process. During the analysis of content, each blog post was read twice, once by 2 evaluators. The evaluators critiqued the posts without the knowledge of the other evaluator's opinion. If the 2 evaluators' opinion of the content and categorized nodes did not match, a third evaluator would assess the post. This process ensured inter-rater reliability, plus an inter-rater reliability analysis using Cronbach's alpha was performed to determine consistency among raters.

Results

Post-Survey Responses

There were a total of 15 Likert statements, 5 for each research question, asking students to agree, strongly agree, neutral, disagree or strongly disagree with each statement. The results of each category of survey statements are combined to show percentage outcomes per research question. For research question 1, student response indicated that 56% agreed or strongly agreed that they used the Internet to identify community oral health issues and develop solutions to address the issues. Seventy-eight percent agreed or strongly agreed blogs were a good tool to discuss and engage students in conversation with each other and to connect them with community oral health resources. For research question 3, 58% agreed or strongly agreed blogging will impact future academic and personal communication.

Qualitative Findings

A constant comparative approach to conduct the analysis of blog posts was used.²³ The Cronbach's alpha reliability coefficient was found to be 0.872, which indicates good internal consistency. Thoughtful incidences (n=620) were categorized accordingly: critical thought (17%), critical discussion (18%), personal posts (18%), action (12%), impact statements (8%) and other dialogue (19%), with epistemic shifts occurring 5% of the time (Figure 1).

Excerpts from student blogs have been included to demonstrate nodes researchers were looking for in blog posts. The following excerpt is an example of critical thought where Holly (student names have been changed to protect anonymity) is attempting to incorporate new information with her personal paradigm. Also indicative in this post is the

student's lack of writing skills and difficulty putting their thoughts into words:

"Narrowing my target population was necessary in order to truly focus on the needs of these select individuals. I chose these individuals because I believe they will have a more optimistic outlook as what is going on in their lives. Many of the individuals that I have met who still live at home, are of course receiving aid from either family, friends or the community; but they still have that determination to be independent and remain vital productive human beings. The reality of my decision boiled down to this: I did not want to focus my attention on those whose perception of life was negative..."

This excerpt indicated Megan's action that she would take to address a perceived oral health need:

"As prompted, I began to analyze the manner in which I could inform, meet, and educate such a population in any community. My first thought was, why not tag along with the "Meals on Wheels" crew. They meet people everyday that are at home doing what they can to be happy and vital. If they are receiving meals, than they still must have some decent chompers that are in good or semi-good working order. And even better, they would be more apt to want to retain their teeth by having qualified dental practitioners providing free dental care."

The following excerpt demonstrates that Ashley was impacted by a discussion that took place on peer blogs regarding fluoride that resulted in an epistemic shift:

"You might be surprised to hear that I am undecided on the issue of fluoridation in drinking water. To clear this up in the very beginning, I am not against fluoride. However, since I was undecided on this hot topic, I decided to come into this with an open mind, which is hard to do if you already have your mind made up. So I did some research on it. Why not fix the problem where it starts, which is what we put into our mouths. We also need to remember to respect other peoples' opinions on this issue, not to mention other issues. When reading my other classmate's blogs, I couldn't help but notice that everyone got so angry about people who were against fluoride in the water! I know we will face patients whose views differ from ours and from what we are taught and THAT IS OKAY! We can do our part and try to educate them for the better and they have the choice to listen or not. We need to be tolerant and respectful of others opinions."

A quantitative analysis of student posts indicat-

Figure 1: Breakdown of incidences of nodes identified in coding scheme.

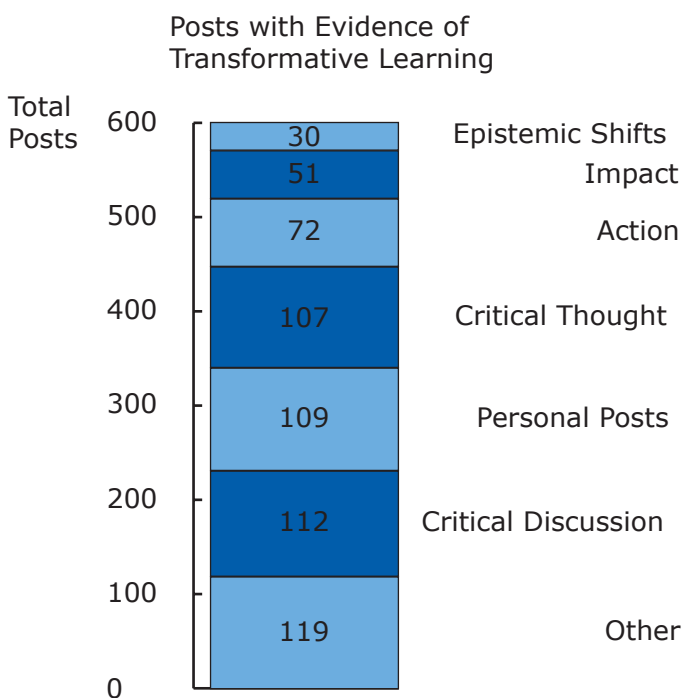
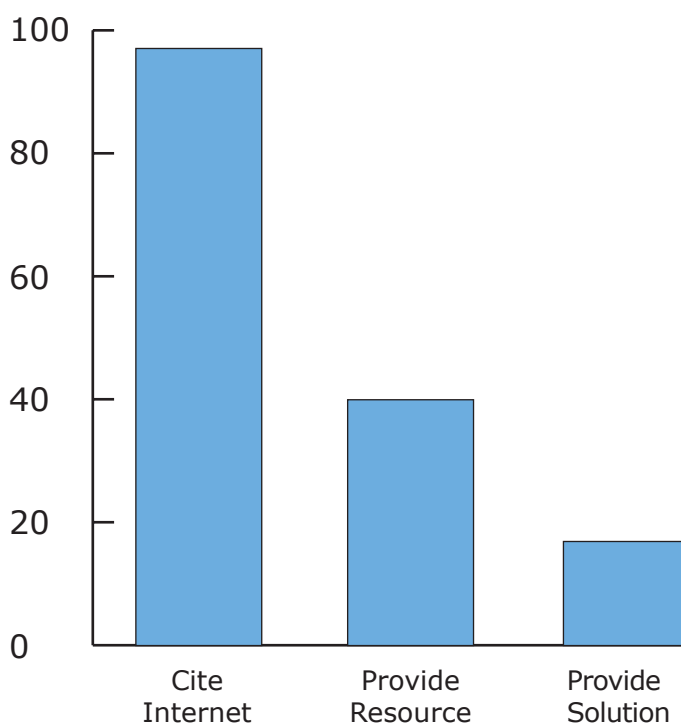


Figure 2: Qualitative analysis of student posts (# of posts)



ed some students were referencing the Internet by providing hyperlinks in their discussions with one another. Specific instances of resource-sharing and provision of solutions to peers were less common, but present. For example, Megan found a Web site that would help Ashley in the development of her community project, so she provided a hyperlink to that site for her on a blog comment. Students cited the Internet and shared resources and solutions with peers in one quarter of all blog posts (Figure 2).

Students were asked an open-ended question about what they liked or disliked about using the Internet and blogs in a community oral health class. Students liked learning about blogs as a new tool for interacting with others online and liked the plethora of resources and Web sites that were available online. However, some did not like the inconvenience of blogging if they were not technologically savvy, and felt it pressured them to go outside their comfort zone (Table I).

In addition, student blogs were monitored after the community class ended to see how many continued posting to their blogs. Institutional review board approval was granted for this monitoring, although it was for a larger research project extending past the community course on electronic journaling and critical reflection. Twenty percent (n=6) of students involved in the project have extended their use of blogging for both academic and personal purposes.

Due to the novelty of blogging at the time of this research and the initial resistance to the idea, extended use of blogging, even for 6 students, was perceived as noteworthy.

Discussion

There was weak support for research question 1 (Will students use the Internet to identify community oral health issues and then develop solutions to address those issues?). Over half of survey respondents agreed they used the Internet in their search for community oral health issues and potential solutions. However, support for this question is strengthened by the frequency with which students cited the Internet as a reference or resource on their blog posts. The strongest support was for research question 2 (Will blogs be a good tool to discuss and engage students in conversation with each other and to connect them with community oral health resources?). The use of blogging as a tool for student engagement was also evident in the amount of critical discussion that occurred through blog commenting. Moderate support was present for research question 3 (How will blogging impact future academic and personal communications for the student?). While only 6 students continued their blogs after the course had ended, they posted often and convinced their peers to write or comment on blogs. Further research could more accurately de-

Table I: Student comments on use of the Internet and Blogs

What did you like?	What did you dislike?
<ul style="list-style-type: none"> • I was able to post my own opinion on topics that otherwise I would probably keep to myself. • I became more aware of information that is accessible. Sharing views and work with classmates. Learned what blogging is and how blogging works for a possible use for future. • Access to multiple resources. New way to interact. • I found a lot of good info on the Internet. It was interesting to see what my classmates thought about different issues. • I had a really bad attitude about blogging but I have come to think that it is OK and was a good way to communicate with the class. 	<ul style="list-style-type: none"> • It was new and somewhat awkward for me, a pretty strong introvert, to get used to. • Sometimes it is hard to put all of our opinions in writing. For the most part it wasn't too bad. • I disliked having to blog as an assignment. We should just be able to blog for fun. • It took time to research other's blogs and to comment on their blogs. I got too caught up in it sometimes and it was too time consuming. • I have a hard time with things that I can't actually hand in. I wasn't sure if my blog posts/comments actually published or not. • Very time consuming. Sometimes I had a hard time finding what I needed on the Internet. I don't always know where to look.

termine the impact of the blogging experience on the future academic and personal communication for these students.

Research outcomes suggest blogging provides opportunities for critical reflection of one's assumptions, and textual discourse to validate the critically reflective insight. Incidents of critical discussion and thought were common among blog posts. However, posts indicating epistemological shifts were rare, possibly due to the difficulty in describing a shift for novice writers.

While epistemological shifts were rare, this outcome was not discounted as irrelevant. Any shift in an individual's paradigm is considered meaningful and is not a cognitive process that occurs often in the learning process. Researchers were encouraged with this outcome and feel the use of blogs for student interaction was constructive in the educational process.

Student comments on the use of the Internet and blogs were informative and led the researchers to consider the following recommendations for future research. The use of emergent technologies, such as the Internet and blogging, should be incorporated into other dental hygiene course curriculums to familiarize students to their use. In addition, it is postulated that a student blog will become more personal and meaningful as a student develops their own voice and style of writing over a longer period of time (this research project took place in the span of just 7 weeks). Practice in writing and participating in critical discourse enhances a student's meta-

cognition, which may lead to strengthening of the dental hygiene profession.

Limitations of this study included the lack of more male participants (only 2 men participated in this project). Replicated studies with a predominantly male sample and an evenly mixed male/female sample would provide additional insight regarding potential gender interaction with the variables measured. In addition, it is recommended that 2 evaluators review each qualitative piece of data for future research. While 3 researchers performing the qualitative analysis were calibrated, it was seen as a flaw that only 1 evaluator viewed each incidence of discourse. The validity of qualitative assessment could be strengthened by a higher degree of agreement between researchers.

Conclusion

The qualitative data suggests the use of technologies, such as the Internet and blogging, are a way to support peer-to-peer learning and foster critical discussion. However, students need a longer period of time to become familiar with these tools, such as blogging. Technologies allowing students to engage with course concepts and personal paradigms, as well as with peers and other online communities of practice, could greatly enhance the way dental hygiene is learned and practiced in the future. Therefore, continued investigation into the concepts presented in this article is encouraged.

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Evidence-based Tobacco Cessation Treatment by Dental Hygienists

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Introduction

Cigarette smoking continues to be the number one preventable cause of death in the United States, with approximately 20% of deaths annually due to smoking-related diseases.^{1,2} In addition to influencing mortality, tobacco use is linked to cancer, heart disease, stroke and oral disease.³⁻⁵ While the percentage of U.S. adults who report tobacco use has decreased significantly in recent decades, 19.8% currently report cigarette smoking.^{6,7} Given the health consequences cited above and economic losses associated with tobacco-related disease, tobacco use warrants attention from health care providers in all areas, including dental hygiene and dental professionals.^{2,8,9}

The dental office is uniquely suited for tobacco education and cessation intervention for several reasons. First, many tobacco users visit a dental office each year, which means dental hygiene-based interventions would have broad reach.^{10,11} Second, because oral health care usually requires multiple visits, dental hygiene professionals are afforded multiple opportunities to intervene with patients.¹² Third, some oral and dental procedures allow an opportunity to demonstrate visibly the association between tobacco use and oral health, which has been shown to motivate tobacco-using patients to make a quit attempt.^{9,13} Overall, incorporating standardized and routine tobacco cessation treatment into dental offices is a cost-effective method of reaching a large number of tobacco users, and could have a positive and significant public health impact.¹³

Abstract

Purpose: Dental hygienists have opportunities to take a substantive role in tobacco control efforts. Previous research has suggested that implementation of tobacco cessation strategies has been sub-optimal, but few studies have examined factors associated with dental hygienists' delivery of evidence-based tobacco cessation treatment. Among dental hygienists, the current study investigated tobacco-related knowledge and attitudes, as well as clinical practices consistent with evidence-based guidelines for tobacco cessation.

Methods: Practicing dental hygienists in the state of Kentucky (n=308) responded to a paper and pencil questionnaire that collected information regarding their demographic, clinical characteristics and knowledge, attitudes and clinical practices regarding tobacco cessation treatment.

Results: Participants were somewhat familiar with evidence-based clinical practice guidelines regarding tobacco cessation treatment, but reported infrequent implementation of the 5 A's (Ask, Advise, Assess, Assist, Arrange). While participants were well aware of health risks associated with tobacco use and the value of cessation, few reported comfort or confidence in their ability to employ evidence-based interventions. However, several key variables were associated with implementation of recommended clinical practices (guideline awareness, comfort with specific tobacco cessation activities and self-efficacy).

Conclusion: Results identified potential deficiencies in areas of tobacco control knowledge and confidence among dental hygienists. Correlations with evidence-based tobacco control practices suggest that knowledge and attitudes could serve as targets for education and training programs to promote greater implementation. While dental hygienists have unique opportunities to reduce tobacco-related morbidity and mortality, more education and training is necessary to increase adoption, implementation and sustainability of these important interventions.

Keywords: dental hygienists, evidence-based practice, smoking cessation, public health

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Studies in this category address the dental hygiene process of care (assessment, diagnosis, treatment planning, implementation and evaluation); decision-making and clinical reasoning; and data management systems.

As reviewed by Warnakulasuriya, several studies have evaluated the willingness of oral health care professionals, including dental hygienists, to provide tobacco education and cessation interventions to their patients.¹⁴ In one study, dental hygienists who received training in tobacco cessation treatment during their formative education were questioned about the frequency in which they provide such services.¹⁵ Study findings suggested that nearly 95% of dental hygienists do not regularly ask about patients' tobacco use status, assist patients who are willing to quit or arrange a follow-up, despite having specific training that prepared them to do so. Slightly more positive results were found among dental hygienists and other dental professionals who agreed to participate in the National Cancer Institute's tobacco education and cessation training program, though the percentage of persons conforming to evidence-based clinical practice guidelines was still low.¹⁶ If one aggregates research results on the subject,¹⁴⁻¹⁷ it appears dental hygienists have not widely adopted the guidelines described in the U.S. Public Health Service's Treating Tobacco Use and Dependence: Clinical Practice Guideline (TTUD-CPG).¹⁸

Barriers to routine implementation of tobacco cessation treatment by dental hygienists may be linked to sub-optimal training opportunities. Insufficient knowledge on the subject among dental hygienists may be a consequence of a lack of tobacco prevention and control training within the dental hygiene curriculum.^{14,19} Limited knowledge and comfort with tobacco cessation treatment is important because inaccurate knowledge has been associated with not following evidence-based clinical practice guidelines.¹² Thus, knowledge appears to be a significant barrier to the provision of tobacco education and cessation intervention. In addition, attitudinal barriers involving implementation of tobacco cessation interventions exist among dental hygienists.^{12,14,16} Perceived resistance on the part of the patient, and concerns that tobacco cessation treatment is beyond the scope of dental practice, likely preclude intervention with tobacco-using patients.^{9,16} O'Shea and colleagues found that 85% of dental hygienists believe patients will not quit their tobacco use, even if their health care provider advises them to do so.²⁰ Thus, concerns about the effectiveness of intervention and low to moderate self-efficacy about one's ability to carry out tobacco cessation treatment may contribute further to dental hygiene professionals' inconsistent provision of tobacco cessation treatment.^{12,21} Perceived time constraints and lack of reimbursement have also been reported as barriers to intervening with tobacco-using patients.^{14,16}

Several barriers to implementation of tobacco education and cessation intervention by dental hy-

gienists have been identified. However, many of these barriers can be adequately addressed with intervention.^{9,16,22} Attempts to increase dental hygienists' adoption of evidence-based tobacco cessation treatment should not be abandoned. Results of randomized controlled trials indicate dental hygienists can be effective in helping their patients quit using tobacco.^{13,23-25} Thus, dental hygienists are a seemingly underused resource for tobacco control.

Specific Aims

The primary aim of this study is to describe knowledge, attitudes and clinical practices related to treatment of tobacco use and dependence among dental hygienists in Kentucky. The secondary aim is to explore correlates of clinical practices consistent with the TTUD-CPG,¹⁸ thereby assessing a more comprehensive array of variables that could be associated with the implementation of evidence-based clinical practices than has been done in the past. By systematically assessing the differences between evidence-based guidelines and dental hygienists' current clinical practices regarding tobacco cessation treatment, this study may assist in the development of educational and training programs.

Methods and Materials

Procedure

All licensed, practicing dental hygienists in Kentucky were notified of the opportunity to participate in the Kentucky Cancer Program's Providers Practice Prevention: Treating Tobacco Use and Dependence (PPP-TTUD) continuing education program. The program was offered through direct mail. Additional notification efforts included articles in trade journals, newsletters and conference presentations. Individuals expressed interest in program participation by contacting the Kentucky Cancer Program and subsequently received materials by mail.

To evaluate the current state of knowledge, attitudes and clinical practices among dental hygienists in the state of Kentucky, data analysis was limited to data collected prior to PPP-TTUD program participation. A request to analyze de-identified archival data was approved by the Human Studies Committee at the University of Louisville.

Participants

Of the 1,671 dental hygienists who received direct notification of the PPP-TTUD program, 485 (29%) ordered the kit, and 308 completed the pre-program survey. Thus, the sample included 18% of all dental hygienists in Kentucky. Years of

practice ranged from 0.5 to 44 years (mean=13.9, sd=10.5), and 1 participant was male (0.3%). Participants practiced in suburban (45%), rural (38%) and urban areas (13%). Fourteen participants (5%) indicated that they were not currently seeing patients. Data from these participants were excluded from analyses involving current clinical practices.

Measures

The survey included questions assessing knowledge, attitudes and clinical practices regarding tobacco cessation treatment. Additional items assessed participants' demographic characteristics and practice setting.

Tobacco cessation knowledge

Tobacco use and cessation knowledge questions included 5 subjective and 8 objective items. With regard to subjective knowledge, participants were asked to rate their comfort discussing tobacco cessation with a patient, helping the patient develop a tobacco cessation plan and recommending pharmacotherapy, using scales ranging from 1 (not at all comfortable) to 4 (very comfortable). A fourth question asked participants to rate their knowledge of pharmacotherapy on a scale from 1 (not very knowledgeable) to 5 (very knowledgeable). The fifth subjective item assessed TTUD-CPG awareness.

To assess objective knowledge, 8 items employed a multiple choice format with 4 response options. Items were scored dichotomously as correct or incorrect, with objective knowledge test scores having a possible range of 0 to 8. Knowledge-based items targeted tobacco use facts conveyed in the PPP-TTUD program video and TTUD-CPG.

Tobacco cessation attitudes

Five survey questions assessed current attitudes toward tobacco cessation using items from the Risk Behavior Diagnosis Scale.²⁶ On a scale from 1 (strongly disagree) to 4 (strongly agree), participants indicated their perception of the susceptibility of their patients to mortality and morbidity resulting from tobacco use, the severity of this threat, their own self-efficacy to address the threat (the belief in their own ability to implement cessation interventions) and 2 aspects of response efficacy regarding recommended interventions (the belief in the efficacy of tobacco cessation treatment in general and in brief clinician intervention, specifically). A sixth question asked participants to indicate which of the 5 barriers limited counseling tobacco users during every visit.

Tobacco cessation treatment practices: The 5 A's

Eight questions addressed clinical practices involving the 5 A's.¹⁸ The first 3 questions focused on whether every tobacco user was identified, how tobacco use status was tracked and how often participants asked patients about tobacco use. The fourth question assessed how often participants advised tobacco users to quit, and the fifth asked when they assessed willingness to quit. The sixth question listed methods of assisting patients to quit tobacco use (e.g., educational materials), and asked participants to indicate the frequency with which they employed each method. The seventh question listed outside resources (e.g., telephone quit lines), and asked participants to identify where they referred patients for further assistance. Finally, participants indicated which methods they used to arrange follow-up.

Statistical Analyses

To address the first study aim, descriptive statistics were calculated to portray participant knowledge, attitudes and clinical practices regarding the treatment of tobacco use and dependence. To address the second aim, bivariate correlations were used to describe the relationship between reported implementation of evidence-based clinical practices and participant demographic information, knowledge and attitudes. A 2 sided alpha of 0.05 was used to determine the statistical significance of all correlations.

Results

Knowledge of Tobacco Use and Cessation Treatment

More than half of participants (60%) reported they had never heard of the TTUD-CPG, and 28% had heard of the guideline but had never read it. Less than 2% of participants reported routinely following TTUD-CPG recommendations. While most were either somewhat (63%) or very comfortable (19%) discussing tobacco cessation with their patients, participants were reportedly less comfortable formulating a quit plan or recommending pharmacotherapy. Fifty-three percent of dental hygienists were either not at all comfortable helping patients develop a tobacco cessation plan or not too comfortable doing so (14% and 39%, respectively). Similarly, 58% reported being not at all comfortable or not too comfortable recommending pharmacotherapy to patients making a quit attempt (24% and 34%, respectively). Average subjectively-rated pharmacotherapy knowledge was 2.17 (sd=0.99),

Table I: Correct Responses to the Objective Knowledge Test (N=307)

Test Items	Frequency (%)
Smoking rates of Kentucky high school students (33%)	175 (57)
Failure rates of unaided quit smoking attempts (90–95%)	150 (49)
Rates of current smokers who have expressed a desire to quit (70%)	108 (35)
Approach not recommended for patients unwilling to quit (Encourage patient to cut back on cigarettes)	211 (69)
Most common age of initiation of tobacco experimentation (11–12 years old)	177 (58)
First-line pharmacologic agents for tobacco cessation (Nicotine replacement, bupropion – not Clonidine)	191 (62)
Recommended follow-up approaches (Scheduled office visit, phone call, mailed letter/card)	230 (74)
Specific practice recommended in the TTUD-CPG (Identify tobacco use status at every visit)	226 (73)

on a scale from 1 to 5, indicating minimal knowledge.

The 8 objective knowledge items were based on facts regarding tobacco use and cessation treatment. Results indicated a mean knowledge score of 4.76 (sd=1.68), ranging from 0 to 8 total correct responses. As shown in Table I, the majority of participants correctly answered 6 of the 8 items. However, none of the items were correctly answered by more than three-quarters of the sample.

Attitudes toward Tobacco Use and Cessation Treatment

Participants strongly agreed with the importance of discussing tobacco use with patients (87%) and the seriousness of tobacco's health consequences (98%). Almost all participants also strongly agreed that tobacco cessation in general is effective in reducing morbidity and mortality (response efficacy: 84%). However, fewer agreed that a brief, 3 minute intervention would be effective for tobacco cessation (strongly agree: 33%, somewhat agree: 51%). Eight percent strongly agreed and 50% somewhat agreed that they possessed the skills and knowledge to treat nicotine dependence (self-efficacy).

When reporting specific barriers to counseling tobacco users and applying tobacco cessation strategies, participants identified an average of 1.45 of 5 barriers (sd=0.74). Participants cited 2 factors substantially more often than others: the perception that tobacco cessation is a low priority for patients (58%), and time constraints (57%). Additionally, 24% of participants endorsed as a barrier the belief that patients might seek another provider if tobacco cessation was discussed. The remaining factors were cited by fewer than 3% of participants.

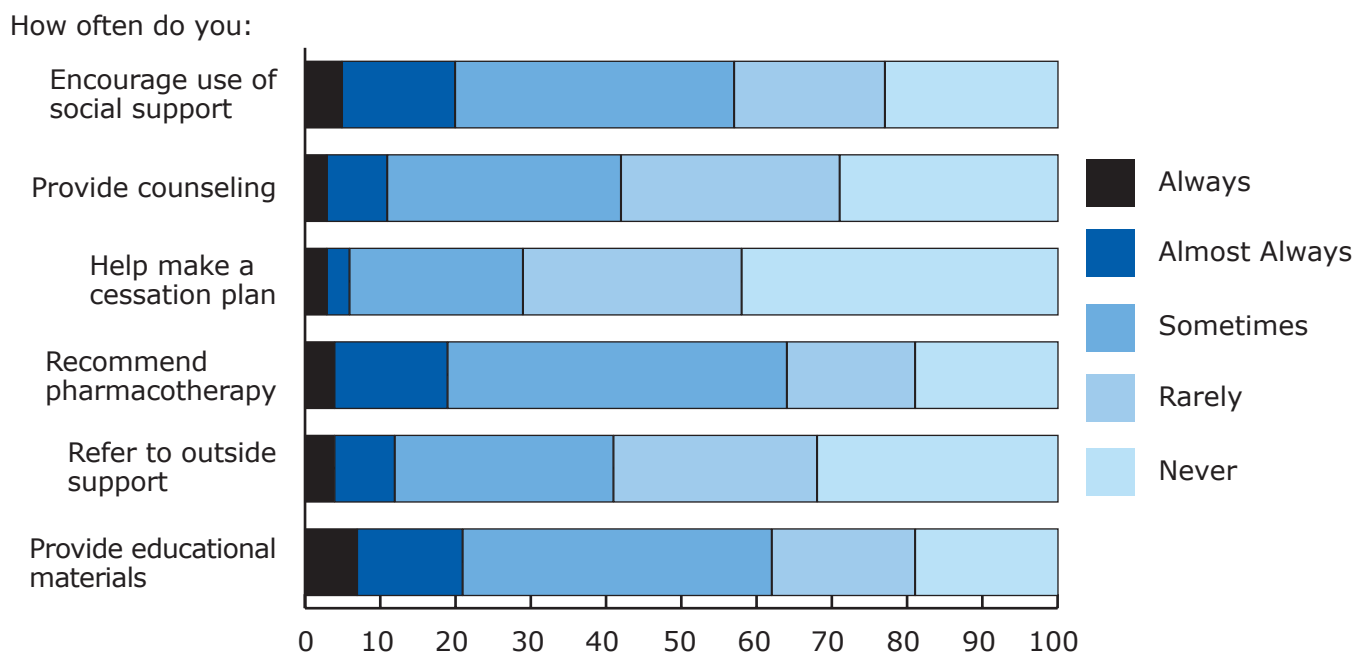
Clinical Practices Regarding Treatment of Tobacco Use and Dependence

Ask: Eight percent of participants reported they always identify the tobacco use status of every patient, while 40% reported they almost always identify the use of every patient. Six percent of participants reported generally not asking each patient about tobacco use, and 24% reported having no routine method. The most common method of identifying tobacco-using patients included having patients complete a medical history form (67%) or verbally asking patients during examination/consultation (65%). Only 8% reported recording tobacco use as a vital sign at every visit.

Advise and Assess: Participants indicated they almost always (41%) or sometimes (35%) advised tobacco-using patients to quit. Thirty-three percent of participants reported assessing patient willingness to quit during routine check-ups, but this was followed by 24% of participants having no routine method of assessing patient willingness to quit. Only 13% reported assessing patient willingness at every visit, 13% reported assessing only at the initial visit and 12% reported assessing when patients present with a tobacco-related problem. A minority (6%) indicated not assessing this factor at all.

Assist: As depicted in Figure 1, participants reported relatively infrequent use of assist methods. The most common response for 4 of the 6 assist methods was "sometimes," and ranged from sometimes providing practical counseling (31%) to sometimes recommending pharmacotherapy (45%). "Never" was the most common response to assisting with a cessation plan (43%) and referring to outside sources of support (32%).

Figure 1: Frequency (in %) of Assisting Patients Willing to Quit (N=286)



Consistent with reported use of assist methods, very few participants indicated they made referrals to additional cessation resources. Fifty-nine percent reported they did not refer patients for tobacco cessation assistance. Of those that offered referrals, the most commonly reported efforts involved cessation support groups or classes (26%), followed by individual therapy (15%), cessation Web sites (5%), inpatient cessation programs (3%) and telephone quit lines (2%).

Arrange: Even fewer participants indicated arranging a follow-up with patients – only 14% reported any type of follow-up procedure.

Correlates of Clinical Practices Regarding Treatment of Tobacco Use and Dependence

To examine associations with clinical practices recommended in the TTUD-CPG, 3 sets of variables were correlated with responses to items regarding the 5 A's: demographic characteristics, knowledge factors and attitudinal variables. Only 1 demographic factor was associated with any of the 5 A's. Participants who practiced in a rural setting were significantly more likely to Ask than participants practicing in suburban or urban settings ($\chi^2(2, N=280)=7.76, p=.02$).

As shown in Table II, participants' report of clinical practices consistent with the 5 A's were significantly and positively associated with the following variables: perceived knowledge of pharmacotherapy (median correlation=0.30), comfort discussing tobacco cessation (median correlation=0.27),

developing a quit plan with tobacco-using patients (median correlation=0.22), comfort recommending pharmacotherapy (median correlation=0.17), self-efficacy (median correlation=0.15), awareness of the TTUD-CPG (median correlation=0.15) and perceived risk of tobacco use (median correlation=0.15).

Discussion

Healthy People 2010 identified dental hygiene and dental professionals as key practitioners in the effort to meet public health goals for treatment of tobacco use and dependence.²⁷ In particular, dental hygienists are a viable and vital channel for decreasing tobacco-related morbidity and mortality. Since dental hygienists are trained extensively in providing oral health education,⁹ incorporating information on the oral health effects of tobacco use and intervening with tobacco-using patients can be viewed as an extension of their unique skill set. To increase the likelihood dental hygienists implement evidence-based clinical practices, tobacco cessation training has been advocated by the American Dental Hygienists' Association, and recommendations have been made to include tobacco-related training as part of the dental hygiene curriculum.^{10,28} By implementing evidence-based clinical practice guidelines outlined in the TTUD-CPG, dental hygienists have the greatest chance to maximize their impact on reducing tobacco-related morbidity and mortality. For this to be accomplished, dental hygienists must receive training in evidence-based tobacco cessation treatment and feel comfortable and confident in their ability to in-

Table II: Correlates of Clinical Practices Consistent with TTUD-CPG 5 A's (N=308)

Knowledge Variables	TTUD-CPG 5 A's					
	Ask*	Advise†	Assess*	Assist-Cessation†	Assist-Referral*	Arrange*
TTUD-CPG Awareness	.16‡	.14§	.02	.21**	.16‡	.16‡
Pharmacotherapy Knowledge	.32**	.31**	.26**	.39**	.21**	.30**
Comfort Discussing Cessation	.33**	.49**	.31**	.23**	.20**	.13§
Comfort Develop. Cessation Plan	.26**	.30**	.18‡	.32**	.15§	.09
Comfort Rec. Pharmacotherapy	.22**	.19‡	.15§	.27**	.15§	.14§
Objective Knowledge Score	.04	.11	.11	.02	.16‡	.03
Attitudinal Variables						
Perceived Risk	.15§	.20**	.15§	.11	.16‡	.01
Perceived Severity	.07	-.05	-.07	-.04	.00	-.10
Self-Efficacy	.15§	.25**	.15§	.25**	.11	.17‡
Response Efficacy - Cessation	.05	.10	.05	.06	.05	-.01
Response Efficacy - Brief	.05	.17‡	.05	.04	.04	-.02
Perceived Barriers	.02	-.13§	-.02	-.06	.02	.02

*Spearman correlations (rho) †Pearson correlations (r)

‡p ≤ .01

§p ≤ .05

**p ≤ .001

tervene with patients. In this way, knowledge and attitudes regarding tobacco cessation intervention are considered important variables when promoting implementation of evidence-based clinical practices among dental hygienists.

Ample opportunities remain to achieve optimal implementation of evidence-based practices by dental hygienists. Consistent with previous research, results showed that dental hygienists reported a higher rate of adherence to TTUD-CPG regarding tobacco use and dependence assessment (i.e., Ask, Advise, Assess) than implementation of tobacco cessation treatment (i.e., Assist and Arrange).¹⁴⁻¹⁷ While half of the participants reported asking about patients' tobacco use status at every visit, 25% reported having no routine method of doing so. Without standardized assessment procedures, it is unlikely dental hygienists will fully appreciate opportunities to provide subsequent interventions to support tobacco cessation. While the majority of participants reported advising tobacco-

using patients about cessation, the frequency of doing so was inconsistent with TTUD-CPG recommendations. Assessing patient willingness to quit, which allows for tailored intervention, was accomplished infrequently by study participants. Finally, results showed that assisting those patients making a quit attempt and arranging follow-up care was not performed by most dental hygienists in this study.

Lack of implementation of evidence-based tobacco treatment strategies could be related to several factors. First and foremost, dental hygienists in this study reported little awareness of the TTUD-CPG, a notable dissemination concern for guideline advocates and an educational issue for training programs. Interestingly, participants reported greater comfort assessing the tobacco use status of patients than intervening with those patients willing to make a quit attempt. The differential level of comfort probably explains the observed difference in the extent to which participants engaged in the

Ask, Advise and Assess practices as compared to Assist and Arrange. Thus, it is thought that efforts to disseminate evidence-based clinical practice recommendations and to promote greater comfort with each of the 5 A's may lead to increased adoption of the Assist and Arrange phases.

Regarding objective knowledge, participants' general amount of tobacco use and control information was promising. However, as is common in prevention research, factual knowledge did not readily translate into practice. Particular areas of concern included participants' knowledge of the percentage of tobacco users who desire cessation and failure rates associated with unaided quit attempts. These 2 points are critically important because they are potentially significant barriers to implementation. First, underestimating the percentage of tobacco users with a desire to quit smoking likely explains a frequently endorsed barrier to tobacco cessation treatment in dental hygienists – the belief that tobacco cessation is not a priority for their patients. Second, over-estimating the efficacy of unaided quit attempts is likely another explanation why dental hygienists implement the behavior change-oriented components of the 5 A's less often than recommended. Effectively addressing these 2 areas could result in fewer missed opportunities to intervene with patients, ultimately leading to greater tobacco control.

Consistent with the American Dental Hygienists' Association's position on the subject,²⁸ dental hygienists in this study clearly reported favorable attitudes recognizing the importance of discussing tobacco use and its ill-effects with patients. Yet participants' level of response efficacy regarding tobacco cessation treatment was moderate, and confidence in their ability to carry out such practices was less so. In other studies, dental hygienists reported low to moderate belief in the effectiveness of tobacco cessation treatments,^{12,21} despite accumulating empirical support for dental office-based intervention.^{13,18,23,29} The identification of several barriers to routine implementation of tobacco cessation treatment found in this study is consistent with previous reports.^{14,16} This suggests that important points of intervention among dental hygienists include addressing the misconception that patients will respond negatively to discussion of tobacco cessation, as well as highlighting the fact that effective tobacco cessation treatment can be accomplished within the constraints of a standard dental hygiene appointment.^{25,30} Developing continuing education programs, encouraging use of available Web resources (e.g., www.askadviserefer.org or smokingcessationleadership.ucsf.edu) and integrating additional training modules that enhance

comfort and confidence regarding evidence-based tobacco treatment would likely enhance integration of these key tobacco control strategies into standard clinical practice regimens.

Results of this study should be interpreted in light of some considerations. First, the data relied on was self-reported, which has been common among studies of this kind. Therefore, future research should consider incorporating objective measures of dental hygienists' clinical practices (e.g., chart review, patient report) to cross-validate self-reported data. Second, self-selection to participate in the PPP-TTUD program may be considered a study limitation because results may not generalize well to the broader population of dental hygienists. On the other hand, results from this study may be used to inform the development of interventions that are tailored to individuals interested in conforming to evidence-based guidelines. Further, comparisons between results of the current study and those of other studies are largely consistent and lend credibility to the current data.

Beyond the above limitations, there are several strengths of the current study. First, this study employed comprehensive assessment of factors related to tobacco cessation interventions. By measuring subjective and objective knowledge, attitudes (i.e., self-efficacy, response-efficacy, perceived barriers) and clinical practices, this study adds significantly to the current knowledge base. Second, this study included a large sample size relative to most other studies in this area. Third, the study collected data regarding participants' demographic and practice characteristics, which allowed the evaluation of whether such characteristics were related to dental hygienists' clinical practices. Fourth, results of the current study can be used to inform development of interventions designed to increase dental hygienists' adoption of evidence-based tobacco cessation interventions.

Conclusion

The results of this study found that dental hygienists in Kentucky showed sub-optimal awareness of evidence-based guidelines for tobacco control, as well as low levels of comfort and confidence in implementing the 5 A's. Consistent correlations between measures of knowledge and attitudes (e.g., guideline awareness, perceived knowledge of pharmacotherapy and comfort and confidence in treating tobacco), with implementation of evidence-based practices, suggest that interventions could target these parameters to increase tobacco control efforts by dental hygienists. It is recommended that effective means of increasing knowl-

edge about pharmacotherapy, comfort in discussing and developing tobacco cessation plans, as well as enhancing self-efficacy, should be developed to promote the knowledge and attitudes necessary to expand dissemination and implementation of efficacious tobacco use and cessation interventions among dental hygienists.

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The Empire Challenge: Statewide Initiative Linking the Role of Dental Hygienists to Tobacco Dependence Treatment

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Introduction

Each year in New York state, over 25,000 people die from a tobacco-related illness, 1.1 million children are exposed to secondhand smoke in their homes and 27,700 children under the age of 18 become daily smokers.¹ The state's total medical expenditures resulting from smoking are \$8.2 billion a year.² It is estimated that if every health care practitioner, including dental hygienists, would address tobacco use according to the Clinical Practice Guideline, "Treating Tobacco Use and Dependence Recommendations," cessation rates would double from 1 to 2 million nationally each year.³

The dangers of tobacco use and secondhand smoke exposure are well documented. Tobacco use can cause oral diseases such as oral cancers, leukoplakia, stomatitis nicotina (smoker's palate), impaired gingival bleeding, periodontal disease, receding gums, acute necrotizing ulcerative gingivitis, halitosis, dental staining and excess dental calculus.⁴ Tobacco use has also been linked to a number of other dental health conditions including salivary changes, delayed wound healing, smoker's melanosis, oral candidiasis, canker sores and hairy tongue.⁵ Oral health diseases and problems related to tobacco use may be arrested or reversed if a patient discontinues tobacco use. Dental practices have the potential to reduce tobacco use in their patients.^{6,7}

This 3 year initiative investigated the promotion of tobacco cessation through preventative dentistry. According to the National Center for Health Sta-

Abstract

Purpose: The primary goal of this 3 year grant-funded pilot project was to determine if a specialized training program could increase the number of dental hygienists in New York state who routinely address tobacco use with their patients.

Methods: A training program based on the 2000 Clinical Practice Guideline, Treating Tobacco Use and Dependence, was developed to educate licensed and registered dental hygienists in New York. Outcome data are from cross-sectional surveys conducted before and after the training and from the New York State Smokers' Quitline.

Results: The formal training program was associated with a significant increase in the percentage of a sample of hygienists routinely addressing tobacco use and dependence with their patients. An increased number of calls to the Quitline were generated.

Conclusion: A comprehensive training program based on accepted clinical guidelines, which included increased accessibility to free supplies, was associated with an increase in the proportion of dental hygienists who routinely address tobacco use and dependence with their patients.

Keywords: Tobacco, cessation, behavior change, hygienists, training, Quitline, oral health

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Validate and test assessment instruments/strategies/mechanisms that increase health promotion and disease prevention among diverse populations.

tistics, more than half of all smokers see a dentist each year.⁸ Dental patients are likely to be highly receptive to positive health messages during check-ups, and each dental visit allows the provider the time needed to deliver health-related messages and make referrals.⁶ Dentists and dental hygienists are in a unique position to provide tobacco cessation messages and interventions that many other health care providers cannot offer.

The primary goal of this project was to determine if a training program specifically designed for

a sample of dental hygienists from New York state would increase the percentage of tobacco use and cessation messages they deliver to their patients. A related goal was to increase the number of smokers referred to the New York State Smokers' Quitline from dental practices.

Review of the Literature

The link between tobacco use and oral cancer was first reported widely in the landmark 1964 Surgeon General's Report on smoking and health.⁹ More recently, the Surgeon General reported that tobacco use is responsible for 75% of deaths resulting from oral and pharyngeal cancer, and it is related to many other detrimental oral health effects.^{10,11} Other oral health conditions for which tobacco is a primary risk factor include leukoplakia, periodontitis and delayed wound healing.^{6,12,13} As a result of the relationship between smoking and diseases of the oral cavity, a compelling case can be made for a concerted effort by dentistry to reduce tobacco use.

Albert et al stated that dental practice in the 21st century should move from a restorative orientation to a broader promotion of health, and this shift in practice must include the treatment of tobacco use and dependence.¹⁴ Several studies have focused on the relationship between tobacco use and dependence interventions and the dental practice. Monson and Engeswick conducted a study to investigate the prevalence of tobacco use among their patients and their readiness to quit tobacco within a collegiate dental hygiene clinic setting.¹⁵ They also measured faculty perceptions regarding tobacco use and dependence education. Results suggest that dental hygienists have an opportunity to intervene but lack the knowledge, training and experience to provide personalized tobacco cessation counseling.

Two studies looked at the impact of tobacco dependence training on the opinions and behaviors of dental hygiene students or registered hygienists. Studts et al examined the impact of an education program provided to registered hygienists.¹⁶ At the conclusion of the training, and with data from a follow-up survey, significant improvements in hygienists' knowledge, attitudes and practices towards tobacco dependence treatment in the clinical setting were noted. Maillet et al tested the impact of a tobacco cessation curriculum on dental hygiene students' practices related to providing cessation treatment to their clients.¹⁷ This included advice to quit, informing clients of health risks, self-examination techniques for oral cancer and arranging post-counseling follow-ups. A survey with a sample of

clients found that the program had little effect on improving dental hygienists' practices.¹⁷

Through a series of surveys administered by Davis et al to clinic patients, it was determined that there is a strong need for oral health care providers to effectively address tobacco use and dependence with their patients.¹⁸ Survey data revealed that most patients who smoke want to quit, yet the majority of respondents reportedly did not want assistance with quitting. Dental hygiene faculty also reported strong positive attitudes associated with tobacco control education, however, at the time the study was conducted, dental hygiene faculty stated that it is generally not included in the hygienist's education. Dental hygiene faculty are unlikely to feel prepared to offer didactic training and evaluation when they have not received adequate training. The authors found that the barriers to addressing tobacco use and dependence can be easily overcome by promoting competency-based education in tobacco control.¹⁸ This education will then provide dental hygienists with the skills to approach patients about their tobacco use and intentions to quit.

Albert et al found that dentists, like dental hygienists, have similar attitudes and practice behaviors associated with the integration of tobacco cessation intervention into dentistry practice.¹⁴ The investigators surveyed dentists in a large, managed-care dental plan and addressed perceptions about the barriers to adopting cessation counseling in their practices. They found that many dentists did not have prior training in tobacco control, did not ask their patients about tobacco use and did not recommend nicotine replacement therapy. Dentists who were confident in their tobacco cessation knowledge were more likely to advise patients to quit. Nearly all dentists (95.6%) were willing, or very willing, to receive the training on best practices in tobacco control.

Monson and Engeswick examined the prevalence of hygienists who provide tobacco cessation counseling to their patients after they received tobacco control training provided during post-secondary dental hygiene education.¹⁵ Dental hygiene students received 2 hours of didactic instruction on the best practices for tobacco control, specific counseling interventions from the Clinical Practice Guideline and assessment of patient's readiness to quit.³ Each student also completed an intensive intervention followed by a self-evaluation. After the self-evaluation, students were required to implement brief interventions for all clinic patients who reported current tobacco use. During their final semester, students were given resource material for

implementing a tobacco use and dependence intervention in private dental practices.

The researchers mailed a survey to former students who were trained in tobacco cessation counseling techniques and were now working in private practice as dental hygienists. Between 1 and 3 years after receiving training, fewer than 6% of former students were providing tobacco cessation counseling to a high percentage (defined as 81 to 100%) of their patients.¹⁵

Harris et al conducted a survey of graduating dental hygiene students in North Carolina.¹⁹ They reported that, while the students said they were comfortable providing counseling to their patients who use tobacco, 25% were unsure of how to work with smokers who were unwilling to quit tobacco.

The American Dental Education Association, an organization that establishes basic core competencies for dental and dental hygiene education, does not specifically include tobacco cessation education as a competency for these providers. However, this organization recognizes that dental hygienists need to emphasize both prevention of disease and effective health care delivery.²⁰ Based on the studies cited, it appears that a comprehensive training program that features a tobacco dependence curriculum comprised of training in evidence-based procedures and providing for sufficient practice is needed to enhance adoption of these procedures and to build confidence in service delivery. In addition, further study is needed to determine whether or not training dental hygiene students on tobacco dependence treatment has an impact on their behaviors and which training method is most effective.

Following is a description of a pilot program implemented in New York State that educates dental hygienists on how to help their clients that use tobacco to quit smoking. In addition, outcome data is presented regarding program effectiveness.

Empire Challenge Project

The Empire Challenge project was developed to replicate California's Gold Rush project. The project included an advisory board of staff from the American Dental Hygienists' Association, the Robert Wood Johnson Foundation's Smoking Cessation Leadership Center at the University of California at San Francisco and the Dental Hygienists' Association of the State of New York. A key component of the Empire Challenge Project was direct dental hygienist training, for which the New York State Department of Education and the Dental Hygienists' Association

of the State of New York approved up to 6 continuing education credits. Trainings were offered at 15 locations throughout New York and were marketed across the state to ensure even geographic distribution. Thirty-three trainings were conducted and 1,953 dentists and dental hygienists attended the certificate trainings.

Each training session varied in length from 2 to 6 hours, depending on attendee and site organizer needs, and was conducted by the grant project coordinator. Various learning methods were used including lecture, slide presentations, role plays, educational DVDs, question and answer sessions and clinical case studies.

To assess the participants' level of understanding during the trainings, a quiz was given at midpoint. Correct answers were shared and time to discuss subject matter was allotted. All programs included an evaluation that was used to assess the instructor, materials, subject matter, facilities and space. All training materials, quizzes and evaluation forms are available upon request.

The training program was based on the Clinical Practice Guidelines and several existing educational programs, and it was designed to raise dental hygienists' awareness and knowledge of how to address tobacco use with their patients and the existence of resources to help patients quit.³ Guideline concordant care incorporated into the training included education on the cessation process, counseling techniques and behavior modification. Key features from the Clinical Practice Guidelines incorporated into the Empire Challenge Project included the need for consistent documentation of tobacco use status and treatment, practical brief counseling strategies (Ask, Advise, Assist, Assess, Arrange), importance of social support and use of pharmacotherapy.³ Findings from the Guideline were introduced during trainings to heighten the dental hygienists' awareness of tobacco dependence treatment and the dangers of secondhand smoke. It was recommended that the dental hygienist provide appropriate tobacco dependence interventions while the patient was receiving routine oral care.²¹

Other activities conducted as part of the Empire Challenge Project included broad distribution of educational materials at conference professional meetings and through special web access. A statewide incentive-based contest was created to increase the number of referrals to the New York State Smokers' Quitline, and to motivate hygienists to help patients quit. Mass mailings, e-mails, newsletters and listserv postings at various conferences were employed to educate dental providers about

the Empire Challenge trainings and the importance of treating tobacco dependence. The project provided a variety of free educational resources and other supplies to dental practices.

The Center for Smoking Cessation at Seton Health's Web site (www.QuitSolutions.org) served as the main Web site for the Empire Challenge and provided links to specific dental hygiene pages for education, ordering supplies, trainings, slides, latest research, related links, contact information and references. Trainings focused heavily on using the New York State Smokers' Quitline as a resource for helping patients quit. The Quitline provides free counseling and mails nicotine replacement therapy to callers who meet eligibility criteria. Patients can be referred to the Quitline by having the patient call directly or via a proactive faxed referral by the dental hygienist called "Fax-to-Quit." Quitline personnel contact the patient within a short time after the referral is made to determine the patient's status, motivation and need for Quitline services.

To sustain the project after the grant funds were gone, the project coordinator offered training and materials to all college-based dental hygiene programs to encourage incorporation of a tobacco dependence and treatment curriculum. All accredited dental hygiene programs were notified of local cessation centers for future tobacco cessation education and needs.

Program Assessment

Cross-sectional surveys were conducted before and after the Empire Challenge activities, with the post-survey completed 2 years after baseline. In each case, the survey was mailed to all dental hygienists registered with the New York State Department of Education. The baseline survey assessed prevalence of routine chair-side tobacco interventions. Dental hygienists were asked to complete and return surveys within 4 weeks via postal mail or fax. A nominal, non-monetary incentive was used to increase participation in the post-survey. The study design was cross-sectional, and it is unknown how many hygienists responded to both surveys. Data analyses were conducted using SAS 9.2.

Results

The initial survey was mailed to 9,416 licensed and registered dental hygienists across New York. The total number of surveys returned was 221 (2.3%). For the final evaluation, 9,410 surveys were mailed out and 388 (4.1%) were completed.

Results of the baseline survey showed that

64% of respondents reported they always or often asked their patients if they smoke. Over 70% reported they always or often advised their smoking patients to quit smoking. Only 40% reported they documented tobacco interventions and fewer than 20% reportedly referred smoking patients to the Smoker's Quitline. Barriers to use of these interventions cited by dental hygienists include lack of knowledge (31%), lack of time (10%) and privacy concerns (10%) (Figure 1).

Following the Empire Challenge Project, all these figures significantly improved (Figure 1), with 80% of responding hygienists reporting that they always or often asked patients if they smoke (chi-square=4.39, $p<0.05$). Nearly 90% of responding hygienists reported they always or often advised smoking patients to quit (chi-square=30.02, $p<0.0001$), whereas 70% documented their intervention (chi-square=51.78, $p<0.0001$). Although still the lowest scoring indicator, 41% of hygienists often or always referred smokers to the Smoker's Quitline (chi-square=29.18, $p<0.0001$), a significant improvement.

Data from the New York State Smokers' Quitline was analyzed in the year prior to the project (April 2005 to April 2006) to establish a baseline (Figure 2, 3). The results showed that dental referrals were 0.3% of the total Quitline call volume. Fax-to-Quit referrals by dental professionals were just 2.6% of the total prior to the start of this project. Following the Empire Challenge Project, these percentages increased. The averages for 2006 to 2008 showed an increase of 2% of direct referrals to the Quitline and 17% of Fax-to-Quit referrals. Figures 2 and 3 show an increase in calls in 2006 and 2007, with declines in 2007 and 2008. However, the dental provider graph shows a larger increase in calls and a sharper decline when the project was transitioning to evaluation and no longer providing active trainings (Figure 3). Overall, both figures show a significant increase in the number of referrals made to the New York State Smokers' Quitline during the April 2006 to March 2007 period when the project was actively conducting training.

Discussion

For the sample of dental hygienists who responded to the survey, significant improvements in each tobacco indicator were noted. Eighty percent and nearly 90% of responding hygienists reported that they often or always asked and advised their patients about tobacco use, respectively. Documentation of their intervention with patients is somewhat lower at 70% of the sample, but this increased from just 40% at baseline. Finally, the proportion

of hygienists referring their patients to the Quitline doubled during the course of this project, but still remains as the lowest of the 4 indicators.

The principal limitations of this study are the small sample/low survey response rate and the cross-sectional nature of the survey. Both potentially limit generalizability of the findings. Although the results are provocative, it is difficult to say that the results of this pilot project can be directly tied to the intervention. It is possible that hygienists who responded may be more attuned to the issues of tobacco dependence and therefore more responsive to the intervention. The incentive provided for the follow-up survey seemed to have improved response rates and should be used in future research for both pre- and post-survey data collection.

Despite these limitations, the results are strengthened by the objective findings related to increased use of Quitline services, which was an important component of the project. Use of these services peaked during the project and decreased after the project was completed. This suggests that sustainability is dependent on continuing dissemination of the project message.

The Empire Challenge Project might have been strengthened if thorough and intensive technical assistance were able to be conducted, to further increase the knowledge and understanding of dental hygienists on how to address patients who use tobacco. More intensive technical assistance and staff training within the dental practice, such as was done by Stevens et al for smokeless-tobacco cessation interventions in dental practices, may have led to higher Quitline referral rates.²² Indeed, the decrease in Quitline calls/referrals during the 2007 to 2008 project year suggests a potential lack of sustainability for this relatively short-term project.

Figure 1: Results of survey of dental hygienists in New York before and after the Empire Challenge Project

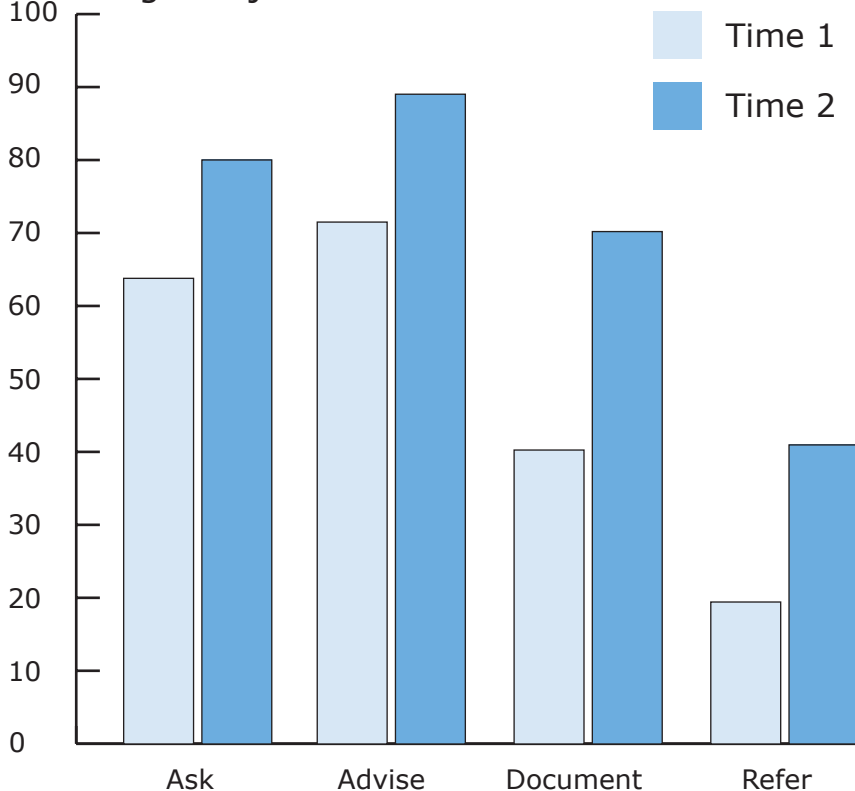
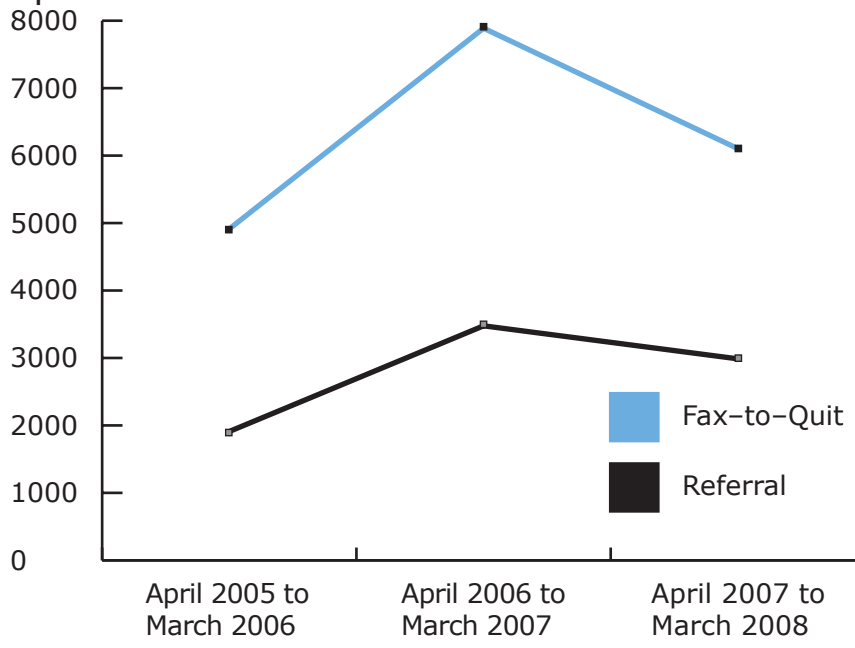


Figure 2: Quitline trends for telephone and Fax-to-Quit referrals from all health care providers - April 2005 to March 2008



Future studies should focus on improving response rates through the use of incentives and more intensive recruitment. Other methods of reaching

professionals might include online panel surveys that allow for targeted surveillance. It would be helpful to have more information about the respondents relative to their own attitudes, beliefs and behaviors regarding tobacco use and their perceived role in tobacco cessation. More demographic information would help understand the sample better, and online surveys often have access to this type of information about panel members.

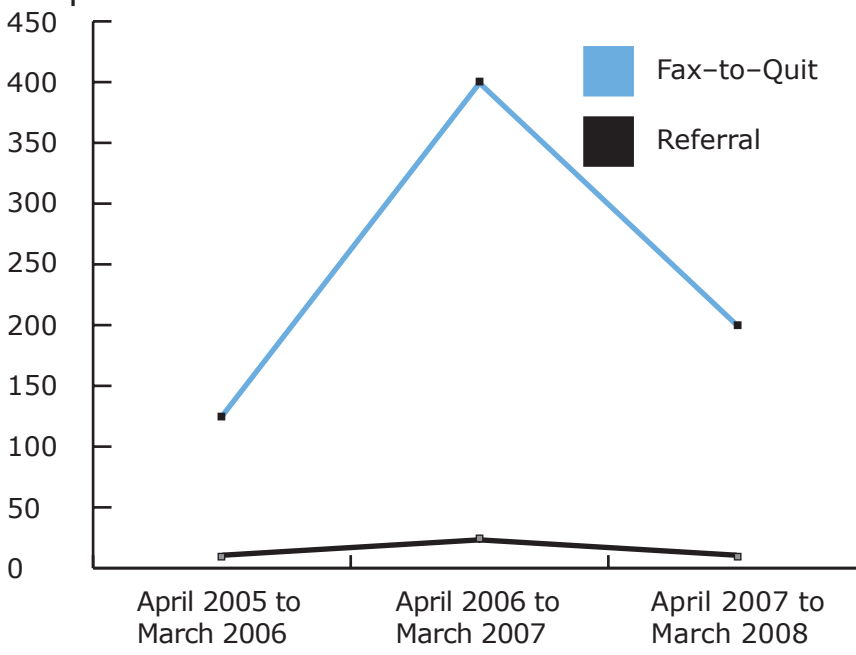
Stevens et al examined the effectiveness of training dental professionals to address patients who use spit tobacco.²² They concluded that tobacco cessation interventions for spit tobacco users were effective in the dental office. They further stated that if it became a standard of care for all patients, there would be a substantial reduction in smokeless tobacco use. The current study, though different in approach and reach, demonstrated a similar outcome relative to addressing cigarette use by patients in dental practices. Overall, the authors believe targeting specific health care providers, such as dental hygienists, with a training program tailored expressly to them generates promising outcomes, as seen by increased referrals to the Quitline during the height of the project's implementation.

Although the authors believe that success similar to that found in this pilot project could be achieved elsewhere, additional research is needed to verify. Larger samples and different surveillance methods would contribute to improved understanding of the impact of dental hygienist training. Dental hygienist training guidelines are changing, and the authors encourage the incorporation of comprehensive tobacco dependence treatment curriculum in the training of all dental hygienists.

Conclusion

A comprehensive training program based on accepted clinical guidelines, which included increased accessibility to free supplies, was associated with an increase in the proportion of dental hygienists who routinely address tobacco use and dependence with their patients. Results of this pilot project show that dental hygienists can be effective tobacco use and dependence counselors. Quitline data showed that when a statewide comprehensive

Figure 3: Quitline trend for telephone and Fax-to-Quit referrals from dental professionals – April 2005 to March 2008



training program was active, the dental provider referrals produced a higher call volume than general health care providers. However, sustainability will require additional effort. This supports the need for a statewide training program to work specifically with dental practices. Chair-side tobacco intervention could become a sustainable practice with appropriate training and technical assistance.

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Historical Review of the Commissioning of Health Care Disciplines in the USPHS

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Introduction

The United States Public Health Service (USPHS) cites its earliest beginnings in the 1798 Act for the Relief of Sick and Disabled Seamen, which established a Marine Hospital System and a Marine Hospital Service. The uniformed medical provider component of the Marine Hospital Service became known as the Commissioned Corps in 1889. The name of the service formally changed to the U.S. Public Health Service in 1912, and by the 1930s and 1940s the Commissioned Corps of the USPHS expanded its cadre of Public Health Officer providers from physicians to dentists, nurses, dietitians, engineers, research scientists and other health care specialists.¹

As the public health needs of the nation changed and increased in scope, new health care disciplines were commissioned into the Corps. Today the Commissioned Corps of the USPHS includes health care officers in 11 different professional categories, with the Health Services Officer (HSO) category containing 57 different health care disciplines, including physician assistants and dental hygienists.¹

The purpose of this investigation was to examine the history surrounding the commissioning and the procedures followed in the commissioning process of the first physicians, dentists, nurses, nurse practitioners, physician assistants and dental hygienists into the USPHS Commissioned Corps, and to determine a critical pathway to commissioning new health care professions into the USPHS.

Abstract

Purpose: The purpose of this investigation was to examine the commissioning history of the professions of physicians, dentists, nurses, nurse practitioners, physician assistants and dental hygienists of the United States Public Health Service (USPHS), and to determine a critical pathway to commissioning new health care professions into the USPHS. The Advanced Dental Hygiene Practitioner (ADHP), recently developed by the American Dental Hygienists' Association, is an oral health care provider proposed for public health settings that shares the same goal as the USPHS of treating underserved populations in the U.S. With the establishment of the ADHP role, an opportunity for the ADHP to be commissioned into the USPHS may arise.

Methods: Journal articles, books and Web sites documenting the history and commissioning process of the USPHS were researched. Interviews with key USPHS commissioned officers involved with the commissioning process of the selected health care disciplines were conducted. A qualitative comparative analysis to examine published documents and interpret interviews was performed to reveal patterns of events leading to commissioning. Systematic, time-oriented visual displays of data were constructed to identify critical pathways for commissioning new professions into the USPHS.

Results: The need for health care professionals to provide quality health care to the Federal beneficiaries of the USPHS was found to be the driving force behind commissioning the selected health care professions into the USPHS. A critical pathway for commissioning new professions into the USPHS was identified.

Conclusion: Understanding the commissioning process of new health care professions into the USPHS would assist with defining the critical pathway for future USPHS commissioning of the ADHP.

Keywords: United States Public Health Service, Advanced Dental Hygiene Practitioner, Mid-level Health Professions, Access to Care, Dental Hygienists

This study supports the NDHRA priority area, **Health Services Research:** Investigate how alternative models of dental hygiene care delivery can reduce health care inequities.

The USPHS is one of the providers of oral health care services to the underserved populations in the U.S. The majority of the approximately 500 dental

commissioned officers and 60 dental hygienist commissioned officers provide oral health care services through the Indian Health Service, the Federal Bureau of Prisons and the Health Resources and Services Administration.¹ The U.S. Surgeon General's 2000 report titled *Oral Health in America* defined oral health care and its relationship to general health, emphasizing the disparities of current oral health care among specific populations.² This report also discussed the ineffectiveness of the current dental care delivery system and the problems many populations have accessing dental care.

Healthy People 2010, published by the United States Department of Health and Human Services, developed objectives to address oral health disparities and access to quality health care.³ Adding to the complications of limited access to dental care, the numbers of dentists in the U.S. is declining. Approximately 2,000 more dentists are retiring each year than are graduating from dental school, while the population is growing and living longer.⁴

New workforce models are being developed and utilized to help facilitate access to oral health care. A new workforce model currently under development by the American Dental Hygienists' Association (ADHA) is the Advanced Dental Hygiene Practitioner (ADHP), a mid-level oral health care provider of dental services. In May 2009, Minnesota became the first state in the U.S. to pass legislation allowing licensing of the ADHP, called the Advanced Dental Therapist in Minnesota.⁵ The introduction of the ADHP to the oral health care workforce could increase the numbers of dental providers practicing in the public health setting, thereby helping to increase access to oral health care services.

As the role of the ADHP becomes established, opportunities may become available for the ADHP to be commissioned into the USPHS, thus increasing the numbers of oral health care providers and increasing access to oral health care services to the underserved. Understanding the history of the USPHS and the commissioning process of health care providers into the USPHS could provide a critical pathway for the future commissioning of the ADHP into the U.S. Public Health Service.

Review of the Literature

A review of the literature provided the basic description and historical background of the professions of physicians, dentists, nurses, nurse practitioners, physician assistants and dental hygienists. Current professional demographics provided a view of future workforce implications.

Physician

A physician is defined as one who is educated and trained to "diagnose illnesses and prescribe and administer treatment for people suffering from injury or disease."⁶ References to physicians and the use of medicines are found in the ancient history of many civilizations, with the earliest known surgical operations depicted in the tomb of the Pharaohs of Saqqarah in Egypt, dating back to 2500 B.C.⁷

Dentist

A dentist is defined as one who is educated and trained in "the evaluation, diagnosis, prevention and/or treatment ... of diseases, disorders and/or conditions of the oral cavity, maxillofacial area and/or the adjacent and associated structures and their impact on the human body."⁸ Oral health has its earliest documented beginnings in an ancient Sumerian text dating back to 5000 B.C., describing tooth worms as the cause of dental decay.⁹

Nurse

The American Nurses Association defines nursing as "the protection, promotion and optimization of health and abilities, prevention of illness and injury, alleviation of suffering through the diagnosis and treatment of human response and advocacy in the care of individuals, families, communities and populations."¹⁰ Early historical documentation detailing nursing practices is lacking, and it is only speculative to say that nursing practice began in the home with family members caring for the sick. As societies grew, nursing practices developed in conjunction with medicine and religion. Houses for the sick and dying were associated with temples in Egypt and Persia.¹¹

Nurse Practitioner

The American College of Nurse Practitioners defines nurse practitioners as "registered nurses who are prepared, through advanced education and clinical training, to provide a wide range of preventive and acute health care services to individuals of all ages."¹² An emerging shortage of primary care physicians limiting health care access by the disadvantaged, rising health care costs and the quest for autonomy of the nursing profession in the 1960s brought about the creation of the nurse practitioner profession in 1965.¹³

Physician Assistant

A physician assistant is a health care provider credentialed and licensed to practice medicine un-

der the supervision of a physician, and is considered part of a physician-directed team.¹⁴ The physician assistant profession was established in 1965 as an answer to the increased need for primary care providers, the rising cost of health care and need for comparable jobs for returning Vietnam War corpsmen and combat medics.¹⁵

Dental Hygienists

"The dental hygienist is a licensed primary health care professional, oral health educator and clinician who provides preventive, educational and therapeutic services, supporting total health for the control (and prevention) of oral diseases and the promotion of oral health."¹⁶ The early history of the practice of dental hygiene is combined with that of dentistry and medicine. Aristotle and Hippocrates made references to the treatment of oral disease as well as the link between oral health and systemic health.¹⁷

Future Workforce Implications

In recent decades, the increasing U.S. population, the aging health care workforce and increasing demand for health care services has prompted the development of new workforce models of health care delivery, specifically the nurse practitioner and physician assistant models, to meet the demands of access to primary health care. The nurse practitioner health care model has proven to be effective in providing primary health care at a lower cost with an equivalent quality of care to physicians, as well as providing increased access to primary health care to the disadvantaged.¹³ Physician assistants have also been shown to consistently provide cost-effective quality primary care and have become well respected by both physicians and patients.¹⁵

Current data suggests a shortage of nurses in the U.S. that is projected to reach over 500,000 by 2025, due to nursing school faculty shortages and budget constraints,¹⁸ while the Association of American Medical Colleges warns "the United States will face a serious doctor shortage in the next few decades. Our nation's rapidly growing population, increasing numbers of elderly Americans, an aging physician workforce and a rising demand for health care services all point to this conclusion."¹⁹

In the 2000 report, *Oral Health in America*,² the Surgeon General reported the existence of disparities in access to oral care and the prevalence of oral disease. It is projected that with the increasing overall U.S. population and the increasing number of older Americans keeping their teeth longer, the

number of dentists will fall short of the current and future demands for dentistry.²⁰

The demand for dental services is projected to exceed the capabilities of the dental profession to produce adequate numbers of dentists to provide basic dental care – the resulting shortage of dentists will further limit access to dental care by the disadvantaged. These projections, coupled with rising dental care costs and the desire for autonomy by the dental hygiene profession, prompted the ADHA in 2004 to develop the ADHP, a new workforce model to help facilitate access to oral health care. Similar to the nurse practitioner in medicine, the ADHP could increase the number of dental providers practicing in the public health setting, helping to increase access to oral health care services.²¹

Methods and Materials

The purpose of this investigation was to examine the history surrounding the commissioning, and the procedures followed in the commissioning process, of the professions of physicians, dentists, nurses, nurse practitioners, physician assistants and dental hygienists into the USPHS Commissioned Corps, and to determine a critical pathway to commissioning new health care professions into the USPHS. The professions of physicians, dentists and nurses were chosen as representative examples of long established professions within the USPHS. The professions of nurse practitioners, physician assistants and dental hygienists were chosen for their interrelatedness to the professions of physicians, dentists and nurses, and their relatively new commissioning into the officer ranks of the USPHS.

Forty-five journal and Web site articles were collected and evaluated, with 30 providing relevant information of the history of the USPHS, the events leading to the commissioning of the professions of physicians, dentists, nurses, nurse practitioners, physician assistants and dental hygienists within the USPHS and the commissioning process of the USPHS. The USPHS Web site revealed early history and details about the USPHS.¹ The Office of the Public Health Service Historian Web site contained several scholarly documents chronicling and interpreting the early history of the USPHS.²² Three texts documenting the early history of the USPHS were acquired and researched – these texts by Ralph C. Williams, Bess Furman and Fitzhugh Mullan, MD are considered to provide an authoritative history of the USPHS.²³⁻²⁵

Twenty e-mails requesting information related to the establishment of the selected health care professions in the USPHS were sent to the chief

officer and the professional advisory committee chair for each of the professions being researched, as well as officers who are colleagues and professional acquaintances in the professions being researched. The e-mail recipients were asked, "Do you have knowledge of the decision making process and the public health needs that led to the commissioning of the first (physician, dentist, nurse, nurse practitioner, physician assistant or dental hygienist) into the USPHS Commissioned Corps, and the steps that were followed in the commissioning process?" Officers were asked to either provide the requested information by e-mail, arrange to be interviewed or provide a reference to an officer who may know the requested information. Ten referred officers were sent e-mail requests for information. Of the 30 e-mail requests, a total of 27 responses were received (90% response rate), furnishing links to resources and relevant data, other persons or corroborating data. Five responses led to interviews with 3 key commissioned officers. Interviews were conducted using an open-ended questioning technique utilizing the same questions asked of the e-mail recipients. CAPT Emmett Knoll PA, MPH, USPHS (retired), who was involved with the commissioning process of physician assistants, was interviewed twice via telephone. CAPT Candace Jones, RDH, MPH, who was involved with the commissioning process of dental hygienists, was interviewed twice – once in person and once via telephone. CAPT Meribeth Reed, RN, PhD, USPHS (retired), a PHS nurse historian, was interviewed via telephone.

The data analysis advocated by Miles and Huberman, as described in *Research for the Health Professional – A Practical Guide*, was used for the qualitative research discussed in this paper.²⁶ A qualitative comparative analysis was conducted to examine and interpret previously published documents, e-mail correspondence and personal interviews to discern patterns or commonalities in events leading to commissioning and the commonalities of the commissioning process. Contact summary sheets were constructed to aid in data collection and interpretation for each interview, e-mail and document. These contact summary sheets outlined the needs, events, dates, processes and persons involved with developing the commissioning of each of the selected health care professions into the USPHS. Questions and comments that occurred during the course of data collection were notated on the summary sheets for further follow-up. Reflections and ideas that occurred during the research process that demonstrated patterns found throughout data collection were also recorded on the contact sheets. Important variables and patterns were identified from the collected data and

organized into a time-oriented visual display table to present the data systematically.

For the purpose of this investigation, it was assumed that persons interviewed had accurate recollections of the commissioning process of the selected profession and provided accurate, informative answers during the interviewing process. The current and historical documents and resources utilized during this investigation were assumed to provide accurate data on the commissioning of the health care professions into the USPHS.

Limitations

Although there are many published documents relating to the USPHS, there are few documents pertaining to the professions of nurse practitioners, physician assistants and dental hygienists within the USPHS. There was a lack of published documentation of the development of the commissioning of the selected health care professions into the USPHS. The National Archives and the National Library of Medicine houses the archived files of the USPHS in a non-digitized format that only allows for physical viewing from the sites. These were not accessed by this researcher. It is not known whether information on the development of the commissioning of the selected health care professions is contained in these files.

Results

Early history of the health care professions of physicians, dentists, nurses and nurse practitioners within the USPHS was collected from the aforementioned authoritative texts written on the history of the USPHS, published journal articles, the USPHS Web site and the Office of the PHS Historian Web site, as well as a personal interview with a nurse historian. The early history of the professions of physician assistant and dental hygienist within the USPHS was collected during personal interviews with the creators of the commissioning process for that profession.

Physicians

The USPHS began with the Marine Hospital Service, which was established in 1798. For nearly 100 years the Marine Hospital Service functioned with varying levels of success, establishing more than 30 hospitals coast to coast. In 1871, Dr. John Maynard Woodworth was appointed the first supervising surgeon of the Bureau of the Marine Hospital Service and was responsible for its reorganization. Woodworth created a "cadre of competent, mobile, career service physicians,"²⁵ following the

military model with regulations and procedures for appointment, promotion, discipline and separation of medical officers. Congress authorized the commissioning of physicians into the Marine Hospital Service in 1889.²⁵

Dentists

As the responsibilities of the USPHS increased due to a growing body of scientific knowledge, a need for other health care services was recognized. With the onset of World War I, large numbers of civilians were enlisting in the military, increasing demand for health care services. Congress passed legislation in 1918 establishing the Reserve Commissioned Corps of Public Health Service officers, which included dentists. The War Risk Hospital Act of March 3, 1919 authorized the Public Health Service to provide health care, including dental care, to the disabled veterans of World War I, necessitating the establishment of the commissioning of dentists into the USPHS. The first dental officer to be commissioned (Reserve) into the USPHS was Ernest E. Buell, DMD in 1919. In 1923, the U.S. Veterans' Bureau was established, taking with it 146 of the 169 Public Health Service dental officers.²⁷ Williams identifies Dr. Clinton T. Messner, Chief of the Dental Service, as the person who "furnished leadership for the development of the dental group in the commissioned corps."²³ Under the leadership of Dr. Messner, "the fledgling dental section maintained and expanded its program of care for Federal beneficiaries, through the detail of dental officers to the Marine Hospitals."²⁷ The Parker Act of April 9, 1930 allowed for dentists to be commissioned into the Regular Commissioned Corps of the U.S. Public Health Service.²⁷

Nurses

The Public Health Service employed nurses since the inception of the Marine Hospital Service in 1798. These early nurses had no formalized professional training and were mostly former seamen. By 1912, professionally trained female nurses were employed by the USPHS. In 1933, Pearl McIver, public health nursing analyst, was hired to address the needs for public health nursing in the USPHS.²⁸ A shortage of nurses nationwide was realized with the onset of World War II, prompting the 1943 Nurse Training Act, which created the Cadet Nurse Corps of the Public Health Service, a scholarship program to recruit more nurses for both civilian and military service. Lucile Petry was appointed the Director of the Division of Nurse Education within the Office of the Surgeon General to administer the Cadet Nurse Corps program.^{24,28,29} The Public Health Service Act of 1944 served to

strengthen the Commissioned Corps by expanding the commissioning of officers to include nurses and other specialists in public health.^{30,31} Lucile Petry and Pearl McIver were among the first of 18 nurses to be commissioned into the USPHS on August 16, 1944, (Meribeth Reed, personal communication, January 2009).

Nurse Practitioners

New technologies and social changes during the 1940s and 1950s enabled an increase in the scope of nursing practice and the expansion of the nursing profession. During the 1950s and early 1960s, a shortage of primary care physicians limited access to health care. The establishment of the Medicare and Medicaid programs in 1965 greatly increased the demand for primary care providers. The nurse practitioner was developed in 1965 to help meet the demand for an increase in primary care providers.³² In 1970, the Emergency Health Personnel Act, known as the National Health Service Corps (NHSC), was enacted to provide health care to underserved areas of the U.S. The expansion of the NHSC provided scholarships to student dentists, physicians, nurse practitioners, physician assistants and certified nurse midwives for service in the NHSC upon graduation.³³ Nurse historian CAPT Meredith Reed, RN, PhD, BC and COHN-S, USPHS (retired) asserted that the success and acceptance of nurse practitioners, both in civilian and NHSC practice, created the opportunity for the nurse practitioner to be commissioned into the USPHS (Meribeth Reed, personal communication, January 2009). Nurse practitioners are commissioned into the nursing category in an advanced practice billet, or job description showing a career path with increasing skills and responsibilities for promotion. LCDR David Magnotta, USPHS Office of Commissioned Corps Operations, Division of Commissioned Corps Assignments, stated that the USPHS billeting records were not searchable before the 1979 date, but that an advanced practice nurse was commissioned on September 30, 1979 (David Magnotta, personal communication, February 2009).

Physician Assistants

As with nurse practitioners, the shortage of primary care physicians in the 1950s and 1960s was one of the factors that prompted the development of the physician assistant role. The number of military corpsmen and combat medics returning from the Vietnam War who were seeking comparable jobs equivalent to their military training was another major stimulus for the development of the profession. The physician assistant profession was established in 1965, and by 1972 the NHSC provid-

ed scholarships to student physician assistants for service in the NHSC upon graduation.³³ In 1966 the USPHS hospital in Staten Island began a training program for physician assistants.³⁴ CAPT Emmett Noll, PA, MPH, Physician Assistant Program Director (1973–1977), USPHS Staten Island Hospital, further developed the program and advocated for the commissioning of physician assistants into the USPHS. The need for increased numbers of primary care providers in both the Indian Health Service (IHS) and the Federal Bureau of Prisons, both beneficiaries of USPHS medical care, motivated CAPT Noll to begin the process of developing the physician assistant discipline for the USPHS (Emmett Noll, personal communication, January 2009). By 1987, CAPT Noll completed the drafting of the commissioning standards and the billets for physician assistants in consultation with both the American Academy of Physician Assistants and with RADM Kenneth Moritsugu, Assistant Director and Medical Director of the U.S. Department of Justice Federal Bureau of Prisons. CAPT Noll stated that, after preparing the final draft of the billets and commissioning standards, these documents were submitted to the Division of Commissioned Personnel Headquarters for review and final approval (Emmett Noll, personal communication, February 2009). The success of the physician assistant role in the NHSC facilitated the establishment of the physician assistant profession in the USPHS. (Meribeth Reed, personal communication, January 2009.) The first physician assistants, CAPT Don Gabbard, CAPT Stuart Richards and RADM Michael Milner, were commissioned into the USPHS in 1989. (RADM Michael Milner, DHSc, PA-C, Assistant Surgeon General, Chief Health Services Officer, USPHS, personal communication, January 2009).

Dental Hygienists

CAPT Candace Jones, RDH, MPH, USPHS–IHS, National Programs Albuquerque Liaison Officer, commissioned in 1988 as a Dental Prevention Officer with the IHS in Alaska, was instrumental in establishing the dental hygienist profession in the USPHS. CAPT Jones saw the need for providing quality oral health care for the Native American population. Prior to 1991, only a few clinical dental hygienists were employed by the USPHS as civilian contractors. Dental assistants, with only limited training and experience, provided the majority of cleanings and patient oral health education (Candace Jones, personal communication, October 2008). In 1988, CAPT Jones began developing the commissioning standards and billets for dental hygienists, meeting with the Alaska Area Dental Officer for IHS, the Chief Dental Officer for IHS and the Special Assistant to the Chief Dental Officer

for the USPHS. A consensus was established, and the needs statement was developed for the RDH discipline within the HSO category of the USPHS. Working with CAPT Donald Schneider, DDS, MPH, Special Assistant to the Chief Dental Officer, CAPT Jones developed the commissioning standards and billets for dental hygienists. After consulting with the Chief Health Services Officer, the Chief Dental Officer and the HSO Professional Advisory Committee, the commissioning standards and billets for dental hygienists were sent to the Division of Commissioned Personnel for final evaluation and approval (Candace Jones, personal communication, February 2009). According to CAPT Schneider, DDS, MPH, USPHS (retired), Consultant in Health Policy and Dental Health, who assisted CAPT Jones through the development of the dental hygienist discipline, the decision to commission dental hygienists at the baccalaureate level was made between September 1989 and August 1991 (Candace Jones, personal communication, February 2009). Sherry Paxson, RDH, (August 1991) and CDR Beth Finnson, RDH (September 1991) were the first dental hygienists with baccalaureate degrees in dental hygiene to be commissioned into the USPHS to provide clinical dental hygiene services (Sherry Paxson and Beth Finnson, personal communications, February 2009). The research results are provided in Table I.

Discussion

Similarities were found in the commissioning pathways of the selected health care professions. Each profession was in existence in the civilian workforce before it was commissioned into the USPHS Commissioned Corps. The need for well-educated, career-oriented professionals to provide quality health care to the Federal beneficiaries of the USPHS was the stimulus for the development of the health care profession within the USPHS. One or more persons were the driving force behind the development of the commissioning of the selected health care professions into the USPHS. The dates the selected health care professions were established in the USPHS Commissioned Corps were found.

A critical pathway followed in the commissioning process for developing the disciplines of physicians, dentists, nurses, nurse practitioners, physician assistants and dental hygienists was identified. First, each profession was in existence in the civilian population before it was commissioned into the USPHS. Second, a need was recognized for the professional services of that profession within the USPHS and established in consultation with the chief officer for the Area of the Operating Division, the chief officer of the professional category or discipline of the operating

Table I: Summary of the Development of the Commissioning of Health Care Professionals into the USPHS

Health Professions	Need Leading to Commissioning	Date Established	Persons(s) Responsible for Development
Physicians	<ul style="list-style-type: none"> • Need for competent, mobile, career service professionals 	<ul style="list-style-type: none"> • Congressional Act of 1889 	<ul style="list-style-type: none"> • Assumed: John Woodworth, MD
Dentists	<ul style="list-style-type: none"> • WWI Veteran care 	<ul style="list-style-type: none"> • Congressional Act of 1919 – Reserve Corps • Congressional Act of 1930 – Regular Corps 	<ul style="list-style-type: none"> • Assumed: Clinton Messner, DDS
Nurses	<ul style="list-style-type: none"> • WWI Veteran care • WWII nurse shortages • Pandemic illness • Public health nursing needs 	<ul style="list-style-type: none"> • PHS Act of 1944 	<ul style="list-style-type: none"> • Assumed: Pearl McIver, RN • Lucille Petry, RN
Nurse Practitioners	<ul style="list-style-type: none"> • Post WWII shortage of primary care physicians • Medicare and Medicaid • Establishment of NP profession in 1965 • Success of NPs in NHSC and in civilian population 	<ul style="list-style-type: none"> • Advanced practice nurse billet added to the nursing category on or before 9-30-1979 	<ul style="list-style-type: none"> • Not Found
Physician Assistants	<ul style="list-style-type: none"> • Need for increased primary care providers in IHS and BOP • Success of Pas in NHSC and in civilian population 	<ul style="list-style-type: none"> • 1989 	<ul style="list-style-type: none"> • CAPT Emmet Noll • RADM Kenneth Moritsugu • DCP Headquarters
Dental Hygienists	<ul style="list-style-type: none"> • To provide quality oral health care for the Native American population 	<ul style="list-style-type: none"> • 1991 	<ul style="list-style-type: none"> • CAPT Candace Jones • Area Dental Officer • Chief DO IHS • Special Assistant to Chief DO IHS • Chief HSO • HSO PAC Chair • DCP Headquarters

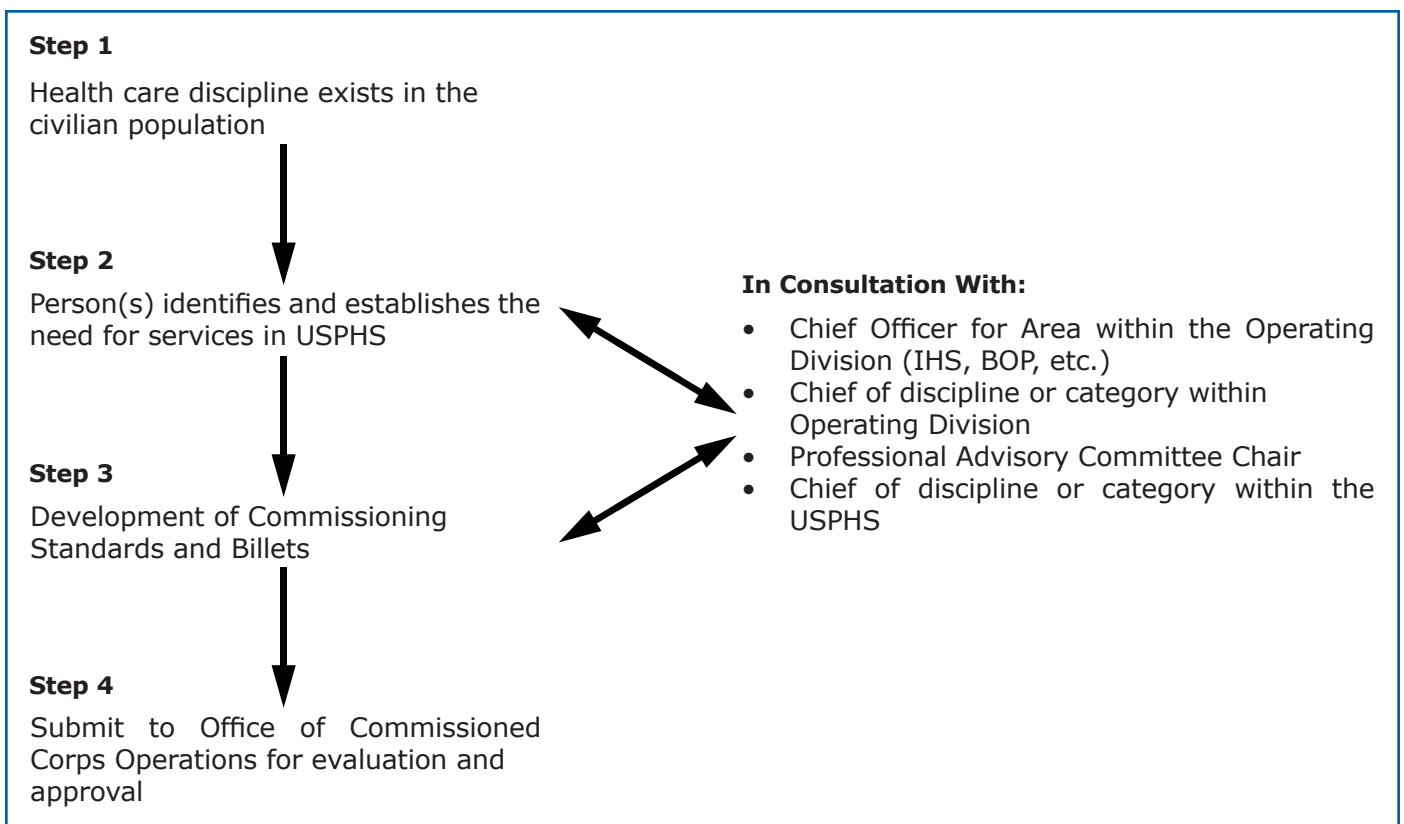
division and of the USPHS and the Professional Advisory Committee Chair. The third step was the construction of the commissioning standards and billets. This was accomplished in consultation with the same representative officers used in step 2 for evaluation. After consultation and completion of revisions, the fourth step was to submit the proposal to the Office of Commissioned Corps Operations (OCCO) (formerly the Division of Commissioned Personnel). The OCCO then followed established protocols to evaluate the merits of the proposal for commissioning a new profession. After thorough evaluation of the proposal to provide added value to the Commissioned Corps of the USPHS, permission for the commissioning of the new health care discipline was awarded.

The most important variables identified from the research and the relationships among them allow for inferences to be made for future commissioning of new health care disciplines into the USPHS. The final analysis of the research data proposes a path to commissioning new health care disciplines into the USPHS (Figure 1).

Conclusion

The significance of establishing the pattern followed by the USPHS for commissioning health care professions in the past is to provide guidance to those who will endeavor to establish a new health care profession in the USPHS in the future. With the

Figure 1: Steps to Commissioning New Professions into the USPHS



establishment of the ADHP role, an opportunity for the ADHP to be commissioned into the USPHS may arise. Understanding the commissioning process of new health care professions into the USPHS would assist with defining the critical pathway for future USPHS commissioning of the ADHP.

Further research of the development of the commissioning of other health care professions of the USPHS is warranted to verify the critical pathway to the commissioning of new health care professions into the USPHS. Accessing the archived documents of the USPHS Commissioned Corps housed at the National Archives and the National Library of Medicine might reveal additional primary sources further illuminating the historical processes of commissioning new health care professions into the USPHS.

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Determinants of oral health behaviors among high school students in Shahrekord, Iran based on Health Promotion Model

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Introduction

Oral health is fundamental to overall health, well-being and quality of life. A healthy mouth enables people to eat, speak and socialize without pain, discomfort or embarrassment.¹ Oral health means more than healthy teeth – it includes health of the gums, oral soft tissues, chewing muscles, the palate, tongue, lips and salivary glands.² Good oral health has always been the cornerstone of public and private dental health promotion.³

At the global level, the prevalence, incidence and pattern of oral diseases have changed considerably over the past 3 decades. Dental caries and periodontal diseases in children have been declining in most industrialized countries.^{4,5} Such changes are often attributed to changing living conditions and lifestyles, effective use of oral health services, implementation of school-based oral health care programs and adoption of regular self-care practices.⁶⁻⁸ However, this positive trend has not been seen in developing countries. Increasing levels of dental caries among children are observed, especially for those countries where community-based preventive oral care programs are not established.⁴

Poor oral health can have a harmful effect on children's performance in school and their success throughout life. Children with poor oral health are 12 times more likely to have more restricted-activity days, including missing school, than those with good oral

health.⁹ More than 50 million hours annually are lost from school because of oral diseases.¹⁰ Worldwide, the occurrence of gum disease is high among

Abstract

Purpose: This paper reports on predictors of students' oral health behaviors, using variables based on the Health Promotion Model in an attempt to identify influential variables that may be addressed through intervention efforts.

Methods: A non-probability sample of 300 high school students was recruited from 4 high schools in Shahrekord City, Iran. The study took place between January and March of 2008. Appropriate instruments were used to measure the variables of interest. The statistical analysis of the data included bivariate correlations, t-test, one-way ANOVA and linear regression.

Results: The cognition variables – perceived self-efficacy, perceived benefits, perceived barriers and activity-related affects, and commitment to a plan of Oral health behaviors, were significantly related to oral health behaviors among the respondents. A negative association was found between oral health behaviors and perceived barriers. Interpersonal influences, such as modeling and norms, and situational influences were found to be significantly related to increased oral health behaviors. All of the Health Promotion Model variables were statistically significant predictors of oral health behaviors, and accounted for 65.1% of the variation.

Conclusion: Promotion of interpersonal modeling and the students' perceived self-efficacy should be priorities of any programs aimed at promoting oral health behaviors among students. It is also concluded that the Health Promotion Model may be used in developing countries, like Iran, as a framework for planning intervention programs in an attempt to improve the oral health behaviors of students.

Keywords: Oral Health behavior, Health Promotion Model, Students

This study supports the NDHRA priority area, **Health Promotion/Disease Prevention:** Investigate the effectiveness of oral self-care behaviors that prevent or reduce oral diseases among all age, social and cultural group

older children and adolescents, with 50 to 100% of 12 year old children having the signs of gum inflammation.¹¹ Gum disease is also more prevalent among adults.

The Islamic Republic of Iran has a population of more than 70 million people. Approximately 40% of the population is younger than 20 years, making Iran a country with one of the youngest populations in the world.¹² There are approximately 13,000 dentists in Iran (1 dentist per 5,500 people), and nearly 1,200 specialists in universities and private practices.¹³ Data from surveys in the past 2 decades show a marked decline of 4 to 1.5 in dental caries using the DMFT index (D=decayed teeth or untreated caries, M=missing teeth, F=filled teeth and T=permanent teeth) in 12 year old children. However, the general level of oral health is still not satisfactory, particularly among children. The percentage of 6 and 9 year old children caries-free with deciduous and permanent teeth is 13.8 and 11.5, respectively, and more than 50% of 12 year old children have caries experience. Therefore, an important aim of the national oral health plan should be developing oral hygiene skills and health practices that improve oral self-care and promote dental and oral health throughout the community.¹⁴

Oral health as an essential part of overall health is the outcome of a complex interaction of many different influences. These health determinants include biological, social, economic, cultural and environmental factors, knowledge and attitudes to health and learned behaviors, as well as access to and availability of health services and interventions.¹ Within these determinants, oral health behaviors are an important factor which need to be addressed through a variety of research methods. Oral self-care behaviors are based on personal choices. The guiding principles found in health behavior models provide useful methods to the oral health care providers in promoting effective individual client behaviors. Theories provide explanations about observable facts in a systematic manner.¹⁵ Therefore, utilizing these health behavior models as a framework for understanding the determinant factors of oral health behaviors is critical for planners and oral health care providers to achieve a comprehensive set of those factors as the goals of intervention programs in the community.

Pender's comprehensive model of health promotion is one of the explanatory nursing models which predicts the health behavior.¹⁶ The revised Health Promotion Model,¹⁷ derived from social cognitive theory,¹⁸ includes 3 groups of factors which are proposed to influence health-promoting be-

haviors: individual characteristics and experiences, behavior-specific cognitions and affect and behavioral outcomes. Health promoting behavior is the desired behavioral outcome and is the end point in the Health Promotion Model.¹⁹

In this study, behavior-specific cognitions included the following:

- Perceived benefits (anticipated positive outcomes that will occur from oral health behaviors)
- Perceived barriers (anticipated, imagined or real blocks and personal costs of understanding oral health behaviors)
- Perceived self-efficacy (judgment of personal capability to organize and execute the health-promoting behavior)
- Oral health behaviors' related effects (subjective positive or negative feeling that occur before, during and following oral health behavior based on the stimulus properties of the behavior itself)
- Interpersonal (cognition concerning behaviors, beliefs or attitudes of the others like norms and modeling) and situational (personal perceptions and cognitions of any given situation or context that can facilitate or impede the health-promoting behavior) influences on oral health behaviors
- Commitment to a plan of oral health behavior (the concept of intention and identification of a planned strategy leads to implementation of the health-promoting behavior)
- Oral health behaviors (endpoint or action outcome directed toward attaining positive oral health outcome) taken¹⁹

These are variables from Pender's revised Health Promotion Model, which provides the theoretical basis for this study. In this model, the likelihood of performing oral health behaviors is related to these behavior-specific cognitions.

The strength of Pender's Health Promotion Model is that it is based on established theoretical perspectives (expectancy value theory and social-cognitive theory) and is grounded in research.²⁰ The model has been used in studies predicting exercise behaviors in American and Iranian adolescents, use of hearing protection in American workers, physical activity in Taiwanese adolescents and

explaining quality of life in chronic disabling conditions.²¹⁻²⁹ As far as our knowledge, the only study performed to investigate the determinants of oral health behaviors applying the Health Promotion Model in developing countries was the study done by Morowatisharifabad and Shirazi in Yazd, Iran.²⁰ Although this model has been applied to a range of health-promoting behaviors, its application on predicting oral health behaviors among students, especially in developing countries, has not been well examined.

Research questions

This paper reports on predictors of oral health behaviors, using variables based on the Health Promotion Model in an attempt to identify influential variables that may be addressed through intervention efforts. The following questions guided the study:

1. What is the pattern of performing oral health behaviors in the students in a developing country, like Iran?
2. In what aspects of oral health behaviors do students report having difficulties?
3. To what extent do the variables of the Health Promotion Model predict performing oral health behavior of the students?
4. May the Health Promotion Model be used in a developing country, like Iran, as a framework for planning intervention programs to improve the oral health behaviors of students?

Methods and Materials

The original survey protocol was reviewed and approved by the Human Subjects Committee at School of Public Health, Shahid Sadooghi University of Medical sciences. Ethical approval for the study was also given by the Medical Research Council's Ethics Committee in Yazd Shahid Sadooghi University of Medical Sciences.

Sample

In 2008, a non-probability sample of 320 high school students was recruited from 4 high schools in Shahrekord City, Iran. At the first days of autumn semester, the questionnaires were administered to the selected students prior to the beginning of formal classes, and they were told that the results would be confidential. The purpose of the study, which included their rights as human subjects for a research study, was explained to participants, and

all signed consent forms. Twenty students did not participate in the study or did not answer questions completely. Therefore, they were excluded from the study. Three hundred students (140 male, 160 female) completed the questionnaires.

Measures

Most of the measures used within the study were developed in a previous study published by Morowatisharifabad and Shirazi.²⁰ The only measure developed by the researchers was commitment to a plan of oral health behavior, which was a 2 item scale. In the first item, the respondents were asked to report if they have a regular plan to brush their teeth. The respondents selected "Yes" or "No" and were scored 0 or 1. If yes, then the second item asked them to report how often they are committed to implement their plan of action. A 3-point Likert-type scaling was used (0=not at all, 1=somewhat, 2=completely) for the second item. Total possible scores ranged from 0 to 3, with higher scores suggesting greater commitment to a plan of oral health behavior.

While developing commitment to a plan of action scale, various ways of wording questions were considered to avoid the possibility that certain responses may be consistently chosen in error. This was important, as a particular phrasing of a question may ultimately be misleading to the respondent.

A panel of experts, consisting of 5 scholars in the areas of health behavior and education, a dentist and an oral health care provider with field experience in dentistry, reviewed and assessed the questions of commitment to a plan of action scale, orally, by evaluating the appropriateness and relevance of the items and response format. They confirmed them to be representative of the construct in order to confirm content validity of the instrument. The feedback from the panel of experts, which was mostly regarding the wording and phrasing of questions, was used to revise and modify the instrument.

A pilot study was conducted to examine the utility of the instruments and to identify the problems and benefits associated with the design. The first draft was prepared following consultation with the multidisciplinary team. The questionnaire was pilot-tested with 30 students. The data were used to estimate the internal consistency of the scales, using Cronbach's coefficient alpha. The content validity of the scales was also established. This pilot sample was not included in the final sample. The scales, number of items, reliability coefficients and

Table I: Health promotion model concepts, scales, and reliabilities

HPM concepts	Scales	Number of items	Alpha	Range	Mean	SD
Oral health behaviors	Oral health behaviors	13	.65	0–26	12.93	4.69
Perceived self-efficacy	self-efficacy	10	.81	0–20	11.47	3.82
Activity-related affect	Positive affects	5	.82	5–25	18.31	4.37
	Negative affects	4	.80	4–20	6.17	3.22
Perceived benefits	Benefits	7	.80	7–35	29.97	4.44
Perceived barriers	Barriers	9	.73	9–27	14.93	3.60
Interpersonal influences	Interpersonal norms	5	.66	5–15	11.61	2.19
	Interpersonal modeling	3	.65	3–9	7.44	1.25
Situational influences	Situational influences	4	.65	0–4	1.93	1.02
Commitment to a plan of action	Commitment to a plan of oral health behavior	2	.65	0–3	1.17	.26

possible ranges of the constructs are listed in Table I.

Demographic data relating to students, including age, gender and parents' education level, was also collected with a form designed for this study. The data are presented in Table II.

Statistics

The statistical package for the social sciences was used for the purpose of data entry, manipulation and analysis. Summary statistics and frequency distributions were used to describe and interpret the meaning of data and the relationship between demographic variables. The Health Promotion Model variables were calculated with t-test and one-way ANOVA. A Pearson's correlation coefficient was used to demonstrate the nature of associations between oral health behavior and the Health Promotion Model variables. In order to explain the variation in oral health behavior scores on the basis of these Health Promotion Model variables, linear regression analysis was performed.

Results

Three hundred questionnaires were completed and returned, giving a response rate of 93.7%. The demographic characteristics of the 300 students are shown in Table II. The mean age of the sample was 16.24±0.84. The sample contained more girls (53.3%) than boys (46.7%).

The prevalence of performing oral health behaviors in high school students were as follows: tooth

Table II: Demographic characteristics of the students

Total students	300
Mean Age ± SD (range), (year)	16.24±0.8(15–18)
Gender (%)	
Male	140(46.7)
Female	160(53.3)
Year of education in high school (%)	
Second year	125(41.7)
Third year	175(58.3)
Father's education (%)	
Illiterate	45(15)
Primary (1–9 years)	140(46.7)
High school(10–11 years)	63(21)
Diploma(12 years)	33(11)
College/university education	12(4)
Mother's education (%)	
Illiterate	16(5.3)
Primary (1–9 years)	102(34)
High school(10–11 years)	82(27.3)
Diploma(12 years)	70(23.3)
College/university education	22(7.3)

brushing (49.3%), using dental floss (15.3%), visiting a dentist twice a year (7%) and using fluidized oral irrigator (5.3%).

Statistically significant differences were found in oral health behaviors, perceived self-efficacy, activity-related affects and perceived benefits and barriers by gender using t-test (Table III). The difference favored female gender. Also, statistically significant differences were found in oral health behavior by father's education level ($p=0.007$) and mother's education level ($p=0.011$) using one-way ANOVA for independent samples. Both the father and mother's education level differences persisted after post hoc tests, with students having parents with high school, diploma and college/university education perform oral health behaviors significantly higher than those having parents with primary education and no literacy ($p<0.05$).

Regarding the commitment to a plan of oral health behavior, 50.7% of students reported that they did not have a regular plan to brush their teeth. Among those who reported having a regular plan, 43.7% were not committed to their plan of action at all, and only 36.6% were completely committed.

The respondents noted that the following individuals (as interpersonal influences) encourage them a lot to perform oral health behaviors: mothers ($n=255$, 85%), fathers ($n=195$, 65%), teachers ($n=126$, 42%), siblings ($n=133$, 44.3%) and peers ($n=46$, 15.3%). Moreover, from the students' point of view, 58% of their mothers, 39% of their fathers and 54.4% of their siblings perform oral health behaviors.

Applying Pearson's correlation analysis, it was found that oral health behaviors had statistically significant positive correlations with all Health Promotion Model variables (Table IV).

The cognition variables (perceived self-efficacy, perceived benefits, perceived barriers and activity-related effects) and commitment to a plan of oral health behavior were significantly related to oral health behaviors among the respondents, with a positive association found between oral health behaviors and perceived self-efficacy, perceived benefits, commitment to a plan of oral health behavior and activity-related effects. Negative associations were found between oral health behaviors and perceived barriers. Among the cognition variables, perceived self-efficacy had the highest correlation

Table III: Mean scores comparison of HPM variables and oral health behaviors by the students' gender

		Male n= 140 Mean(SD)	Female n=160 Mean(SD)	P
Oral health behaviors		12.03(5.1)	13.71(4.1)	0.002
Perceived self-efficacy		10.72(4.2)	12.13(3.2)	0.001
Activity-related affect	Positive affects	17.56(4.4)	18.97(4.1)	0.005
	Negative affects	6.83(3.7)	5.6(2.5)	0.001
Perceived benefits		29.3(5.2)	30.5(3.5)	0.013
Perceived barriers		15.38(3.8)	14.54(3.3)	0.043
Interpersonal influences	Interpersonal norms	11.5(2.2)	11.71(2.1)	>0.05
	Interpersonal modeling	7.39(1.2)	7.49(1.2)	>0.05
Situational influences		1.85(0.8)	1.97(0.7)	>0.05
Commitment to a plan of oral health behavior		1.15(0.4)	1.19(0.3)	>0.05

with oral health behaviors. Interpersonal influences, such as modeling and norms, and situational influences were found to be significantly related to the increased oral health behaviors.

Multiple regression analysis was performed to explain the variation in oral health behavior scores on the basis of Health Promotion Model variables. As shown in Table V, all norms (except for interpersonal norms and negative effects) were statistically significant predictors, and accounted for 65.1% of the variation.

Discussion

In this study, oral health related factors among Iranian high school students based on the Health Promotion Model were investigated. The results showed that the sample contained more girls than boys. This is similar with the findings of previous studies done in Yazd and Sanandaj, 2 Iranian cities, based on the Health Promotion Model.^{20,23} Moreover, the mean age of students and the level of parents' education in this study were very similar with those found in the study conducted in Yazd, considering the different grade of students in these 2 studies (high school (11th grade) vs. pre-university (12th grade)).²⁰ Therefore, we can presume that the students in the present study are representative of students in Iran.

Table IV: HPM Variables with Oral Health Behavior Correlation Matrix

Variables	1	2	3	4	5	6	7	8
1=Perceived self-efficacy	1							
2=Activity-related affect	0.471**	1						
3=Perceived benefits	0.354**	0.511**	1					
4=Perceived barriers	-0.259**	-0.276**	-0.250**	1				
5=Interpersonal influences	0.310**	0.326**	0.264**	-0.157*	1			
6=Situational influences	0.125*	0.089	0.167*	-0.005	0.190*	1		
7=Commitment to a plan of oral health behaviors	0.179*	0.189*	0.223**	-0.129*	0.144*	0.085	1	
8=Oral health behaviors	0.529**	0.406**	0.374**	-0.293**	0.386**	0.228**	0.323**	1

* P < .05

**p < .01

Table V: Regression Analysis of HPM Variables as Predictors of Oral Health Behaviors

Predictors	Un-standardized B	t	p	F	R2
Constant	3.8	1.22	.221	22.97	0.651
Perceived self-efficacy	0.41	6.27	.000		
Positive affects	0.12	2.26	.024		
Negative affects	0.02	0.77	.442		
Perceived benefits	0.14	2.5	.012		
Perceived barriers	-0.14	-2.3	.021		
Interpersonal norms	0.44	1.5	.111		
Interpersonal modeling	0.85	4.7	.000		
Situational influences	0.22	3.0	.003		
Commitment to a plan of oral health behaviors	0.20	2.7	.007		

The mean score of oral health behavior scale in the respondents was 12.93±4.69. In the study reported by Morowatisharifabad and Shirazi, the mean was 13.05±3.67.²⁰ Girls had a better performance in oral health behaviors in proportion to the boys, which is consistent with the findings of the present study. Several studies have shown that, in the area of oral health care, girls perform better than boys.^{20,30,31} Therefore, in order to enhance performance among boys, we can propose that oral health educators consider the successful girls in performing oral health behaviors as role models in oral health-promoting programs.

In the oral health behavior domain, "tooth brushing regularly" and "using toothpaste while tooth brushing" were rated as the most frequent behaviors among study subjects. The lowest scores in oral health behaviors were for "referring to dentist regularly," "tooth brushing after eating food" and "using a fluidized oral irrigator." Oral health care profession-

als should provide information about the best way of performing oral health behaviors for students, or refer them to dental specialists for further guidance or assistance, as well as considering these behaviors as priorities while designing educational programs for students.

Approximately 15% of the studied students in Shahrekord were using dental floss, but in a study of teenagers in Sweden, more than 50% of respondents performed this behavior.³² In another study conducted on Turkish dental students, the rate of regular dental floss usage was 32.3%.³³ Not using dental floss in Iranian students may be a result of their lack of knowledge and attitude regarding the importance of this behavior for oral health and not instructing them. It was reported that education about dental health care in the pre-university curriculum could be an important factor that can influence the oral health attitudes of students entering the dental field.³⁴ Based on what was stated, edu-

cating students about oral health care in high school and pre-university periods may promote not only their knowledge and attitude, but promote performing oral health behaviors through other periods of their life.

In the commitment to a plan of oral health behavior domain, more than 50% of the respondents had never been committed to a plan of oral health, and approximately one third were committed completely. These results may, again, be a sign of weak knowledge toward oral health behaviors in students. The results showed that the commitment to a plan of oral health correlated to perceived benefits and self-efficacy, significantly. The Health Promotion Model proposes that commitment to a plan of action is less likely to result in the desired behavior when other actions are more attractive and thus preferred over the target behavior.¹⁹ Therefore, in order to attract the students to a plan of oral health behavior, instructing a planned oral health strategy along with the benefits of oral health behaviors and increasing their perceived self-efficacy through educational programs may result in promoting their commitment to the action plan and, consequently, oral health behaviors.

In multiple regression analysis, we found that interpersonal modeling and perceived self-efficacy are the most powerful predictors of oral health behavior. The total variance explaining these behaviors was 65.1%. In the Morowatisharifabad and Shirazi study, perceived self-efficacy was the strongest predictor of oral health behaviors, and the total variance explaining oral health behaviors was 32%, considering the direct and indirect effects of the Health Promotion Model variables.²⁰ In the report which tested the Health Promotion Model for the use of hearing protection devices among farmers, interpersonal and situational influences and barriers were the most powerful predictors of the behavior.³⁵ But in the reports that tested the Health Promotion Model for physical activity and exercise, self-efficacy was the strongest predictor of the behavior among youth.^{27,28,36} Therefore, and on the basis of our findings, the practical implications of interpersonal modeling and perceived self-efficacy in promoting oral health behaviors of students are noteworthy.

The results of this study showed that parents are the most important influences on oral health behaviors of the students, and peers are the least important. Furthermore, regression analysis showed that interpersonal modeling is the strongest predictor of oral health behaviors. Oral health care providers should consider the student's parents as an important part of intervention while designing interven-

tion programs in order to promote the oral health behaviors of students.

About 45% of students in the present study stated that teachers are great incentives of performing oral health behaviors. Petersen et al noted that a successful school health program would depend on the responses by teachers.³⁷ Some previous programs were not reported successful since the teachers received limited instruction on dental health education or they lacked motivation.³⁷ Therefore, joining the teachers in school oral health programs may have a great influence on the successfulness of program.

The results of this study showed a statistically significant correlation between students' level of self-efficacy and all of the other variables of the Health Promotion Model, especially oral health behaviors. Our findings complement the conclusions of other studies which have shown that self-efficacy mediated the effect of other variables on health behaviors.^{20,27,29,38} As Brekke pointed out, self-efficacy is not a static trait and can be altered.³⁹ Additionally, we may find in clinical trials that self-efficacy programs have a beneficial effect.^{40,41} Therefore, we can propose self-help courses for students within which promoting self-efficacy is one of the most important priorities.

According to our data, there was a strong relationship between interpersonal influences and self-efficacy. Furthermore, mothers were the most important influences on the oral health behaviors of students. In other words, self-efficacy is probably related to the importance that mothers place on oral health. A strategy to enhance self-efficacy is modeling.¹⁸ Modeling means that patients who are successful in coping with certain problems act as models for other patients. Therefore, we can presume that if mothers act as models for their children in performing oral health behaviors, the children's self-efficacy, as well as their adherence with oral health behaviors, will be increased.

Moreover, similar to another researcher who has reported self-efficacy to be negatively correlated with perceived barriers,²⁰ our results also showed a significant negative relationship between self-efficacy and perceived barriers. As Morowatisharifabad and Shirazi noted before,²⁰ it means that when perceived barriers on practicing oral health behaviors are high, it may cause an increase on perceived self-efficacy for dealing with the problems, but any programs aimed at increasing perceived self-efficacy among students may induce a decrease on perceived barriers and a higher practice of oral health behaviors.

Conclusion

In multiple regression analysis, we found all of the variables, with the exception of interpersonal norms and negative effects, to be effective predictors of oral health behaviors, accounting for 65.1% of the total variance, within which interpersonal modeling and perceived self-efficacy were the most powerful predictors of oral health behavior. It was concluded that the Health Promotion Model may be used in developing countries, like Iran, as a framework for planning intervention programs in order to predict and improve the oral health behaviors of students.

Health care professionals should develop stage-specific intervention programs based on the Health Promotion Model, within which promoting interpersonal modeling and the student's perceived self-efficacy are priorities of the program, followed by providing individual instructing practices and information through self-help groups in an interactive environment to improve Oral health behaviors. To improve the oral health behaviors of the students, an aim of the educational program should be strengthening students' self-efficacy. Effective

methods to increase self-efficacy are guided exercise of new skills, setting short-term goals and combining feedback about accomplishments and modeling.¹⁸ Social support can be a motivating factor for the students to perform oral health behaviors. Therefore, it is important not only to educate the student, but to also educate the student's parents, teachers and other close relatives.

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Knowledge of Oral Health Issues Among Low-Income Baltimore Adults: A Pilot Study

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Introduction

Parker and Ratzan defined health literacy as the "degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions."¹ Researchers believe that health literacy encompasses a constellation of health-related abilities, including word recognition, reading comprehension, communication skills and conceptual knowledge.² National data show that limited health literacy is widespread within the population. According to the 2003 National Adult Assessment of Literacy, 22% of adults had only basic literacy skills, and 14% of adults had below-basic abilities.³ Among those most likely to have been affected were seniors, individuals for whom English was a second language and low-income and minority adults.

There have been numerous investigations regarding the links between health literacy and general health in the literature. These studies have shown that limited health literacy is associated with lower knowledge of disease management and health-promoting behaviors, poorer health status and lower utilization of health care services.⁴ These studies have also shown that limited health literacy is associated with higher rates of hospitalization, greater use of emergency services and higher medical costs.^{5,6} By comparison, there have been relatively few investigations concerning the links between health literacy and oral health. These

Abstract

Purpose: This pilot study documents conceptual knowledge of oral health among low-income adults in Baltimore.

Methods: Selected questions from the Baltimore Health Literacy and Oral Health Knowledge Project, a cross-sectional, population-based investigation of oral health literacy, were used for this analysis. Participants were asked questions during face-to-face interviews about basic oral health and the prevention and management of dental caries and periodontal diseases. Descriptive analyses included tests of association with selected socio-demographic variables (age, sex, education level, annual household income).

Results: The majority of respondents were African American women, 45 to 64 years of age, with 12 years of education and an income less than or equal to \$25,000. Ninety-one percent of respondents knew that sugar caused dental caries, while 82% understood that the best way to prevent tooth decay was to brush and floss every day. Knowledge of oral hygiene practices and the prevention and management of gingivitis and periodontitis was mixed. Seventy-six percent understood that the best way to remove tartar was by a dental cleaning. However, only 15% knew how often to floss their teeth and only 21% knew that plaque was composed of germs.

Conclusion: Conceptual oral health knowledge is one component of oral health literacy. In turn, oral health literacy impacts communication. Practitioners should account for limited conceptual knowledge when they discuss oral health issues with their low-income and minority patients. If this is not accounted for, they will probably find that their oral hygiene education messages are being ignored and health promotion is being adversely affected.

Keywords: adults, knowledge, oral health, oral hygiene, periodontal diseases, questionnaires

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studies primarily showed that limited oral health literacy is associated with poor oral health quality of life.⁷⁻⁹ Despite the dearth of studies linking health literacy and oral health, there is wide agreement that they are related. In 2008, the American Dental Association (ADA) stated that "limited oral health literacy is a potential barrier to effective prevention, diagnosis and treatment of oral disease."¹⁰ Horowitz and Kleinman added that "being able to understand health information and how to obtain services is critical to oral health management."¹¹ Several investigations of oral health literacy are ongoing and should provide support for additional associations between health literacy and oral health in the future.

The purpose of this pilot investigation is to document conceptual knowledge of oral health issues among a population of low-income adults. Findings will be useful to practitioners who wish to emphasize particular health education topics when they communicate with their low-income adult patients. Results will also be useful to policymakers who wish to tailor health education messages to underprivileged communities. Dental hygiene faculty will find the results valuable for designing health education curricula.

Review of the Literature

Health literacy is the bridge between having knowledge and applying that knowledge to one's health care. Accurate and timely knowledge enables an individual to control a variety of challenging health-related situations and scenarios.¹² Acquisition of knowledge from print and broadcast media stems from familiarity with the vocabulary that is being used. Unfortunately, most patient brochures and other educational materials require a reading level far above that of the average person.¹³⁻¹⁵ The majority of health educational materials are written at the tenth and eleventh grade level, whereas a more appropriate level would be fifth or sixth grade level.¹² For those with limited health literacy, gaining knowledge from these educational sources of information is especially challenging. Acquisition of knowledge from encounters with other persons also relates to familiarity with vocabulary, however, it is also associated with a variety of interpersonal factors, including culture and social position.^{16,17}

According to a National Institute of Dental and Craniofacial Research work group on health literacy, improving understanding of oral health issues by the public will follow from increased sensitivity to the social and cultural factors that affect oral health, comprehensive health educational programs offered to students in the K-12 and adult education systems and greater attention to communication between

patient and provider.¹⁸ Horowitz and Kleinman stated that effective communication is the key to quality and success in oral health care.¹¹ The ADA's House of Delegates echoed this sentiment when it stated "clear, accurate and effective communication is an essential skill for effective dental practice."¹⁰ Good communication is an integral part of dental hygiene practice, particularly as it relates to the prevention and management of oral conditions such as dental caries, periodontal disease and oral cancer.

When communicating with their patients, health care providers may believe they are using layman's terms when, in fact, they are using technical terms and jargon that are unclear to the patient. Consequently, the messages imparted become irrelevant.¹⁹ Manner of communication is also important. Culturally appropriate content that focuses on actions and behaviors is preferred over detailed facts.¹² Patients also appreciate practical information that motivates action.

For the provider, communicating so the patient is involved may lead to increased understanding and better decision-making.¹⁹ One such type of communication is motivational interviewing (MI). Using MI, the health care provider establishes rapport with the patient which, in turn, leads to the patient feeling more comfortable with decision-making.²⁰ This pattern of communication is likely to work especially well for those with limited health literacy, as it establishes interactive dialogue and offers the patient some level of control. One additional technique to improve communication involves using a teach back method. The patient is asked to summarize discussions and demonstrate skills to the practitioner, providing evidence that knowledge has been imparted or not imparted.¹¹

Methods and Materials

Data for the present study was derived from the Baltimore Health Literacy and Oral Health Knowledge Project (BHLOHKP), a cross-sectional investigation of oral health literacy conducted by selected authors on the present article. The BHLOHKP utilized a comprehensive questionnaire to assess knowledge in 4 broad topic areas:

1. Basic oral health
2. Prevention and management of dental caries
3. Prevention and management of periodontal disease
4. Prevention and management of oral cancer

The BHLOHKP was designed to assess whether conceptual knowledge in these 4 broad topic areas was associated with word recognition and reading comprehension – 2 accepted measures of health literacy.²¹ The present article used selected data from the BHLOHKP to describe conceptual knowledge results of particular interest to dental hygienists. Additional analysis describing the conceptual knowledge findings thought to be of interest to general and pediatric dentists are planned for the future.

The BHLOHKP questionnaire was developed in 2 phases. During the first phase, a panel of dental content experts developed a list of open-ended questions related to each of the 4 broad topic areas. The open-ended questions were then administered to a sample of 16 low-income adults from Baltimore during a pilot-testing session. Participants were also asked to comment on the wording and formatting of each survey item. During the second phase of questionnaire development, responses generated during the pilot-testing session were used to create multiple-choice versions of each open-ended question. Comments regarding wording and formatting were also used to guide decisions about the appropriate number of questionnaire items. The resulting multiple-choice questionnaire contained a total of 44 items. A convenience sample of 15 practicing dentists from Maryland was asked to review the draft questionnaire, and minor changes to the wording and ordering of survey items were subsequently made.

Sampling Method

Researchers at the University of Baltimore's Schaefer Center for Public Policy randomly selected study participants for the present study from a list of Baltimore residents who had documented land-line telephones. Telephone numbers were matched against mailing addresses to maximize the number of residences in the sample. In order to facilitate the objectives of the research project, participants were drawn mainly from areas in Baltimore where the U.S. Bureau of the Census indicated lower levels of educational achievement in comparison to the general population of Baltimore.

Those who agreed to participate during initial telephone contact were sent a follow-up letter confirming participation. Reminder telephone calls were made both the day before and the day of the scheduled interview appointment. Among residences contacted, 231 adults said they were willing to participate in the study and were given an appointment. Of these, 100 adults presented to their appointed time. Interviewed participants

received a \$25 payment and a packet containing a toothbrush, floss, toothpaste and a selection of oral health-related brochures. They also received information about safety-net dental clinics in Baltimore.

Data Collection

Surveys were conducted during face-to-face interviews in small conference rooms at the University of Baltimore. Interviewers were trained to conduct the face-to-face sessions in a standardized fashion. Instructions were scripted to minimize variation across interviews. Data collection occurred on weekdays between 9:00 a.m. and 8:00 p.m.

Questionnaire items were printed in large font and placed in a bi-fold binder so the participant could view the questions and response categories while the interviewer read the questions aloud. Before interviews began, participants were reminded that if they were not sure of their answer or if they did not know the correct response to a question it was acceptable to answer "I don't know."

Study Variables

The present study limited its focus to the questionnaire items from the BHLOHKP that were most relevant to dental hygiene practice. Among the items highlighted in this report, 4 questions came from the Basic Knowledge section of the survey, 2 from the Knowledge of Dental Caries Prevention and Management section and 8 from the Knowledge of Periodontal Disease Prevention and Management section.

In addition to these oral health knowledge questions, participants were also asked questions about several demographic factors, including age (coded as 18 to 44 years, 45 to 64 years and 65 years or more), sex, race (African American, other), education level (less than 12 years, 12 years and 12 or more years) and annual household income (\$0 to \$25,000, more than \$25,001 or unknown).

Data Management and Analysis

Responses to questionnaire items were recorded on data entry sheets by the interviewers and later transferred into a Microsoft Excel spreadsheet. Descriptive data analysis was conducted using SAS Statistical Software for Windows (Version 9.1).²² Chi-square statistical tests were used to test associations. Statistical significance was defined by an alpha value of 5%.

Research methods were approved by institution-

al ethics review boards at the University of Maryland, Baltimore and the University of Baltimore. Informed consent was obtained from each participant and documented.

Results

Table I lists characteristics of the study sample. The majority of respondents were African American women, 45 to 64 years of age, with 12 years of education and an annual household income that was less than \$25,000.

Only 63% of respondents knew that the ADA recommended adults brush their teeth at least 2 times per day. By comparison, 35% percent incorrectly thought they were supposed to brush every time they ate or drank. Regarding dental visits, only 57% knew that the ADA recommended dental visits twice per year – 31% incorrectly thought that only 1 visit per year was recommended. Only 27% of respondents knew that the ADA recommended the use of soft-bristled toothbrushes – 55% mistakenly thought that the bristles should be medium. Only 15% knew they should floss their teeth at least 1 time per day – 35% incorrectly thought that they were supposed to floss every time they ate or drank. Of these basic knowledge questions, only 1 was significantly associated with demographics – adults with 12 years or more of education were significantly more likely to know what type of bristles a toothbrush should have than were those with fewer years of education.

In general, knowledge of dental caries prevention and management was notably higher than it was for basic knowledge. Ninety-one percent of respondents knew that sugar caused dental caries, while 82% understood that the best way to prevent tooth decay at home was to brush and floss every day. Realizing that sugar caused dental caries was significantly associated with age – adults aged 45 to 64 years had better knowledge than did those aged 65 years or more. Knowing that regular brushing and flossing was the best way to prevent tooth decay at home was significantly associated with sex – women had better knowledge than men.

Knowledge of gingivitis and periodontitis was mixed. Of the 8 questions asked, 3 reflected relatively high levels of understanding. Seventy percent correctly identified “gums that are puffy and red” as gingivitis, 76% knew that the best way to remove tartar from one’s teeth was by a dental cleaning and 75% knew that failing to brush and floss was the main cause of gingivitis. The remaining questions, however, reflected much poorer

Table I: Sample characteristics, Baltimore, Maryland, 2008 (N=100)

Characteristics	N	Percentage
All	100	100.0
Age (years)*		
18–44	30	30.3
45–64	43	43.4
>65	26	26.3
Sex		
Male	45	45.0
Female	55	55.0
Race*		
African American	92	93.9
Other	6	6.1
Education level*		
<12 years	20	20.2
12 years	50	50.5
>12 years	29	29.3
Household income		
Unknown	15	15.0
\$0–\$25,000	51	51.0
>\$25,001	34	34.0

*Total does not sum to 100 due to missing values

knowledge. Only 21% knew that dental plaque was composed of germs – the majority of respondents (62%) incorrectly thought that plaque was made up primarily of food. In addition, only 29% of respondents knew that diabetes was associated with periodontitis, 34% knew that smoking cigarettes was a risk factor for periodontitis and 36% equated gingival recession with periodontitis. Finally, only 39% knew that dentists and dental hygienists usually treat gingivitis with a dental cleaning – 35% mistakenly believed that prescribing antibiotics was the treatment of choice.

Several of the periodontal disease knowledge questions were significantly associated with education level. Years of education was significantly associated with knowing the etiology of gingivitis – adults with less than 12 years of education were less likely to know that it was related to brushing and flossing than were those with 12 or more years of education. Education was also significantly associated with knowing that recession equated with periodontitis – those with less than 12 years of education were less likely to make the connection between recession and disease than were those with 12 or more years of education. Knowing that smoking cigarettes was a risk factor for periodonti-

tis was also significantly associated with education level. Those with less than 12 years of education were less likely to know the connection between smoking and periodontitis than were those with 12 years of education.

Discussion

The present study revealed that oral health knowledge in Baltimore is mixed. On the positive side, knowledge of dental caries prevention and management was very good. A majority of respondents knew that sugar caused dental caries and that brushing and flossing were good ways to prevent tooth decay at home. These findings likely reflected the frequency and consistency by which some oral health messages are being delivered to the public. However, less than half of respondents knew that a toothbrush should contain soft bristles, knew how often they should floss their teeth, knew how to identify periodontal disease, understood the behaviors and conditions that were associated with periodontitis, knew the composition of dental plaque and understood how gingivitis was usually treated. These poor results were rather troubling, especially considering that knowledge of some of these issues related to the topics of better understanding listed previously. For example, whereas most knew that brushing and flossing prevented tooth decay, relatively few knew how frequently to engage in the activity. Additional attention to these areas of poor understanding follows.

Almost three-quarters of study participants mistakenly thought that toothbrushes should contain "medium" or "hard" bristles. Adults with 12 or less years of education were even more likely to have incorrect knowledge of this topic. Although the survey did not ascertain why respondents thought stiffer bristles were better than soft bristles, one possible explanation was that respondents believed harder bristles cleaned more effectively or lasted longer. Given that using stiffer bristles may be associated with root surface abrasion, gingival recession and sensitivity, incorrect knowledge in this area could be causing undue harm to periodontal tissues.²³

Although 15% of respondents knew that they should floss at least 1 time per day, a total of 65% thought they should floss more frequently (35% answered "every time they ate or drank" and 30% answered "at least 2 times per day"). On the surface, this lack of knowledge might not seem to be a problem – there may be nothing wrong with flossing more often than what is recommended. The problem, however, is that those who believe they should floss at least 2 times per day may believe that this frequency is too burdensome. As a result,

they may refrain from the behavior all together. The relatively low prevalence of flossing in the U.S. supports this possibility.²⁴⁻²⁶

When shown a photograph of gingival recession, approximately one-third of study participants correctly identified the "receding gums" as a sign of periodontal disease. For those with less than 12 years of education, only 10% recognized the condition. Given that periodontitis is more prevalent in groups with low socioeconomic status (SES),²⁷ poor adults and those with less than a high school level of education are likely to see gingival recession frequently among family and friends. As such, the respondents might not have equated what they commonly saw within their social circles as a sign of disease. In other words, these findings might have reflected expectations (i.e., the public viewed "becoming long in the tooth" as normal).

In addition to not recognizing the signs of periodontitis, less than half of respondents knew that smoking cigarettes and having diabetes were risk factors for the disease. For smoking, this lack of knowledge is problematic because low SES adults are more likely to use tobacco than are their higher SES peers.²⁸ Diabetes is also more common among those with low SES, particularly among women,²⁹ so lack of knowledge of the connection between diabetes and periodontitis is also a problem for low-income adults. However, lacking knowledge of the diabetes and periodontitis connection is also problematic because periodontitis may negatively impact one's glycemic control.³⁰ As national studies have shown, dentate adults with diabetes are significantly less likely to visit a dentist than those without diabetes.³¹⁻³³ A lack of knowledge of the diabetes and periodontitis connection may also be adversely affecting dental visit behaviors.

Only 21% of respondents knew that plaque was made of germs. The vast majority (62%) mistakenly believed that it was composed of food. This lack of knowledge could have potentially impacted whether gingivitis and periodontitis were considered diseases and, by extension, whether brushing and flossing were taken seriously. In other words, study participants might have been less concerned about food buildup on their teeth than they would have been about a buildup of bacteria. Building on this argument, we discovered that 35% of respondents thought that prescribing an antibiotic was the usual way that dental professionals treated gingivitis. On the one hand, this incorrect answer suggested that some respondents thought gingivitis was, indeed, a disease. On the other hand, believing that antibiotics were necessary also suggested that respondents had little understanding of

the roles that plaque, calculus and regular prophylaxis played in the disease process.

Limitations

This study had 2 notable limitations. The first was that the study sample might not have been representative of all adults in Baltimore. In the city, African Americans comprise approximately 60% of all adults and in the study sample they comprised about 94%. In addition, about 18% of Baltimore's adults are 65 years of age or older, whereas 25% of the study sample was in this age range. It is possible that the study sample was more representative of low-income adults in the city than it was of the general population. However, demographic data was not available to make this comparison directly. Given these differences between the study sample and target population, generalizations of our study findings to the larger population of Baltimore adults should be made with some caution.

The second limitation was the relatively small sample size. Some of the statistical tests that assessed differences in knowledge across socio-demographic variables might not have attained significance because of insufficient power. For example, associations between demographic variables and 3 of the survey items yielded chi-square p-values between 0.05 and 0.10. These associations might have reached statistical significance had the sample size been larger. Despite these shortcomings, the present pilot study and the larger BHLOHKP were the first to comprehensively measure oral health knowledge among Baltimore adults, and the breadth of findings provided compelling evidence that oral health knowledge among low-income Baltimore adults needs to improve.

Conclusion

Dental hygienists are in a unique position to improve oral health knowledge through their encounters with low-income and minority patients with limited health literacy. Communication between the patient and provider should begin with simple terminology and vocabulary that is consistent with the patient's reading level.^{12,34} Dental hygienists are also urged to reinforce conceptual knowledge whenever possible, explaining to their patients the fundamentals of disease prevention and management. Furthermore, in order to ensure that messages are transmitted effectively, practitioners should follow Streets' 5 principles of communication:³⁵

1. Do not make assumptions about the patient's level of knowledge

2. Show empathy
3. Recognize the supportive role of family caregivers
4. Exhibit encouragement and support
5. Follow up, as needed

Having patients involved in decision-making may also increase understanding.¹⁹ Once a trusting relationship is established, the patient will likely feel more comfortable asking questions, requesting additional information and sharing in treatment decisions.²⁰

Effective communication between patient and provider is complex and challenging, especially for those with limited health literacy.³⁶ Persons with poor conceptual knowledge of oral health issues may not understand why certain behaviors are important and why some other behaviors should be avoided. Practitioners who take knowledge for granted will probably find that their messages are being ignored. Strategies to address these challenges need to be imparted during provider training and reinforced by periodic updates and reviews over a practitioner's professional career. Only then will dental health education have the desired effect – prevention of oral diseases and promotion of oral health.

The results of this pilot study should serve as the basis for larger studies of the links between health literacy and oral health. These studies will explore the relationship between conceptual oral health knowledge, appropriate health decisions and a variety of oral health outcomes. Until these new data are available, the present study provides a tantalizing glimpse into how common poor understanding is and the role it likely plays in determining oral health disparities within the population.

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Status of Current Dental Hygiene Faculty and Perceptions of Important Qualifications for Future Faculty

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Introduction

The dental hygiene profession experienced a period of major growth in the 1960s and 1970s, and its popularity has continued ever since. With that growth, the need for programs in dental hygiene increased, along with need for faculty. A number of dental hygienists entered the profession of dental hygiene education and have remained in those positions for several years. At this time, many of those same faculty members are nearing retirement age.¹

Health care education, in general, has experienced a shortage of educators due to large numbers of faculty reaching retirement age. This has fueled a growing concern about filling open positions in the future.¹⁻³ This issue has become increasingly important in dental and allied dental health education.³⁻⁵ The results of a national survey of dental hygiene program directors which examined faculty openings reported this concern in the literature as early as 1992.⁶ As a result, several ways of coping with the educator shortage have been implemented, such as increasing the numbers of part-time faculty, increasing the workload of current faculty and hiring faculty with less than preferred credentials.⁴ The prestige of a profession has always been directly linked to the academic qualifications of its faculty. Dental hygiene as a profession will need to acquire more qualified educators in order to continue to move forward. In addition, studies to date examin-

Abstract

Purpose: Dental hygiene educators are expressing concerns about faculty retirement causing an educator shortage. The primary objective of this study was to investigate current dental hygiene faculty demographic characteristics, future plans and perceptions of important skills for future faculty.

Methods: A Web-based survey instrument was designed after reviewing the literature and consulting with dental hygiene faculty. Permission to conduct this study was obtained from the University of Michigan. The survey investigated demographic characteristics, future plans and perceptions of important skills of future faculty. A cover letter was sent via e-mail to dental hygiene program directors requesting them to forward the link to faculty. Data were analyzed using descriptive statistics and chi-square testing in SPSS.

Results: The response rate was 65%. Program directors provided 24% of responses while non-directors provided 76%. The average age of faculty was 50 years. Within 5 years, 60 of the responding faculty will retire, which includes 20 program directors. Eight percent were in their first year of teaching. Greater than 90% of faculty perceived clinical, educational and technological skills as important for future faculty. Only 53% believed research skills were important, a significantly lower result ($p < 0.0001$). Responses for research skills differed significantly by institution type ($p < 0.0001$) and credentials ($p = 0.013$). Older faculty ranked educational and clinical skills significantly higher than younger faculty ($p = 0.005$, and $p = .018$ respectively).

Conclusion: Future dental hygiene faculty will need strong educational backgrounds, clinical skills and technological skills. University and highly credentialed faculty place greater importance on research skills than community college/technical school faculty and those with fewer credentials. Ways to engage current faculty in research should be investigated. Nearly 10% of this sample will retire within 5 years, so ways to attract qualified individuals in the field of dental hygiene education should also be investigated.

Keywords: dental hygiene faculty, retirement, qualifications, education

This study supports the NDHRA priority area, **Professional Education and Development:** Identify the factors that affect recruitment and retention of faculty

ing desired qualities and credentials of future faculty have often surveyed program directors rather than all dental hygiene faculty.^{4,6-8} The purpose of this study was to survey dental hygiene faculty nationwide, examining their demographics, academic profile and perceptions on the important qualifications of future faculty. In addition, this study included items exploring the importance of technological skills needed for teaching in the 21st century, an area not assessed in previous surveys.

Review of the Literature

Faculty Demographics and Academic Profile

Very little information is readily available on the current demographics and academic profiles of U.S. dental hygiene faculty. In 2007, Collins et al studied full-time baccalaureate faculty and found that 71.1% held a master's degree, 13.2% a doctorate degree and 6.1% a DDS.¹ In 1998, program directors were surveyed to identify the highest degree earned for those holding a position of director. The highest degree earned was a master's degree (64.5%), followed by DDS (12.3%), doctorate degree (10.9%) and bachelor's (10.1%). Of those holding a master's degree, the majority held it in the area of education (47.7%).⁹ Both of these studies chose to limit their sample to faculty in baccalaureate programs or program directors. Considering that associate degree-granting programs continue to supply the majority of practicing dental hygienists nationwide, it appears that many faculty members have not been surveyed.

The American Dental Association sponsors an annual survey of Allied Dental Education (ADA-ADE), which collects detailed information from all dental hygiene programs about dental hygiene faculty, including the number of full and part-time faculty, rank and highest degree earned.¹⁰ The ADA-ADE report indicates that approximately 28.2% of dental hygienist educators hold a master's degree, however, information on the area of specialization is not provided.¹⁰ Recent information is lacking on the areas of masters specialization for dental hygiene faculty.

Faculty Shortage Due to Retirement

Results of a recent survey of dental hygiene faculty indicated that in 2006 to 2007, 33% of all dental hygiene faculty were between the ages of 50 to 59, and 11% were over the age of 60.¹⁰ In 2007, Collins et al reported half of full-time faculty in bachelor's programs plan to retire within 10 years, and approximately 31 of those faculty members plan to retire in the next 5 years (the study had a total

sample of 114 individuals).¹ In 2004, an American Dental Education Association task force on the current status of allied dental faculty found that nearly 70% of all dental hygiene programs would need to fill current full-time faculty positions by 2009.⁴ Likewise, a study of Canadian dental hygiene programs found that 47% of faculty were over the age of 49, and that almost half of programs anticipate 1 or more faculty openings by 2010.⁸ Based on this information, there appears to be a consensus that a significant need for qualified faculty in the profession of dental hygiene is imminent.

Qualifications of Future Faculty

Not only has dental hygiene been experiencing an issue with aging of current faculty, but there has been difficulty finding new faculty with the desired skills and credentials to fill open positions. The reasons given for faculty vacancies included: only a few qualified individuals applied, candidates lacked required academic qualifications or there were no qualified candidates.¹¹ Two thirds of program director's describe recruitment of faculty as either very difficult (22%) or somewhat difficult (44%).¹² Because of this situation, the American Dental Hygienists' Association (ADHA), in their 2007 research agenda, called for research examining recruitment and retention of faculty and promoting graduate education and career path options.¹³

Over the past 20 years, program directors have been surveyed to determine desired credentials for new faculty appointments, qualifications of future faculty and the number of faculty openings. Some programs require a master's degree for full-time tenure track faculty. Many programs do not require a master's degree, but would prefer a candidate with a master's degree.^{4,7} Program directors have also reported important qualifications of future faculty. They identified 5 desired qualifications for future faculty, including experience in teaching, research, patient care, administration and sales/marketing.^{6,7}

The importance of technological skills in future faculty has not been addressed in previous studies. This is important because of the current environment in which students learn. Technology is being incorporated into the classroom and clinical environment in a variety of ways. Faculty members have the opportunity to use advanced Web-based course and collaboration sites for placement of course handouts, assignments and grades. Students have access to a number of communication tools and collaboration methods that are also Web-based. In the clinical setting, chair side state-of-the-art computer set-ups include programs with

digital patient radiographs, records and programs for clinical grading.

Distance education is becoming increasingly popular in higher education as well, and dental hygiene is following suit. In 2002, 22% of programs taught a portion of their curriculum using distance education, and 13% of schools had future plans to do so. That same year, the majority of programs with distance education had been using it for 5 years or less. In 2007, 41 dental hygiene programs reported offering online study.^{10,14} In addition, all but 5 of these programs required formal training for their faculty in distance education and delivery. It is clear that online education is the wave of the future, but current faculty members often require significant training to utilize these new technologies.

The most common usage of distance education in dental hygiene courses is through asynchronous learning.^{14,15} This type of instruction makes it possible for students to complete work on their own schedules, with course materials available around the clock. The most common courses being placed online are periodontology, oral pathology, dental anatomy, nutrition, radiology and pharmacology, and 4 programs currently have all their didactic coursework online.¹⁴

In addition to the roles of educator and clinician, dental hygiene faculty members also need technological skills. The importance of these skills has not been addressed in previous surveys of desired qualifications in future faculty. If faculty vacancies are not filled with qualified individuals, there is a potentially negative impact on dental hygiene education and the profession of dental hygiene. Based on these issues, this study addressed the assessment of the current status of dental hygiene faculty, and the identification of current faculty perceptions on the important qualifications of future faculty in the areas of education, technology, research and patient care.

Methods and Materials

Data Collection Instrument

This study examined dental hygiene faculty in the U.S. by way of an electronic survey. The survey instrument was developed using information obtained from a comprehensive literature review and in consultation with faculty from the University of Michigan Dental Hygiene Program and faculty from the University of Michigan, School of Education. Due to the nature of the research study, this project received exempt status from a full review

by the Institutional Review Board of the University of Michigan.

Since there is no current database containing e-mail addresses of all dental hygiene faculty, an invitation to participate in this survey was sent via e-mail by the director of the University of Michigan's dental hygiene program to dental hygiene program directors nationwide. Dental hygiene program director e-mail addresses were obtained using the ADHA's 2008 list of Entry Level Dental Hygiene Education Programs.¹⁶

The invitation was sent to 297 entry-level programs. The invitation letter requested participation in the survey and for program directors to forward the forthcoming electronic survey link to all dental hygiene faculty members associated with their program. One week after the initial invitation was sent, a cover letter with a link was sent to directors asking them to forward it to all dental hygiene faculty members. The survey was distributed in October 2008, and a follow-up e-mail was sent 3 weeks after the initial e-mail to non-respondents.

The 40 item anonymous questionnaire was distributed using SurveyMonkey™ software and included 3 sections. Section 1 addressed questions regarding demographics related to teaching, including institution type, current age, years of experience and faculty position. Section 2 included items of personal information and future plans of the faculty members. The question about a faculty member's future plans was adopted from the National Study of Postsecondary Faculty.¹⁷ In section 3, faculty were given a list of skills and qualifications relating to education, clinical, technology and research skills in dental hygiene education, and asked to rank their level of importance for future dental hygiene and research.

Statistical Analysis

The data were collected with SurveyMonkey™ and downloaded into an excel file. This file was then imported into SPSS (Version 16.0) for analysis. All data were aggregated before to ensure confidentiality. Data analysis consisted of computing descriptive statistics such as frequency distributions, percentages and measures of variability. Continuous variables such as year born, years of experience and days worked were converted to categorical variables. Bivariate relationships (chi-square coefficients for categorical and ordinal data, Pearson correlation and Fisher's exact test) between faculty demographics and importance of skill categories were then examined. In all cases, alpha=0.05 was used for testing significance. All statistical steps

were completed in consultation with a statistician.

Results

Respondents

The letter of invitation, along with the link to the electronic survey, was sent to 297 active dental hygiene programs in the U.S. Six surveys were returned for incorrect e-mail addresses. Of the remaining 291 hygiene programs directors, 149 program directors responded "yes" when asked if they were the program director, but only 87 directors sent return e-mails with the requested information on the number of faculty associated with their program (n=978). Using this information, we calculated the response rate of faculty receiving the survey via e-mail 65% (631 of 978).

Demographics

Faculty demographic data are summarized in Table I. The majority of faculty worked in community colleges or technical school settings (65.7%), and the remaining faculty taught in a university setting (34.3%), with 18.5% being associated with a dental school. The average age of faculty members being surveyed was 50 years. The largest number of faculty were between the age of 50 to 59 years (45%), followed by faculty members aged 40 to 49 years (24.5%). Forty-two faculty members (6.7%) had more than 30 years of experience, and 30.4% of faculty (n=191) had 5 years of experience or less. Fifty-two faculty members (8.1%) were in their first year of teaching. Most faculty members taught didactic courses (76%, n=478), and 24% taught exclusively in the clinic (n=147). Directors represented 26% (n=149) of the sample, and 74% (n=476) of the sample held traditional faculty positions.

Academic Profile

The faculty academic profile is summarized in Table II. The highest degree earned by most dental hygiene faculty was a master's degree (53%, n=330), followed by a bachelor's degree (31%, n=196), doctorate or DDS (13%, n=78) and an

Table I. Faculty Demographics

	Number of Faculty	Percent of Faculty
Institution Type	(N=631)	
Community College	364	57.6%
Technical/Vocational School	51	8.1%
University associated with a Dental School	117	18.5%
University not associated with a Dental School	99	15.7%
Current Age of Faculty	(N=605)	
29 and under	25	4.1%
30-39	82	13.6%
40-49	148	24.5%
50-59	272	45%
60 or older	78	12.9%
Average Age of Faculty	50 years	
Faculty Years of Experience	(N=628)	
0-5 years	191	30.4%
6-10 years	143	22.8%
11-20 years	154	24.5%
21-30 years	98	15.6%
31-40 years	42	6.7%
Faculty Position	(N=628)	
Director	149	24%
Non-director	476	76%
Didactic Teaching Responsibilities	478	76%
Clinical Teaching Only	147	24%

associates (3%, n=18). Faculty with a bachelor's degree concentrated their education in dental hygiene (21.3%), health education/administration (2.5%) and allied health (1%). All other disciplines studied were less than 1%. Among faculty indicating a master's degree, the most common area of study was education/educational administration (19.2%), dental hygiene (9.8%) or health education (4.5%). Four percent of faculty members were currently in progress toward a master's degree. Faculty holding a doctorate degree most commonly indicated DDS (7.6%), education (1.7%) or educational administration/leadership (1.5%) as their area of concentration. One percent of faculty members were in progress toward a doctorate degree. All other areas studied for a master's or doctorate degree were less than 1% for each discipline. The majority of respondents who indicated the direc-

Table II. Highest Degree Earned by Faculty (N=622)

Highest Degree Earned	N	%	Degree Discipline
Associate's	18	2.9%	<ul style="list-style-type: none"> Dental Hygiene- 100% (N=18)
Bachelor's	196	31.5%	<ul style="list-style-type: none"> Dental Hygiene - 67% (N=132) Health Education/Administration - 8% (N=15) Allied Health - 3% (N=6) All other areas <1% per discipline - 22% (N=43)
Master's	330	53.1%	<ul style="list-style-type: none"> Education/Educational Administration - 37% (N=121) Dental Hygiene - 18% (N=61) Health Education - 10% (N=32) In Progress - 8% (N=25) MPH - 4% (N=14) All other areas <1% per discipline - 23% (N=77)
DDS/Doctorate	78	12.5%	<ul style="list-style-type: none"> DDS - 62% (N=48) Education - 13% (N=10) Educational Leadership/Higher Education - 11% (N=9) In Progress - 14% (N=11)

tor position held a master's degree (67.1%), with fewer holding a doctoral degree (22.8%) or baccalaureate degree (10.1%).

Faculty Retirement

Faculty members were asked about their plans in the next 5 years (Table III). The majority of faculty (81.2%) plan to continue in their current position. The next most frequent response was to retire from the workforce (9.5%, 60 faculty members). Of those faculty, 22 are directors of dental hygiene programs. Faculty were also asked a separate question on whether or not they would elect to draw on their retirement and continue working on a part-time basis. Fifty percent (n=312) said they would.

Skills and Characteristics for Future Faculty

Faculty were given 21 qualifications relating to education, clinical, technology and research skills in dental hygiene education and asked to rank their level of importance for future dental hygiene faculty on a 4 point Likert-type scale. For each of the 4 categories, education, technology, research and clinical skill responses were consolidated. If a faculty ranked a category as either very important or moderately important, it was considered to be important. If faculty gave a rank of not very important or not important at all, it was considered to be unimportant. The responses were further consolidated so that if a faculty considered half or more of the individual questions in a given category as

Table III: Faculty Career Pathway in Next Five Years (N=616)

	Number of Faculty	Percent of Faculty
Continue in my current position	513	81.2%
Retire from the workforce	60	9.5%
Accept a full-time job at another educational institution	21	3.3%
Accept a full-time job not in an educational institution	12	1.9%
Accept a part-time job at another educational institution	10	1.4%

important, the response was recorded as indicating the category, as a whole, being important. If faculty considered half or more of the individual questions in a given category as unimportant, the response was recorded as indicating that category, as a whole, was unimportant.

The perceived important skills needed among future dental hygiene faculty as rated by current faculty were clinical dental hygiene (99%), followed by educational skills (97%), technology skills (94%) and research skills (53%). Chi-square tests of significance were used to compare differences in preference of specific skills categories. Research skills were rated significantly lower as an important qualification of future faculty ($p < .0001$).

Chi-square tests of significance were used to examine differences between institution type, highest degree earned, faculty position, level of experience

Table IV. Faculty Ranking of Skill Categories Comparing Highest Degree Earned (N=628)

	Associates (N=18)	Bachelor's (N=197)	Master's (N=335)	DDS/PhD (N=78)	P-value
Placed Importance on Technological Skills	83.3%	92.9%	96.1%	93.6%	P=.066
Placed Importance on Educational Skills	88.9%	97.0%	98.2%	96.2%	P=.082
Placed Importance on Clinical Skills	93.8%	98.4%	99.7%	95.9%	*P=.011
Placed Importance on Research Skills	50.0%	44.7%	59.1%	50%	*P=.012

Table V. Faculty Ranking of Skill Categories Comparing Age Ranges (N=592)

	29 and younger (N=24)	30-39 (N=79)	40-49 (N=144)	50-59 (N=267)	60 and older (N=78)	P-value
Placed Importance on Technological Skills	92.0%	93.9%	93.2%	95.2%	97.4%	P=.578
Placed Importance on Educational Skills	92.0%	93.9%	97.3%	99.3%	100%	*P=.005
Placed Importance on Clinical Skills	91.7%	96.2%	99.3%	99.3%	100%	*P=.018
Placed Importance on Research Skills	52.0%	46.3%	54.1%	52.2%	62.8%	P=.328

and ranking of skill categories. Table IV examined differences in faculty ranking of skill categories according to highest degree earned. Faculty holding a bachelor's or master's degree placed a higher importance on clinical skills and experience than faculty with an associates or doctorate degree ($p=0.011$). Faculty holding a master's degree rated research skills higher than any other degree categories ($p=0.012$).

Table V shows differences in faculty ranking of skill categories by age. When faculty were divided into age categories, older faculty ranked educational skills and clinical skills significantly higher than younger faculty ($p=0.005$, $p=0.018$ respectively). Faculty that teach didactic courses ranked educational skills significantly higher than faculty who teach in the clinic environment exclusively (98.3% compared to 93.9%, $p=0.007$).

When comparing directors vs. non-directors in terms of ranking of skill categories, directors were more likely to believe that technological skills were important than clinical and didactic faculty ($p=0.003$, Table VI). Faculty with higher level credentials believed that research skills were more important ($p=0.012$). Research skills were also significantly more important to university faculty than community college/technical school faculty at 73.6% and 42.2%, respectively ($p<0.0001$, Table VII).

Discussion

The intent of this study was to survey all U.S. dental hygiene educators to determine their perceptions of important skills needed in the development and recruitment of future faculty. However, it appears that almost half of dental hygiene faculty did not get the opportunity to complete the survey, presenting the possibility of response bias. Only 87 out of the 149 program directors who responded sent a return e-mail indicating the number of faculty associated with their programs. Of the 987 faculty indicated, nearly 65% (631 of 987) responded to the survey. Still, the discrepancy between the number of respondents indicating director status and the number of returned e-mails stating the number of faculty associated with their program decreases the total response rate, but the amount of decrease is unknown.

It is important to note that at the time the survey instrument was administered, the ADA-ADE survey reported there were 4,237 part and full-time faculty teaching nationwide in dental hygiene programs.¹⁰ Assuming these numbers truly reflect the size of the pool of available dental hygiene educators in the U.S., the survey captured the opinions of nearly 15% of these individuals, which represents a larger response rate than would a randomized sample of 10% of faculty been taken.

Faculty ages in this study compared favorably

to Collins et al,¹ who reported in 2007 the average age of faculty being 50.2 years over a younger average age (46 years) reported by Nunn et al⁴ in 2004 and Haden et al in 2002.¹⁸ While 21% of faculty surveyed indicated they have more than 20 years of experience, over half of current faculty surveyed had 10 years or less. This study found that 8% of respondents in the sample are in their first year of teaching, a survey item which has not been measured in previous studies, indicating there is a large number of faculty entering or returning to dental hygiene education. Interestingly, over half of the sample in this study was over the age of 50, yet 53.2% of faculty had 10 years or less experience. These results suggest that these newer dental hygiene educators are not necessarily younger.

A surprising finding in the study, considering the average age of the sampled faculty, was the observation that fewer than 10% of faculty respondents indicated their intent to retire within the next 5 years. This figure is significantly less than the 23.2% reported in a 2007 study, and 68% in a 2002 study.^{1,4} Possible differences in the results could be that the Collins et al sample was one-fifth the size of the sample that was used in this study and focused only on baccalaureate institutions.¹ Another possibility, as suggested by the 8% of respondents in their first year of teaching, is that many positions that have become open due to faculty retirement have now been filled with new faculty members. An important finding of this study is that in the next 5 years, over one-third of individuals planning to retire are dental hygiene program directors. This finding agrees with the Nunn et al report that indicated a significant number of dental hygiene program directors plan to retire in the near future.⁴ Of interest is the current economic downturn and its effect on the retirement plans for both faculty and directors.

Comparing faculty academic profiles from this study to the ADA-ADE survey performed in 2007–2008,¹⁰ the results indicate a similar number of faculty hold a bachelor's degree as their highest degree (31.5% in this study compared to 33.8% in the ADA-ADE survey). The number of total faculty holding a doctorate or DDS was significantly lower

Table VI. Faculty Ranking of Skill Categories Comparing Directors vs. Non-directors (N=625)

	Directors (N=149)	Non-Directors (N=476)	P-value
Placed Importance on Technological Skills	98.7%	92.4%	*P=.003
Placed Importance on Educational Skills	96.2%	99.3%	P=.057
Placed Importance on Clinical Skills	99.3%	98.5%	P=.687
Placed Importance on Research Skills	47.7%	54.6%	P=.158

Table VII: Faculty Ranking of Skill Categories Comparing University vs. Community College/ Technical School (N=598)

	University (N=202) %	Community College/ Technical (N=396) %	P-value
Placed Importance on Technological Skills	93.5%	94%	P=.862
Placed Importance on Educational Skills	96.8%	96.9%	P=1.00
Placed Importance on Clinical Skills	98.1%	99%	P=.456
Placed Importance on Research Skills	73.6%	42.2%	*P<.0001

in this survey (12.5% compared to 25.6% in the ADA-ADE survey). This may be due to the fact that the ADA-ADE survey is one in which directors reported on faculty, and many universities associated with dental schools utilize dentists to teach didactic courses in the biological sciences. This study sought to capture both part and full-time dental hygiene faculty, and it is not certain if faculty with DDS credentials were included in all cases when director's forwarded the survey. In the sample used for this survey, the number of faculty who hold a master's degree was significantly higher than the ADA-ADE survey (53.1% to 33.8%, respectively).

The majority of faculty in this study who held a master's degree held it in an area other than dental hygiene. This study indicates a lower number of faculty with a master's in dental hygiene working in academia (9.8%, n=61) compared to what Jevack et al reported in 2000 when looking specifically at master's in dental hygiene graduates (68%, n=119).¹⁹ One reason for the discrepancy in results

may be that graduate dental hygiene programs are not geographically accessible.²⁰ Although there has been a 30% increase in master's programs in the last decade, there are still only 18 programs in the U.S. currently offering a master's degree in dental hygiene.^{20,21} The reality is that most dental hygienists enter the field with an associate's degree. This requires individuals to first complete a bachelor's degree before pursuing a master's degree. Moreover, the master's programs vary greatly according to content, and they take only a small number of students each year as compared to the number of clinical dental hygiene graduates. It is unclear whether the number of doctorate degrees obtained by those holding the position of program director has increased in the last decade. In the current sample, twice the percentage of directors held a doctorate degree compared to the Wilder et al study in 2000, which also included directors in Canadian dental hygiene programs.⁷ On the other hand, a similar number of directors holding a doctorate degree was found when compared to a study done 10 years ago on program directors' demographic and academic profile.³ This would indicate that the number of dental hygiene program directors who hold a doctorate degree has held steady over the last 10 years and not increased.

This study found that more than 90% of all dental hygiene faculty believe that clinical skills, educational skills and technological skills are important qualifications for future faculty. Only half of all dental hygiene faculty reported that they believed research skills are important for future faculty, which was significantly lower than the other 3 skill categories. The reason for this could not be determined from the results, however, it may be due to the fact that the majority of dental hygiene faculty work in community colleges or technical school settings where demands for scholarly activity related to research are not routinely emphasized. Faculty of bachelor degree programs tend to have more requirements relating to research/scholarship, mentoring graduate students and professional growth when compared to community college faculty.²² Even bachelor's degree program faculty report that "no pressure to publish" is an important factor in deciding whether or not to stay at their current position or take a new position in another institution.¹ However, this study found that research skills are more highly valued by faculty in university settings compared to those in technical/associates degree settings. Ultimately, faculty with higher levels of education and faculty teaching in the university setting, including program directors, still routinely placed less importance on research skills compared with other skills.

As might be expected, faculty who teach didactic courses place a higher importance on educational skills than faculty who teach exclusively in the clinical setting (98.3% compared to 93.9%). However, this study found didactic and clinical faculty members place an equal importance on clinical skills. Faculty who teach didactic courses often teach in the clinical environment as well, which may contribute to this result. In general, faculty tend to place a high importance on clinical competence of all faculty teaching in the dental hygiene program.

To date, there have been no studies identified that survey current faculty opinions on the need for technological skills as a qualification in future dental hygiene faculty. When comparing the opinions of dental hygiene directors with that of faculty, this study found that program directors placed significantly higher importance on technological skills than traditional faculty. Directors may be more inclined to seek skills in technology because most new innovative teaching practices involve some aspect of technology.

A survey of community college faculty of all disciplines nearing retirement age conducted in 2001 found that older faculty believe the ability to teach using distance learning and ability to conduct research were the least important skills/qualifications necessary for future faculty.²³ In contrast, this study found that faculty over the age of 60 placed a higher importance on technology and research skills than all other age groups. Although this difference was not statistically significant based on the limited sample of participants over the age of 60, it is an important observation in comparison to the community college faculty survey, which included faculty of all disciplines. Faculty over the age of 60 still placed the highest level of importance on educational and clinical skills, with 100% believing these skills and experiences are important for future faculty. One reason for the differences in these results may be the increased use of the internet during the preceding 9 years, where educators have become more familiar with distance learning and the technology has become more user friendly along with the capacity to reach a wider range of students.

As faculty members continue to age and retire, there is the challenge to educate, recruit and train new dental hygiene faculty. While only 10% of faculty in this samples plan to retire in the next 5 years, there are still 60 projected faculty vacancies by 2013. This study identified current faculty expectations for skills and qualifications considered to be important for future faculty. In addition to the preference for new faculty having master's de-

gree,^{4,7} this study has shown that faculty place a high importance on clinical, educational and technological skills.

By ranking each skill so highly, it appears that current dental hygiene programs are unwilling to compromise their high standards when hiring future faculty, even though there is a clear indication of a dental hygiene faculty shortage nationwide. If the dental hygiene profession is to achieve recognition and status in the dental and medical professions, there must be continued effort to contribute to a body of research in dental hygiene. It is clear from the results of this study that new ways of engaging faculty in the area of research should be explored.

A strength of this study was that the total sample size is greater than any other sample of dental hygiene faculty members taken to date. However, due to the sampling scheme, there is a possibility of response bias and as such the sample does not reflect the real distribution of full to part-time faculty in dental hygiene institutions. This could have impacted the data in several ways – if more part-time faculty responded, it would likely decrease the number of master's degree respondents since part-time faculty tend to have more bachelor's degrees than master's. It may have further decreased the importance of research since most part-time faculty members teach exclusively in the clinic. Finally, it is important to note that the survey did not request that the respondent indicate which state in which they resided, so it is uncertain as to whether each state has adequate representation in the sample and results may not be generalized to every state.

Conclusion

This study is the first to indicate a large number of faculty members who hold the director position planning to retire in the next 5 years. Information regarding the status of retirement plans for dental hygiene directors is important for long term plans of dental hygiene programs and for ADHA leaders

who monitor professional education of the dental hygienist. The retirement of faculty directors will contribute to the shortage of experienced teaching faculty. Program directors assume responsibilities of leadership and administration that may affect their availability for teaching courses. Studies examining desired leadership and administration skills for future program directors will be an important factor to explore in future studies. Another area for further investigation would be exploring reasons for entering the field of education. With a high number of predicted faculty vacancies, and the need to recruit more faculty members, it would be important to know the reasons why they are entering the field.

The present study has identified that clinical, teaching and technology skills are important characteristics for future dental hygiene faculty. Information on this topic is potentially important to graduate program directors regarding key curriculum content or focus areas for dental hygiene master's programs. For those individuals who achieve a master's degree in areas other than dental hygiene with the goal of entering the field of education, the results of this study are valuable in preparing them to obtain faculty positions in dental hygiene programs.

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Dental Hygienists' Evaluation of Local Anesthesia Education and Administration in the United States

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Introduction

Previous studies have examined various aspects of local anesthesia administration by dental hygienists, and provide support for the administration of this pain control modality by these providers.¹ Reporting on such issues as overall frequency of use, delegation, implementation, rates of successful administration, incidence of complications and dental practice impact, these evaluations suggest that employers are allocating local anesthesia administration and dental hygienists are providing effectual injections that have presented positive practice outcomes.¹⁻⁵

Although several studies have been conducted, there has been minimal information reported on perceptions of educational preparedness, the use of specific administration techniques and acuity of need. Since a majority of the U.S. dental boards currently have regulations delegating local anesthesia administration by dental hygienists, the intent of this study was to investigate practice characteristics and educational experiences of dental hygiene providers in the U.S.⁶⁻⁷

Review of the Literature

Administration of local anesthesia by dental hygienists has been studied and reported in the literature for approximately 30 years.¹⁻⁵ These studies have examined the characteristics associated with the utilization of local anesthesia by dental hygienists in various practice settings. They reveal that local anesthetic administration is being delegated to dental hygien-

Abstract

Purpose: The goal of this project was to investigate the educational experiences and the use of local anesthesia by dental hygiene providers in the U.S.

Methods: Approved by the Institutional Review Board at the University of Pittsburgh and undertaken from February to May 2009, this study was designed using a questionnaire-based survey. Using a randomized list obtained via the American Dental Hygienists' Association (ADHA), the survey questionnaires were sent via mail to 1,200 dental hygienists in the U.S. Quantitative evaluations were confined to descriptive statistics including standard summation, an estimation of means and a valid percent for identified variables.

Results: A total of 432 (n=432) of the 1,200 survey questionnaires were returned, which represents a 36% response rate. The respondents represented a total of 296 dental hygiene educational programs, and included practice sites that span all 50 states. Findings indicate that the majority of responding dental hygienists perceive a need for the use of this pain control modality in their practice and administer local anesthetic injections. Additionally, the majority of respondents that administer local anesthetic injections reported that they perform local anesthetic administration for cases in which the dentist provides total care. Furthermore, the results revealed that the hygienists that received training in the administration of local anesthesia injections reported a higher rate of educational preparedness in 6 of the 7 educational topics listed in this survey: local anesthesia related topics (local anesthesia administration, local anesthetic pharmacology and local anesthetic complications), basic pharmacology, medical emergency management and special needs care.

Conclusion: This examination parallels the results presented in previous studies, while offering new data relating to local anesthesia administration by dental hygienists. With the majority of dental hygienists reporting a perceived need and the use of this method of pain control, this practice appears to be a significant addition to overall dental care and dental hygiene education.

Keywords: anesthesia, education, preparedness, local anesthetic, pain management

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Assess how dental hygienists are using emerging science throughout the dental hygiene process of care.

ists by their employers and that dental hygienists are administering successful injections, which have resulted in positive practice outcomes.

The delegation of local anesthesia administration by dental hygiene employers has been frequently reported using survey model research within individual states. In 1980, based on their survey of dental hygiene graduates from California, Rich and Smorang reported that 100% of periodontists and 86% of general dentists delegated the administration of local anesthesia to dental hygienists.³ In a survey of dentists and dental hygienists in Arkansas, DeAngelis and Goral found that 94% of dentists delegated this responsibility to their dental hygienists.⁴ Additionally, Anderson reported that 95% of dental hygienists who completed a Minnesota continuing education course reported their employer delegated responsibility for administering local anesthesia.¹

Previous studies have also demonstrated that utilization of local anesthesia administration by dental hygienists varies by practice type, with the highest frequency of usage occurring in periodontal practices. In a survey of Minnesota dental hygienists, Anderson found that 47.6% of dental hygienists working in periodontal offices reported administering local anesthesia for 3 to 6 patients each week, while 63% of hygienists working in general practice administered local anesthesia for 1 or 2 patients each week. In the same report, Anderson also revealed that, overall, 92% of hygienists were frequently using local anesthesia for periodontal root planing and debridement.¹

The impact on dental practices following the integration of local anesthesia administration by dental hygienists has been examined by Anderson,¹ Cross-Poline et al² and DeAngelis and Goral.⁴ Anderson reported that 58% of respondents revealed that their ability to administer local anesthesia was very valuable to their practice, while 64.4% reported that their practice ran more smoothly.¹ Following their 1992 survey of dentists and dental hygienists from Colorado, Cross-Poline et al reported that a majority of dentists identified benefits to both their practices and their patients as a result of the administration of local anesthesia by their dental hygienist.² In addition, DeAngelis and Goral reported their findings from a survey of all Arkansas dental hygienists certified in the administration of local anesthesia, as well as dentist employers.⁴ Their results indicate that the survey respondents perceived local anesthesia as beneficial for both dental hygiene patients and clinicians. Arkansas dental hygienists and dentists reported that this function has a positive impact on scheduling, production, patient satisfaction and comfort and quality of care.

Methods and Materials

Approved by the Institutional Review Board at the University of Pittsburgh and undertaken from February to May 2009, this study was designed using a questionnaire-based survey to investigate the educational experiences and the use of local anesthesia by dental hygiene providers in the U.S. Questions were formulated to determine common practice characteristics, utilization of various local anesthesia techniques, local anesthesia education satisfaction and preparedness and the perception of need for the provision of local anesthesia by dental hygienists.

The survey questionnaire was pilot tested with 12 dental hygienists, revised and sent via mail to 1,200 dental hygienists in the U.S. using a randomized list obtained via the American Dental Hygienists' Association (ADHA). All prospective respondents possessed a current dental hygiene license in the U.S., and respondents currently in dental hygiene training programs were not included. Completed questionnaires were returned to a central site at the University of Pittsburgh School of Dental Medicine for processing and data entry. All survey-participation requests were accompanied by a letter containing the following: a description of the purpose of the study, an explanation on how to complete and return the questionnaire and directions on how to ensure anonymity. A total of 432 (n=432) survey questionnaires were returned, which represents a 36% response rate. In statistical terms, a population of 200,000 is considered to be infinite and a randomized sample of 386 people is required to achieve a representative sample of the population using the method of this study.⁸⁻¹⁰

Data from the returned questionnaires was entered into an Excel spreadsheet and imported into a JMP Statistical Discovery Software™ program for analysis. Quantitative evaluations were confined to descriptive statistics including standard summation, an estimation of means and a valid percent for identified variables.

Results

Demographics

Evaluation of the survey's demographic data explored the respondents training, current practice setting and employment background. The respondents represented a total of 296 dental hygiene training programs and included practice sites that span all 50 states. Prior to data analysis, each returned questionnaire was also categorized according to a respondent's region of practice using 5 geographic

regions that demonstrate similar population aspects via the United States Census Bureau's 9 U.S. regional divisions (Figure 1). The evaluation of each region's representation demonstrated a similar pattern of distribution throughout the U.S. as follows: Region 1 – 17.8%, Region 2 – 16.2%, Region 3 – 25.2 %, Region 4 – 14.8% and Region 5 – 26.0%. In addition, the respondents' year of dental hygiene program completion was reported by each respondent with a mean year of 1990 (range of training completion – 1961 to 2008).

Evaluation of the survey's demographic data also explored the respondents main practice type. Data analysis of this set revealed that the majority of respondents (76.1%) considered general dentistry as their primary practice identification, with academics/university setting (8.4%), periodontology (7.8%), public health (5.2%), pediatric dentistry (2.2%) and prosthodontics (0.3%) reported with lesser frequency. It should be noted that 38 respondents reported working in multiple practice settings, with general dentistry and academics (50.0%) being the most common combination, followed by general dentistry and periodontology (28.9%), general dentistry and public health (15.8%), public health and periodontology (4.9%) and pediatric dentistry and periodontology (0.4%).

The study investigators also included questions to determine the total number of hours worked per week, as well as the total number of offices in which the respondents were employed. The work-hour evaluation revealed a range of 5 to 41 hours per week and a mean of 28.9 hours per week. Further analysis of the total number of offices in which the respondents were currently employed demonstrated that the majority worked in 1 office (76.1%). The remaining distribution of office employment was determined as follows: 2 offices (18.9%), 3 offices (2.6%), 4 offices (0.7%) and 5 or more (1.7%).

Administration of Local Anesthesia

Several survey questions were devised to evaluate the hygiene provider's practice of local anesthesia administration. The intent of these questions was to ascertain the frequency with which hygienists are performing injections, to identify the types of organizations that provided local anesthesia training and to determine customary practices.

The study found that 257 respondents (59.5%) currently administer local anesthesia in their hygiene practice, while 175 (40.5%) do not. As shown in Figure 1, regional differences were observed in all geographic sections. Dental hygienists located in Region 5 reported the most frequent use of lo-

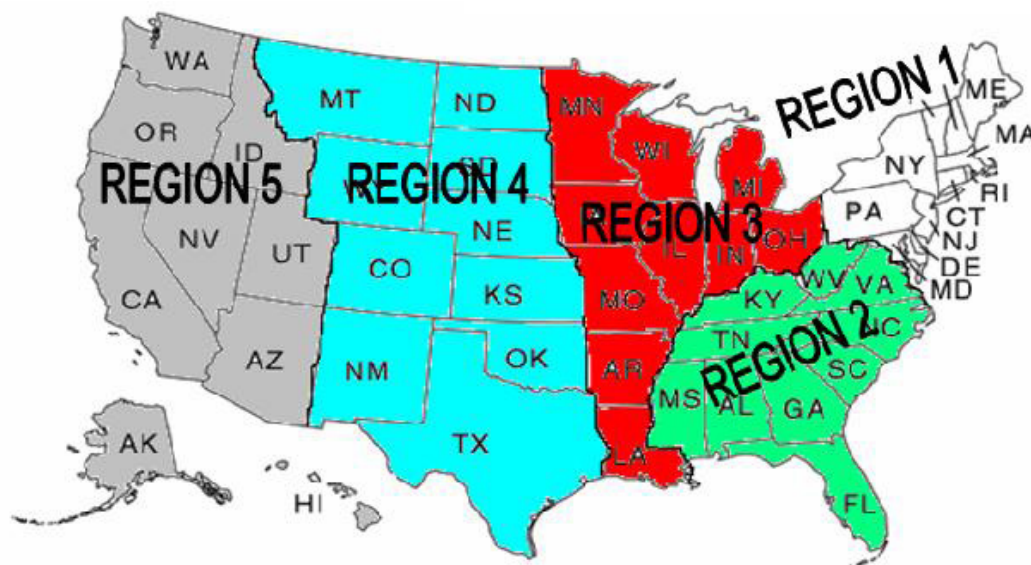
cal anesthesia administration (93.8%), followed by Region 4 (78.1%), Region 3 (55.0%) and Region 1 (31.2%). Region 2 (25.7%) demonstrated the lowest response for hygienists that administer local anesthesia injections. This is most likely the result of a significant portion of state dental boards located in Region 2 (5 states out of 10) not currently endorsing legislation permitting the use of local anesthesia by dental hygienists.^{6,7}

Additional analysis was also completed to compare the mean-year difference between hygienists administering local anesthesia against those who do not. The evaluation revealed a difference between the dental hygiene program/training completion mean-year of the 2 groups – those administering local anesthesia (mean year – 1995) and those not currently administering local anesthesia (mean year – 1986).

Evaluation of how the group administering local anesthesia was trained revealed that the majority of hygienists (67.3%) were educated while students at dental hygiene schools. The remaining responses were as follows: a dental hygiene school administered continuing education course (21.0%), a dental or dental hygiene organization administered continuing education course (7.8%), a dental school administered continuing education course (3.5%) and a post graduate training program (0.4%).

As demonstrated in Table I, analysis was also completed to determine the type of local anesthetic injections used by the respondents administering local anesthesia. The questions were grouped into 4 categories: infiltration/supraperiosteal injections (the injection of local anesthetic to affect the terminal nerve endings), nerve block injections (the injection of local anesthetic at or near the nerve trunk), field block injections (the injection of local anesthetic in the area of the direct branches of a specific nerve, such as the anterior superior alveolar nerve injection) and topical anesthetic application without injection (surface application of local anesthetic to block the free nerve endings of the oral mucosa). The respondent was asked to select a single numeric answer for the frequency of administration of each local anesthesia modality performed each week from the following choices: 0=never, 1=rarely (1 to 2 times per week), 2=occasionally (2 to 3 times per week), 3=often (4 to 5 times per week) and 4=most often (more than 5 times per week). Analysis was performed on each category of local anesthesia injection type response to provide a mean number depicting the quantity of use. The results demonstrated that nerve block injections (mean=-2.12, 2 to 3 times per week) and infiltration/supraperiosteal injections (mean=-2.02,

Figure 1: Regional Distribution of Dental Hygienist Respondents



Region	Total Response (n=432)	Hygienists Administering Local Anesthesia	Hygienists That Do Not Administer Local Anesthesia
1 (n=77)	17.8%	32.1%	68.8%
2 (n=70)	16.2%	25.7%	74.3%
3 (n=109)	25.2%	55.0%	45.0%
4 (n=64)	14.8%	78.1%	21.9%
5 (n=112)	26.0%	93.8%	6.2%

2 to 3 times per week) were the most commonly administered injection techniques, while field block injections (mean – 1.52, 1 to 2 times per week) were administered by the respondents with lesser frequency.

It should be noted that topical anesthetic application without injection was the most common response (mean=2.38, 2 to 3 times per week) among dental hygienists administering local anesthesia injections. When compared to dental hygienists that do not administer local anesthesia injections, the data demonstrates that the group administering injections uses topical anesthetic application at a higher rate – a mean of 2.38 compared to a mean of 1.64 for the group not administering local anesthesia injections.

In addition, an analysis was completed to compare a respondent's main practice setting to the mean quantity of each local anesthetic injection used. This evaluation revealed that hygienists identifying periodontology as their main practice setting administered a greater mean number of infiltration (x=2.87) and nerve block injections (x=2.38), as well as a higher use of topical anesthesia without in-

jection (x=2.65). Conversely, respondents classifying an academic/university practice setting administer the greatest amount of field block injections (x=2.25). Table I displays the complete distribution of injection techniques and practice settings.

Respondents that reported administering local anesthetic injections were also asked if they administered local anesthesia for the procedures in which the dentist was to perform total care. The majority of these hygienists responded yes (58.4%, n=150). Additional regional analysis demonstrated that it was more common for dental hygienists in the western-half of the country to administer injections in this manner. The regional distribution analysis was reported according to the percentage that administers local anesthesia for the dentist. The percentages are as follows: Region 1 – 30.4%, Region 2 – 50%, Region 3 – 53.3%, Region 4 – 72% and Region 5: 61%.

Educational Preparedness

As part of this survey, respondents were asked to evaluate their educational preparedness in topics relating to local anesthesia administration and educa-

Table I: Mean distribution of local anesthetic injection type used according to the dental hygiene respondents' main practice activity.

Local Anesthesia Modality	Total Response (n=257)	General Dentistry Setting	Periodontal Setting	Pediatric Setting	Academic/ University Setting	Public Health Setting
Infiltration Injection	2.02	1.64	2.87	0.75	1.62	2.33
Nerve Block Injection	2.12	1.72	2.38	0.67	2.25	1.64
Field Block Injection	1.52	1.15	2.06	0.67	2.25	1.64
Topical Anesthesia without Injection	2.38	2.09	2.65	1.75	2.62	2.17

Table II: Mean distribution of the respondents' evaluation of their dental hygiene training

Educational Topic	Those Administering Local Anesthesia Injections (n=257)	Those Not Administering Local Anesthesia Injections (n=175)
Local Anesthesia Administration	4.37	2.06
Local Anesthesia Pharmacology	4.16	2.89
Local Anesthesia Complications	4.20	2.78
Basic Pharmacology	4.15	3.03
Medical Emergency Management	4.29	3.04
Special Needs Care	3.86	2.65
Basic Life Support Training (CPR/BLS)	4.28	4.33

tion. The questionnaire provided a numerical value to their self-reported rating of education: 1=Very Poorly Prepared, 2=Poorly Prepared, 3=Prepared, 4=Well Prepared and 5=Very Well Prepared. A total of 7 topics were listed and 2 categories of comparison were created: hygienists administering local anesthesia injections and hygienists not administering local anesthesia injections.

As demonstrated in Table II, analysis revealed that the dental hygienists administering local anesthesia injections reported a higher rate of educational preparedness in 6 of the 7 educational topics listed in this survey. This group demonstrated a higher mean score for educational preparedness in all 3 directly-related local anesthesia topics (local anesthesia administration, local anesthetic pharmacology and local anesthetic complications), as well as basic pharmacology, medical emergency management and special needs care. The mean distribution of preparedness scores for basic life support training proved evenly reported, with a mean score of 4.33 for dental hygienists not administering local anesthesia injections and 4.28 for dental hygienists

that do administer local anesthesia injections.

In addition to the evaluation of educational preparedness, the investigators also included a question relating to a dental hygienist's desired training. Each survey participant was asked, "Would you support an increase in tuition and/or fees, or would have attended a more expensive dental hygiene program if the institution were to offer more efficient local anesthesia training or the ability to attain a local anesthesia permit?" A high percentage (68.9%, n=426) of respondents indicated that they would have paid higher tuition and/or fees for more efficient local anesthesia instruction.

Perceived Need for Services

As a means to determine the participating dental hygienists' perception of the overall need, questions were included within the survey that addressed local anesthesia injection services. Calculation of the response demonstrated that the majority of respondents perceive a need for dental hygienists to administer local anesthesia injections in the office(s)

they were employed (86.4%, n=431). Additionally, 96.7% (n=432) expressed the belief that dental hygienists should be able to provide local anesthesia injections in their current practice setting.

Discussion

Local anesthesia administration by dental hygienists is validated by the literature. Previous studies suggest that employers are allocating this pain control modality to dental hygienists and these providers are administering effectual injections that have presented positive practice outcomes.^{1-5,11} Given that the overall distribution of this study's demographics presented an even distribution across all regions within the U.S., the results of this current assessment offer new data while paralleling the findings of previous studies relating to this topic.

Regional differences in the number of dental hygienists providing local anesthesia care across the U.S. was noted. This difference seems to coincide with the legality in the use of local anesthesia administration, as well as the date of implementation of hygiene related local anesthesia regulations. It was revealed that an earlier mean year of implementation resulted in a greater number of hygienists providing local anesthesia administration. Additionally, this regional pattern was demonstrated in the number of dental hygienists who provide local anesthesia for the dentists' patients. Dental hygienists in the western-half of the country reported administering injections for the dentist's patients more frequently than those in the eastern regions, with 61 and 72% of dental hygienists in Regions 4 and 5, respectively, answering in the affirmative, and 50 to 69.6% of dental hygienists in Regions 1 and 2 answering in the negative. This could be attributed to the fact that the western part of the country, in general, adopted the administration of local anesthesia by dental hygienists much earlier than their counterparts in the east.⁶ Given that dental practices in the western U.S. have implemented this practice modality for a longer period of time, dentists in these regions may have developed greater confidence in their hygienists' ability to safely administer effective local anesthetic injections.

Earlier studies have examined the utilization of local anesthesia by dental hygienists in various practice settings.^{1,3,11} The authors' data analysis revealed that dental hygienists who classified a periodontal office as their primary practice identification reported administering local anesthesia more frequently compared to those working in other practice settings. This result was not unexpected, as this has been reported in previous studies.^{1,3-5} The types of

procedures performed, along with the severity of periodontal disease encountered in a periodontal office, would be expected to require more frequent pain control techniques for comfortable treatment. Of interest was the finding that dental hygienists who identified an academic venue for their practice activity reported using a field block technique much more frequently than dental hygienists practicing in other settings. This may be attributable to the nature of the academic environment, where education is of prime importance and field blocks may be used more frequently in order to provide exposure to the broad range of available techniques. However, since it may be rarely used in other practice settings, it may be advisable for educators to reevaluate the usefulness of employing and teaching this technique to dental hygienists.

The study also determined that topical anesthetic application without injection was the most common form of local anesthesia to be employed. Higher frequency of employment of this modality is expected, as it is likely to be considered the easiest to use and is likely to provide adequate anesthesia for the types of procedures dental hygienists perform, which may only require soft tissue anesthesia for patient comfort. Another consideration for this observed frequency would be patient preference. Studies have shown that patients rank needles as one of the most fear producing elements of their dental care.¹² Additional studies may be warranted to explore patient satisfaction rates between these 2 modalities and their integrated use.

Few areas of dental patient care require a more inclusive understanding of medicine and patient management than the safe and efficient administration of local anesthesia. As has been recognized previously, teaching the principles of dental anesthesia provides an excellent opportunity to integrate the clinical and basic science curriculum.^{13,14} The results of this study reveal a higher rate of educational preparedness in 6 of the 7 educational topics listed in this survey by hygienists administering injections and have received local anesthesia training. The participants in the current study reported a higher mean score for educational preparedness in all 3 directly-related local anesthesia topics (local anesthesia administration, local anesthetic pharmacology and local anesthetic complications), as well as basic pharmacology, medical emergency management and special needs care. It was not surprising that dental hygienists who do not administer local anesthesia injections reported lower scores of educational preparedness in the 3 directly-related anesthesia topics, as they likely only received minimal or no training in these areas. Of interest is the possibility that education and experience in the admin-

istration of local anesthesia contributed to better preparedness of dental hygienists in basic pharmacology, medical emergency management and special needs care. These positive outcomes can enable educators to meet some of the Dental Hygiene Program accreditation standards as set forth by the Commission on Dental Accreditation, which requires that graduates be competent in the following: providing appropriate life support measures for medical emergencies that may be encountered in dental hygiene practice, having knowledge in pain management procedures and assessing the treatment needs of patients with special health care needs.¹⁵

Another surprising finding was that respondents reported they would support an increase in tuition and/or fees, or would have attended a more expensive dental hygiene school, if the institution were to offer more efficient local anesthesia training or the ability to attain a local anesthesia permit. This may reflect the importance that hygienists place on their ability to provide effective pain control through the administration of local anesthesia. The value this pain control modality brings to dental practices can enable dental care providers to consistently provide high quality care as well as lend to higher patient satisfaction.

Conclusion

This study parallels the results presented in previous studies, as well as provides additional data that demonstrates a true value for local anesthesia administration by dental hygienists. With the majority of dental hygienists reporting the use of and a perceived need for this modality, the use of this practice appears to be a significant adjunct to total dental care. In addition, if training in the administration of local anesthesia contributes to better-prepared dental hygienists in basic pharmacology, medical emergency management and special needs care, then patient care and overall educational experiences of dental hygienists would be positively impacted by the complete inclusion of this modality.

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