Editorial

Time for Change

By Rebecca S. Wilder, RDH, BS, MS

The past year was been encompassed by our country seeing changes in our economy, political climate, and relationships abroad. In 2009, change is coming. So it is with the *Journal of Dental Hygiene*. We have seen many changes to the Journal over the years. From a historical perspective, the Journal was created and first published in January of 1927 with Dorothy Bryant of Augusta, Maine as the first editor. According to the ADHA records, the American Dental Laboratory Association first offered space in its journal for ADHA content but the ADHA Board voted unanimously not to affiliate with any magazine. Instead, they decided that ADHA would publish its own journal. The Journal, formally called *Dental Hygiene* is now referred to as the Journal of *Dental Hygiene* and it is the official scientific publication of the American Dental Hygienists' Association. In the summer of 2004, the print option of the JDH was discontinued and the Journal was published in online format only. But, members wanted a change…a change back to a print format. Subsequently, at the 2008 House of Delegates, a vote was cast to bring the *Journal of Dental Hygiene* back into print at a subscription rate for members who wished to have it in hand. Many associations have adopted this option including the American Dental Education Association, The International Association of Dental Research, the International Federation of Dental Hygienists, and others, etc. This issue of the *Journal of Dental Hygiene* represents the first print issue of the Journal (disregarding print supplements) since 2004. You asked for change and ADHA listened. As in any business, the Journal will have to be financially feasible in order to sustain the print version. If you wanted the print version, please subscribe to it.

Another change is occurring with the JDH. It is growing. Submissions to the Journal are up almost 100%. Dental hygienists are writing more than ever before and many see the value of publishing in a peer reviewed scientific publication that can be assessed globally. Since the JDH is one of only three scientific research publications for dental hygienists in the world and only one of two that can be accessed via Medline, it is very attractive to oral care professionals throughout the world.

As we see changes in the oral care needs of our nation and a cry for greater access to care, so we see varying models of practice being proposed. The winter issue of JDH is thought provoking and timely as it includes information about varying models of practice for dental hygienists. Dr. David Nash proposes a model of care based on the dental therapist to meet the oral care needs of children and adults. Ms. Deborah Lyle and her colleagues, Dr. Delores Malvitz and Ms. Christine Nathe provide another option to meeting the oral care needs of the nation by sharing details about the work of ADHA's Task Force on the Advanced Dental Hygiene Practitioner. Scientific inquiry, debate and discussion are good and productive as we move forward and promote change.

Continual change is needed to keep abreast of the research needs of our profession. When the National Dental Hygiene Research Agenda (NDHRA) was first conceptualized in 1993, it was to serve as a tool for guiding research efforts of the profession and to expand our body of knowledge. The NDHRA should be our compass as we move the profession forward and promote scientific inquiry in focused areas. Every dental hygiene student, practitioner, and faculty member should be aware of the value and need for research in DENTAL HYGIENE to develop our own body of knowledge, to enhance our status as a profession and to promote evidence based practice and care. Drs. Jane Forrest and Ann Spolarich have provided a report on the recently revised NDHRA that should be read by all members of the dental hygiene profession.

Finally, a new section to the JDH is being added with this issue. Critical Issues in Dental Hygiene will be featured each quarter to present a topic that is vitally important to

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related bloodstream infections] among adults." That said, this text might behoove the reader to explore areas that present differing recommendations.

This is an impressive text that requires a real commitment by the reader. It is, however, one that should be a part of any dental and medical practitioner's armamentarium. While it may appear daunting to the new student, it provides multiple levels for the reader to access information so that they are not overwhelmed by its comprehensive nature.

Review of Oral Pathology: Clinical Pathologic Correlations

Regezi JA, Sciubba, JJ, and Jordan RCK,
WB Saunders Elsevier,
St. Louis, 2008, illustrated, indexed,
418 pages (with attached CD-ROM),
ISBN-10: 1416045708
ISBN-13: 978-1416045700
$115.00

Reviewed by Margaret J. Fehrenbach, RDH, MS, a dental hygiene educational consultant and dental science technical writer, in Seattle, WA. Her website is www.dhed.net

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However, primary care physicians can help patients by assessing risk, recognizing versus abnormal changes of aging, performing a focus oral examination, and referring patients to a dentist, if needed.

Writers also add that patients might benefit from different types of oral health aids. They recommend electric toothbrushes, manual toothbrushes with wide-handle grips, and floss-holding devices. This may also benefit patients with chronic, disabling medical conditions such as arthritis and neurologic impairment.

Upfront was prepared by Eugenia Jefferson

Upfront

Staff, Parents, and Pregnant Women differ in opinion regarding Oral Health of Early Head Start Children

The United States Health Resources and Services Administration conducted a group among Early Head Start staff, parents, and pregnant women attitudes toward oral health. Nine focus groups were conducted with audiotapes of the sessions transcribed into ATLAS.ti 5.0 for coding and analysis.

Differences in opinions varied among the participants. When it came to the importance of oral health, staff members reported that EHS parents do not place oral health as a high priority. However, many parents understood the importance of caring for their children's teeth and developing good oral habits early. Other parents indicated that they didn't recognize the importance of oral health. One parent stated, "baby teeth fall out anyway and don't have nerve endings, so why care for them?" Pregnant women did not understand the importance of dental care during pregnancy. A number of myths were expressed about the effects of pregnancy on teeth such as "Pregnancy sucking the calcium out of your teeth." The author stated, "Most first-time expectant mothers lacked an understanding of the importance of primary teeth and how they should care for the oral health of their child after birth."

Communication was also a factor between parents and staff. Authors stated, "Many staff members struggled in achieving effective communication with parents and felt unable to persuade them that oral health is important and should be a priority at home." However, parents felt at time misunderstood by EHS staff even perceiving criticism and unfair judgment. Parents expressed difficulties in managing their demanding lives. They also stated that staff members were insensitive to their day to day activities.

Participants also expressed confusion regarding the application of Head Start oral health performance standard compared to EHS. "The need for culturally sensitive, hands-on oral health education was highlighted," authors said.

The writers concluded that "tailored, theory-based interventions are needed to improve communication between EHS staff and families."

Having clear policies on the application of Head Start oral health performance standards to EHS are necessary. The authors add that educational activities should address the needs and suggestions of the participants.

NYUCD study shows flossing can decrease gum disease and cavities

A study from New York University College of Dentistry showed that flossing is effective when it comes to preventing gum disease and cavities. Dental researchers Dr. Patricia Corby and Dr. Walter Bretz published a study in the Journal of Periodontology, which "provides new data about the importance of a flossing regiment in addition to daily brushing of the surfaces of the teeth and tongue."

The study included 51 well-matched pairs of twins and tested their responses to dental flossing over a 2-week period. One twin would floss daily, while the other would not. After the study authors found "putative periodontal pathogens and cariogenic bacteria were overabundant in the group that did not floss compared to the group that performed flossing." In addition, the twin who flossed had a "significant decrease in gingival bleeding compared to twins who did not floss." Overall bleed scores were reduced by 38% with flossers.

Because majority of the twins lived a similar lifestyle including dietary habits and health practices, they were considered perfect subjects for this type of research.

Study shows older people are at risk for oral diseases

Older people are at risk for chronic mouth diseases, including dental infections, tooth loss, benign mucosal lesions, and oral cancer, according to the Department of Family Medicine at the Medical University of South Carolina. The most common conditions are xerostomia (dry mouth) and oral candidi asis. Xerostomia is usually caused by an underlying condition or medi-

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Book Reviews

Review of: Applied Pharmacology for the Dental Hygienist, 5th Edition

Elena Bablenis Haveles
Mosby Elsevier, 2007
St Louis, Missouri
537 pages, indexed, illustrated, soft cover
ISBN 978-0-323-04874-3
Cost: 64.95

Reviewed by Ruth Fearing Tornwall, RDH, MS Associate Professor at the Lamar Institute of Technology in Beaumont, Texas

Applied Pharmacology for the Dental Hygienist is a well-organized comprehensive text on pharmacology directed towards dental hygiene students and dental hygienists. The new text follows the same format as its previous editions by founding author, Dr. Barbara Requa-Clark. The primary goal of the book remains to "produce safe and effective dental practitioners who will continue to learn for their lifetimes." The current author states that as "pharmacology is an ever changing science with new drugs being found and synthesized, with new effects for old drugs being identified, and with new diseases and drugs for their treatment being studied," this text has been updated with 3 objectives in mind:

1. Achieve an understanding of the need and importance of obtaining and using appropriate reference material
2. Develop the ability to find the necessary information about drugs, and
3. Develop the ability to apply that information to clinical dental patients.

The text includes 26 chapters which are divided into 4 parts: General Principles, Drugs Used In Dentistry, Drugs That May Alter Dental Treatment, and Special Situations.

General Principles includes chapters which cover information sources, drug names, federal regulatory agencies, drug action and handling, adverse reactions, and prescription writing. These chapters set the foundation for study of the different classes of drugs in the following chapters.

Drugs Used In Dentistry includes chapters on the autonomic drugs, nonopioid analgesics, opioid analgesics, antiinfective agents, antifungal and antiviral agents, local anesthetics, antianxiety agents, general anesthetics, vitamins and minerals, and oral conditions and their treatment. The drugs which might be used in the course of treatment of the patient are included in this part. The information provided in these chapters are very comprehensive and provides the reader with the technical and factual information for the use of these drugs.

Drugs That May Alter Dental Treatment includes chapters on cardiovascular drugs, anticonvulsants, psychotherapeutic agents, autocoids, and antihistamines, adrenocorticosteroids, other hormones such as thyroid, pancreatic, and sex hormones, antineoplastic drugs, and respiratory and gastrointestinal drugs. This part includes drugs which may affect the treatment procedures and the management of the patient by the dental hygienist.

Special Situations includes chapters which cover information on emergency drugs, pregnancy and breast feeding, drug interactions, and drug abuse. These chapters include unique situations which could change treatment of that patient.

All drug groups are discussed using a similar format which includes the group's indications (what the drugs are used for), the pharmacokinetics (how the body handles the drugs), the pharmacologic effect's (what the drugs do), adverse reactions to the drug (inappropriate effects), drug interactions (how the drugs interact with other drugs in the body), and the dosage of the drugs. This format helps to standardize the information presented.

Each chapter begins with an outline which allows the learner to look at the topics to be covered. The chapters include tables and figures to add support to the information presented, and marginal notes in boxes to identify key concepts. There are also 2 approaches to learn and understand new vocabulary words. The first time a glossary word appears in the text it is printed in bold and included in the glossary with a definition. The second way to understand new words is through the medical terminology section in the appendix which looks at words by dividing them into their stem parts.

Pronunciations for common drug names are also included in the chapters. Review questions are included at the end of each chapter.

Appendixes for the text include the top 200 drugs (2005), medical acronyms, medical terminology, oral manifestations including xerostomia and taste alteration, and natural and herbal products. The "what if" appendix addresses a number of common patient-related questions the dental practitioner may come across in day to day practice. "Decision trees" are then used to

guide the practitioner in evaluating the clinical situations quickly and making good treatment decision. "What if" topics include questions related to allergy management, drugs safe to use in pregnancy, antibiotics for joint replacement and others.

Overall, the text is effective in its presentation of sometimes difficult information. Many points have been clarified from the older edition. However, there are some areas in which the text could use some improvements. The text does not use the latest textbook design and could benefit in this area. Suggestions might include a more colorful presentation of the diagrams, charts, and boxes to help appeal to the visual learner. More highlighting within the chapters would also help. These features would also assist in making the text more readable.

Although the questions at the end of the chapter are identified as "clinical skills assessment", they cannot be accurately described as clinical applications. They merely question the reader regarding the information presented in the chapter. Clinical cases and/or dental hygiene treatment considerations would also be a welcome addition to the text.

The text does have an instructor's resource manual and companion website. The resource manual does include critical thinking questions and clinical case histories to be used in the classroom. The website also includes an image collection and a test bank.

Including some of these suggestions into the text in the future might make the information more manageable and fascinating to study and help to stimulate learning.

Review of: Dental Management of the Medically Compromised Patient

Little, J.W., Falace, D.A., Miller, C.S. & Rhodus, N.L.
Mosby Elsevier, 2008
St Louis, Mo.
628 pages, indexed, soft cover
ISBN 13: 978-0-323-04535-3
Cost: $ 71.95

Reviewed by Lisa Shaw, RDH MS, Residential Health Care Coordinator/Preventive Dentistry Grant Coordinator at Faxton-St. Luke's Health care, James M. Rozanski General Practice Residency Program, Utica, New York

In Sol Silverman Jr.'s forward of this text makes note of the ever-growing population of individuals with special needs. This population has increased by the escalating number of individuals over the age of 65, and the morbidity associated with longevity, as well as by the now recognized role that oral health plays in systemic disease and the oral complications associated with those diseases and their treatments. Treatment of individuals who are medically compromised with be the job of all practitioners, not just specialists, or those working in special settings. Hence, a book of this nature is invaluable to any practitioner. The author's purpose is "to give the dental provider an up-to-date, concise, factual reference describing the dental management of patients with selected medical problems."

Thirty chapters under 10 headings cover cardiovascular, pulmonary, gastrointestinal, genitourinary, endocrine/metabolic, immunologic, hemotologic/oncologic, and neurologic/behavioral/psychiatric diseases, as well as evaluation/risk assessment and the geriatric patient. Appendices cover medical emergencies, infection control, therapeutic management of oral lesions, drug interactions, and alternative and complementary drugs. Also offered is a student learning resource web link. Each chapter is divided into, but not limited to, areas that include general description/definition, epidemiology, clinical presentations, medical management, and dental management of a particular disease or disorder. Chapters are also supplemented with numerous colored photographs and figures, as well as tables, boxes, and graphs that facilitate the understanding of the material presented in the text.

An important feature of this text is the 62 page Dental Management: A Summary. The summary is a table that includes the following headings: Potential Problems Related to Dental Care, Oral Manifestations, Prevention of Problems, and Treatment Planning Modifications. Each disorder or disease listed under these headings is also cross-referenced to it chapter. This table allows the practitioner to quickly ascertain critical information about conditions that may impact dental treatment and well as oral the complications of those conditions.

This text is challenging. Beyond the shear breadth of information, there were recommendations that immediately stood out as being different from other popular texts. Two in particular where the recommendations that individuals with past myocardial infarctions of greater than 1 month who present as an intermediate risk, may have elective dental treatment and that no antibiotic prophylaxis is required for patients with intravascular catheters. The reference regarding the later recommendation arises from Guidelines For The Prevention of Intravascular Catheter-Related Infections, Centers for Disease Control and Prevention, MWR Recomm Rep 2002. When one accesses the reference report, one finds that it clearly stated in its heading regarding systemic antibiotic prophylaxis that "No studies have demonstrated that oral or parenteral antibacterial or antifungal drugs might reduce the incidence of CRBSI [catheter-

related bloodstream infections] among adults." That said, this text might behoove the reader to explore areas that present differing recommendations.

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Linking Research to Clinical Practice

Periodontal Disease and Type 2 Diabetes

Karen B. Williams, RDH, PhD

Karen B. Williams, RDH, PhD, *is a professor and director of the Clinical Research Center at the University of Missouri-Kansas City. She received her certificate in dental hygiene and BS in education at The Ohio State University, her MS in dental hygiene education at the University of Missouri-Kansas City, and PhD in evaluation, measurement and statistics at the University of Kansas.*

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

Periodontal disease and incident type 2 diabetes: results from the First National Health and Nutrition Examination Survey and its epidemiologic follow-up study. Diabetes Care. 31(7):1373-9, 2008 Jul.

Demmer, Ryan T. Jacobs, David R Jr. Desvarieux, Moise. Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, USA. rtd2106@columbia.edu

Objective: Type 2 diabetes and periodontal disease are known to be associated, but the temporality of this relationship has not been firmly established. We investigated whether baseline periodontal disease independently predicts incident diabetes over 2 decades of follow-up.

Research Design and Methods: A total of 9,296 nondiabetic male and female National Health and Nutrition Examination Survey (NHANES I) participants aged 25-74 years who completed a baseline dental examination (1971-1976) and had at least one follow-up evaluation (1982-1992) were studied. We defined 6 categories of baseline periodontal disease using the periodontal index. Of 7,168 dentate participants, 47% had periodontal index = 0 (periodontally healthy); the remaining were classified into periodontal index quintiles. Incident diabetes was defined by 1) death certificate (ICD-9 code 250), 2) self-report of diabetes requiring pharmacological treatment, or 3) health care facility stay with diabetes discharge code. Multivariable logistic regression models assessed incident diabetes odd s across increasing levels of periodontal index in comparison with periodontally healthy participants.

Results: The adjusted odds ratios (ORs) for incident diabetes in periodontal index categories 1 and 2 were not elevated, whereas the ORs in periodontal index categories 3 through 5 were 2.26 (95% CI 1.56-3.27), 1.71 (1.0-2.69), and 1.50 (0.99-2.27), respectively. The OR in edentulous participants was 1.30 (1.00-1.70). Dentate participants with advanced tooth loss had an OR of 1.70 ($P < 0.05$) relative to those with minimal tooth loss.

Conclusions: Baseline periodontal disease is an independent predictor of incident diabetes in the nationally representative sample of NHANES I.

Commentary

There continues to be considerable attention to the link between periodontal infections and systemic diseases, such as cardiovascular disease, adverse pregnancy outcomes, and diabetes. The odds of developing type 2 diabetes doubled between the 1970s and 1990s and current estimates shows that approximately 8% of children and adults in the U.S. have diabetes. Additionally, recent research suggests that there is a bi-directional relationship between periodontal infections and diabetes such that either condition has the potential to exacerbate the other. Much of the current knowledge regarding the association between periodontitis and diabetes has been derived from cross-sectional and case-control designs. The current study is a large follow-up epidemiological study that followed a national sample of individuals who completed the medical examination in the National Health and Nutrition Examination Study I (conducted in 1971-74) for 18 years. Of the original 11,375 participants 9,296 were available for evaluation at the 1982-84, 1987, and 1992 follow-up cycles.

Dental examiners evaluated the periodontal condition of subjects

using an 8-point periodontal index. This index was used to obtain a score on each tooth in the mouth, and then an average score was computed for each individual. In addition, each tooth was scored as decayed, missing, or filled to yield a DMFT score. For statistical analysis purposes, periodontal disease was categorized in 3 ways. First, individuals were grouped with those having a periodontal index score of 0 categorized as healthy and all others grouped based on their percentile periodontal index score or edentate. A second method categorized individuals into one of 3 groups - healthy, gingivitis, or periodontitis. The last method categorized individuals according to the number of remaining based on the assumption that missing teeth is a surrogate marker for periodontal disease in adults. Characterizing periodontal disease in various ways allows the researchers to determine if findings are consistent across the different definitions of periodontal disease. If so, this would give additional credence to the results.

Incident diabetes was determined either by self-report, discharge diagnosis from a health care facility or death certificate with information indicating a history of diabetes. Several other factors were considered in the data collection to account for other possible risk factors for diabetes, and included: demographics such as age, gender, and education; poverty level; body-mass index; skin-fold test; cholesterol level; blood pressure; and cigarette smoking. Logistic regression modeling was used to determine the relationship of periodontal disease to incident diabetes (all new diagnosis over the evaluation period) and for incident cases restricted to > 10 years after baseline to minimize any potential for bias in undiagnosed diabetes at baseline.

The average age of participants was 50 years (S.D. 19) with approximately 84% white and 60% female. During the period between 1971-74 and 1992, 817 new cases of diabetes were reported in this population. Even with other risk factors in the logistic model, there was a consistent relationship between moderate periodontal index scores (> 1.6) on incident diabetes and this effect was similar for models in which incident diabetes was determined across the entire 17–year-period, or whether the incident diabetes was determine > 10 years after baseline. This gives additional support that the relationship is valid for both "operational definitions" of incident diabetes. A similar effect was seen when modeling periodontal disease as healthy, gingivitis, or periodontitis. These results showed statistically significant increased odds of incident diabetes of 40% and 50% for gingivitis and periodontics, respectively. Likewise, participants with 25-32 teeth missing at baseline had a statistically significant increase in incident diabetes (70% greater odds) compared to those with 0-8 missing teeth.

It is important to note that the relationship between periodontal disease and incident diabetes does not suggest that periodontal disease will cause an individual to develop diabetes. However, the longitudinal nature of this study and analytical strategies used to ensure that participants periodontal disease occurred before development of type 2 diabetes give increased weight to the evidence of a relationship. This design along with the large sample is relatively unique in the area of linking systemic health with periodontal disease. However, the authors are clear to caution that it is possible that these results might be explained by a common genetic factor that is jointly related to diabetes and periodontal disease. One factor to also consider is that only nine percent of the 9,296 subjects developed diabetes during the 17-year-period. The results for this study were focused solely on the unique role of periodontal disease and type 2 diabetes. This approach allows the reader to see the consistent pattern of association despite how periodontal disease was measured and when controlling for various combinations of other risk factors. This approach, however, does not allow the reader to determine the relative contribution of periodontal disease compared to other known risk factors. Additionally, the very large sample makes it probable that even a small relationship between periodontal disease and type 2 diabetes will be statistically significant. It is far more important to view the odds ratios presented within the framework of the 95% confidence intervals. For instance, the results found an OR of 2.26 (95% CI 1.56-3.27) for moderate periodontal disease. This suggests that the best estimate of increased odds for having type 2 diabetes is 2.26 times greater compared to no periodontal disease. However, the true value of the OR is likely between 1.56 and 3.27. As evidence continues to be published, it is anticipated that the exact mechanism of this relationship will become increasingly clear. Until that time, it is safe to say that studies examining the relationship between periodontal disease and other systemic health issues are producing fairly consistent findings. The interpretation of the exact nature of the relationship remains to be determined.

Clinical and laboratory evaluations of non-surgical periodontal treatment in subjects with diabetes mellitus. Journal of Periodontology. 79(7):1150-7, 2008 Jul.

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Background: The aim of this study was to evaluate the clinical

and laboratory changes 3 months after full-mouth scaling and root planing in subjects with and without diabetes mellitus.

Methods: This study was performed using 10 subjects with type 2 diabetes mellitus who required insulin therapy (DM) and 10 healthy adult control subjects (NDM) with generalized chronic periodontal disease. Both groups were treated with full-mouth scaling and root planing and given oral hygiene instructions. Clinical parameters, including plaque index (PI), gingival index (GI), probing depth (PD), gingival recession (GR), and clinical attachment level (CAL), were measured at four sites per tooth. Subgingival plaque samples were obtained from sites with the deepest PD (> or =5 mm) and with furcations in each subject. Samples were also tested for the presence of Aggregatibacter actinomycetemcomitans (previously Actinobacillus actinomycetemcomitans), Porphyromonas gingivalis, and Tannerella forsythia (previously T. forsythensis) by polymerase chain reaction. Glycemic control (glycosylated hemoglobin [HbA1c] and fasting glucose levels) and clinical and microbiologic assessments were recorded at baseline and 3 months after periodontal treatment.

Results: Data revealed statistical changes (P < or =0.05; analysis of variance [ANOVA]) in clinical variables (PI, GI, PD, GR, and CAL) between baseline and 3 months in both groups. Conversely, no improvement in the fasting glucose level or glycosylated hemoglobin (P < or =0.05; ANOVA) was found after treatment. Besides some reduction in the bacterial frequency 3 months after treatment, no statistically significant difference was found between the groups.

Conclusion: Clinical and laboratory responses were similar in DM and NDM groups 3 months after full-mouth scaling and root planing.

Commentary

As the evidence continues to support the link between periodontal disease and diabetes, clinicians are increasingly interested in whether traditional dental hygiene interventions produce differential results in diabetic patients. In this study, a team of Brazilian researchers investigated whether the clinical effect of conservative non-surgical therapy was different for patients with diabetes compared to non-diabetic patients. These authors propose that the relationship between diabetes and periodontal disease might be related to local factors, systemic factors, or a combination between the two. Local factors such as vascular changes in the periodontal tissues and changes in oral organisms may predispose diabetics to more severe periodontal disease. Research is still equivocal as to whether the periodontal microbiota of diabetics is similar or different in non-diabetics and whether SRP can positively influence blood glucose control. Therefore, this study assessed the impact of SRP on three primary outcomes: clinical response; shift in periodontal pathogens; and blood glucose. A total of 20 subjects (10 individuals diagnosed with Type 2 diabetes and 10 non-diabetics) received full mouth scaling and root planing under local anesthesia in a single, 2 hour session. The article did not state who performed the treatment nor whether there was more than one clinician providing therapy. Subjects also received home care instruction that included toothbrushing, interdental cleaning and use of a tongue scraper. At 2 week intervals, subjects also received professional plaque control throughout the 3 month study.

Data were collected at baseline and 3 months following scaling and root planing. Three subgingival periodontal pathogens were assessed by polymerized chain reaction (PCR) and included Porphyromonas gingivalis (PG), Tannerella forsythensis (Tf), and Aggregatibacter (formerly Actinobacillus) actinomycetemcomitans(AA). Clinical response was measured using pocket depth, gingival recession, clinical attachment level, plaque index, and gingival index. Blood glucose was determined on blood samples by glycosylated hemoglobin (HbA1C) and fasting glucose levels.

Twenty healthy subjects who had at least 20 teeth and a diagnosis of generalized periodontitis (defined as having pocket probing depths > 5mm in > 10 teeth along with radiographic bone loss ranging from 30-50%) participated in this trial. Additionally, they could not have used antibiotics in the past 6 months, had to be non-smokers and generally healthy with respect to other systemic conditions. Subjects in the 2 groups were of similar age (47.1 versus 45.6) for diabetics and non-diabetics, respectively. At baseline, the diabetics periodontal severity was slightly greater than non-diabetics with respect to number of sites with >5 mms (33.6 vs. 20.1), average pocket depth (5.72 vs. 4.79), and average clinical attachment loss (4.49 vs. 4.03). Microbiologically, the diabetic group had similar values for AA and PG, but higher values for TF at baseline. HbA1c concentrations at baseline were significantly different at 9.23 + 2.60 vs. 5.88 + 0.16 for diabetics and non-diabetics, respectively.

At the 3 month observation period, all subject regardless of group showed improvements in plaque scores, gingival index scores, pocket depth, and clinical attachment. The authors reported that there was not a statistically significant difference between the clinical response to treatment over time for the 2 groups; however, the relative magnitude of effect was clearly greater for the non-diabetic group. Results were reported for each of the groups as change from baseline to 3 month for the clinical parameters, but this presentation did not take into ac-

count that the groups were different at baseline. For instance, the results for the average change in clinical attachment for diabetics was from 5.72 to 5.00, and for non-diabetics 4.79 to 3.97. The absolute differences were 0.71 vs. 0.82 for the groups – seemingly no difference. However, if one computes a relative proportion of change, the proportional reduction in probing depth is 12.4 vs. 17.1. – a small but non-significant, differential response. At 3 months, there were no differences between the 2 groups with respect to any of the periodontal pathogens; however, scaling and root planing did result in a significant decrease in TF at sites >5 mms in the diabetic group. Similarly, bi differences were observed between baseline and 3 month values in blood glucose for either diabetics or non-diabetics. This suggests that scaling and root planing in the diabetic group did not have an effect on blood glucose measures 3 months following treatment.

This study failed to show a significant differential effect of scaling and root planing on clinical parameters between individuals with and without type 2 diabetes. Both groups showed clinical decreases in plaque scores, gingival index scores, pocket depths, gingival recession and clinical attachment, which would be expected given the treatment of scaling and root planing coupled with the twice monthly professional plaque control. Only TF was reduced over the study period in individuals with type 2 diabetes, whereas PG and AA levels remained fairly constant. The lack of change in the metabolic parameters on blood glucose (both fasting and HbA1C) from baseline to 3 months may be explained by the sample characteristics. HbA1C is a measure of stable glucose /hemoglobin binding over a 90 day period, with normal reference range values for HbA1C in healthy individuals from 4%-5.9%. The 10 individuals with type 2 diabetes had elevated HbA1C values at the start of the study (9.23 + 2.60) suggesting that their metabolic control was poor at the beginning of the study and remained so throughout the 3 month period. Clearly the possible effect of periodontal intervention on blood glucose management is not sufficient to offset other factors that influence metabolic control. Previous research does suggests that elevated HbA1C values (>10%) over time can have an adverse effect on the periodontal tissues; however, results from this study suggest that controlling periodontal inflammation over time does not influence blood glucose in individuals with poor metabolic control. The authors caution that these results should be viewed within the context of the design and relatively small sample size. As an additional piece to the puzzle of understanding diabetes/periodontal disease link, they nonethe-less provide fodder for thought.

The Bottom Line

The growing body of evidence investigating the relationship between periodontal disease, type 2 diabetes and metabolic control. Previous studies have demonstrated that diabetes is a risk factor for periodontal disease and that patients with diabetes can influence host response, healing and resistance to periodontal infections. These 2 studies add additional evidence. The first study gives solid support for periodontal disease as a precedent factor using a longitudinal observational study on a representative population using data from the National Health and Nutrition Examination Study (NHANES). NHANES is one of the longest epidemiological studies of American's health. Data are collected using interview, direct medical and dental examinations, specimen collection, and medical record review. Study subjects are selected in such a manner as to ensure that the sample is truly representing the U.S. population based on geography and demographics. Theoretically, each subject in the NHANES study represents approximately 50,000 other Americans. The representative nature of the sample, coupled with the longitudinal manner in which the researchers evaluated subjects over time makes the findings obtained in this study valuable estimates of the relationship between moderate periodontal disease and incident type 2 diabetes. Additionally, the data derived from the second study, while admittedly quasi-experimental and based on a small sample size, is informative about the microbiological effects and clinical effects of an intensive approach to disease management in individuals with poor metabolic control. In both studies, the focus is on individuals with moderate to severe chronic periodontal disease. The clinical implications of both studies for dental hygiene practice may be less directive for treatment planning but more informative for long term patient management. Since periodontal disease appears to be a precedent risk factor in the development of type 2 diabetes, more aggressive management of periodontal disease in patients who possess other risk factors for developing diabetes is likely warranted. Similarly, for patients with type 2 diabetes, integrating information on metabolic control with clinical response to dental hygiene interventions can guide the dental hygienist in setting optimal supportive care intervals over time. Additionally, this knowledge allows the hygienist to play an integral role in educating and motivating patients.

Therefore the following recommendations can be made based on the findings in these 2 studies:

Presence of moderate periodontal disease is an independent risk factor for development of type 2 diabetes over a 17 year span. The odds of incident type 2 diabetes is approximately 2.2 times greater for

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individuals with moderate periodontal disease.

Scaling and root planing, coupled with professional plaque removal every two weeks results in similar improvement of periodontal disease in both healthy and diabetic patients and reduced levels of TF in diabetics.

Professionally delivered periodontal care did not impact blood glucose measures in the sample diabetics with poor metabolic control.

Summary

Dental hygiene clinicians are in a unique role to assist patients in managing the chronic diseases of periodontitis and type 2 diabetes. In doing so, it is important that the clinician have realistic expectations for the role periodontitis has in type 2 diabetes, as well as the expected outcomes to dental hygiene care in this group of patients. Results from the NHANES study suggests that moderate periodontal disease may predispose individuals to increased risk of type 2 diabetes, but not in isolation of other risk factors. Therefore, comprehensive patient evaluation that includes consideration of risk factors such as age, socioeconomic level, body-mass index, blood pressure and tobacco use, along with periodontal status can provide guidance in establishing appropriate periodontal maintenance intervals. Additionally, although it is critical for individuals with type 2 diabetes to have regular and thorough periodontal maintenance, expecting maintenance alone to achieve metabolic control is unrealistic. The dental hygienist is the primary professional in general and periodontal practice charged with providing non-surgical periodontal care and evaluating the results of such care. In order to provide optimal care and assist patients in achieving best outcomes requires an understanding of current and developing evidence. Evidence on the systemic / periodontal link continues to provide clinicians with excellent information that can guide practice, but it is only when clinician appropriately apply that evidence that patient care is optimized.

Dr. Williams has been active in clinical dental hygiene for over 35 years and in clinical research for 23 years. Her areas of specialization include research design and statistics, educational methods, dental product efficacy, health outcomes research, and clinical dental hygiene. She is a research consultant for numerous dental manufacturers. Dr. Williams has presented papers and continuing education programs throughout the United States and internationally.

Online Directed Journaling in Dental Hygiene Clinical Education

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Abstract

Reflecting upon and sharing of clinical experiences in dental hygiene education is a strategy used to support the application of didactic material to patient care. The promotion of interactive, clinically focused discussions creates opportunities for students to foster critical thinking and socialization skills in dental hygiene practice. Twenty-eight dental hygiene students in their first semester of patient care utilized online directed journaling via blogging software, as a reflection and sharing strategy. Journal entries found critical thinking and socialization themes including connection of didactic material to clinical experience, student-patient interaction, student-student collaboration, and a vision of the professional role of the dental hygienist. A 7 item evaluation instrument provided data that the online journaling strategy was perceived as effective and valuable by the students. Online directed journaling is a strategy that has the potential to enhance critical thinking and socialization skills in dental hygiene clinical education.

Key words: journaling, reflection, critical thinking, online, blogs

Background

Dental educators emphasize the importance of developing students' critical thinking skills.[1] The first year of dental hygiene programs are time intensive with 20-26 hours spent weekly in lecture-based courses and performance-based clinical activities. Both courses and activities provide for delivery of core principles, but often result in isolated knowledge and performance not facilitating the development of critical thinking required in a clinical environment.[1] Williams et al., identified that the rapid increase in scientific and health-related information in the health professions has already created overloaded curricula.[1] In spite of the recognition of the need to develop good critical thinking skills in allied dental education, implementation of strategies to encourage good clinical judgment is limited.[2] Learning strategies that provide the opportunity for students to develop critical thinking skills which can be effectively integrated into the curriculum, are important to identify and implement.

Entry level dental hygiene education requires the application of foundation knowledge and new clinical skills to patient care. Synthesis of theory from concept to practice relies on critical thinking skills.[3] Upon entering the clinic, students face the challenge of integrating their developing clinical expertise with the demands of patients' diverse needs. Students benefit from exposure to a rich range of experiences; however, it is impossible to prepare students for every type of problem they may encounter in practice. Creating opportunities for students to share and benefit from each others' experiences can enhance and expand learning for all.[4]

Journaling is a personal recording of experiences and observations. It is a technique which has been utilized in education for a number of years. Critical thinking benefits to journaling include finding meaning in one's actions and connecting didactic information to clinical application.[5] However, journaling is often done in isolation, not allowing for the sharing of these experiences with peers. A "real world" dental hygiene environment includes professional socialization, with communication and collaboration as components of clinical reasoning. Student participation in a reflective process that incorporates peer dialogue, results not only in the application of didactic knowledge to clinical performance, but also the sharing of strategies which may be useful in other situations.[6]

Online (web-based) journaling is a strategy that blends reflection with dialogue.[7] Cohen and Welch identify that with today's array of educational technology, online journaling can be designed to provide opportunities for individual reflection and incorporation of discussion as a means of sharing experiences.[7] To enhance critical thinking and socialization, an online journaling activity which included reflection and peer sharing was integrated in a first year, second semester dental hygiene clinical seminar course.

Review of the Literature

Skillful performance by health care professionals develops through knowledge, reasoning, and applying reflective, critical thought in practice situations.[8] The purpose of this is to ensure that the professional has the depth of knowledge necessary to

comprehend the practice situation so that safe, effective, quality care is provided.[8] This provides an opportunity for every clinical experience to become a lesson which can also be used to guide future practice experiences. Kok et al., identified that problem solving skill development is attained through the use of analytical critical thinking, synthesis, application, and self-evaluation of situations, leading to intellectual growth and self-awareness.[9] A significant challenge facing health care education today is finding ways of engaging learners in creative problem solving.[10]

Reflection has played an active role in education influencing the learning environment and its processes. It is a critical element connecting experience with the student's personal thoughts, feelings, and values in meaningful ways.[11] Reflection allows for introspective thought on lessons learned and understanding of the significance of associated actions.[12] It has also assisted in actively focusing learning, while reducing anxiety, and increasing peer support and cooperation.[4]

Journal writing may be viewed as a strategy to facilitate reflection.[10] Writing enhances learning through increasing active involvement and the fostering of critical thinking or a "questioning attitude."[13] Linking course readings to the practice of reflection provides clinical context, engaging students in an additional discovery.[7] Journaling may also be used as a learner-centered assessment tool, assisting in determining whether students are making sense of course content.[13] For the instructor, a review of journal entries may be insightful, assisting in determining the level of meaning being constructed by the students.

In addition to fostering critical thinking, reflective journaling has the potential to promote socialization. Merton et al., defined socialization as the "process by which people selectively acquire the values and attitudes, interests, skills, and knowledge-in short, the culture-current in the groups of which they are, or seek to become a member".[14] Hammer applied this definition to the field of medicine, and used the term "professional socialization" to describe the transformation of medical students into physicians.[15] Daroszewksi, et al., conducted a pilot test to evaluate the effectiveness and value of online directed journaling related to critical thinking and socialization.4 Using a convenience sample of Advance Practice Nursing students in a 2 quarter community health course, students were required to post one in-depth journal entry per week. Students were provided with goals, objectives, clinical activities, and guidelines for reflection on designated weekly topics. Discussion topics were sequenced to provide structure for cognitive and clinical practice development as the course progressed.[4] Additionally, students were required to read and comment on at least 2 of their classmates' journal entries weekly. A journaling evaluation form was developed by 3 experienced nurse educators, consisting of 4 demographic questions, 10 items which students rated on a 5-point Likert-type scale, and an open-ended response request for additional comments. Journal entries were evaluated and found 4 major themes: discussion, critical thinking, mentoring, and socialization.

The results of the student evaluations showed online journaling to be highly effective and valuable. The ability to share experiences and reflections with peers, through an online format, enhanced the themes of mentoring and socialization. Daroszewski et al., indicated the need for continued research on the use of journaling in health care education.[4] The use of online directed journaling in this pilot study indicated a positive benefit, allowing for the sharing of relevant clinical experiences, which can serve to enrich both cognitive and professional growth.

The student perspective on reflective journal writing and how it promotes reflective thinking in clinical education was explored by Kok et al.[9] A qualitative, descriptive research design was used to determine whether reflective journal writing promotes higher-level thinking skills. A convenience sample of fourth-year nursing students on a 6-month rotation in a psychiatric clinical practice used reflective diaries. Students were given guidelines on how to use reflective journal writing related to their clinical experiences on a daily basis and were asked to submit journals at the end of the 6 month placement. A number of the students in this study did not follow the guidelines for this assignment appropriately, only completing their journal entries the night before the deadline. When surveyed at the end of their rotations, these students indicated the perceived lack of time to complete this assignment on a daily basis was the reason for not addressing entries as prescribed. During the interviews, the students indicated they did not understand that writing shortly after an event provides a more accurate account of the event.[9] In addition to the issue of perceived lack of time; additional negative student perceptions included lack of clear expectations and uncertainty of level of trust between student and instructor evaluating the journal entries. Positive comments identified the improvement of problem-solving skills, self-evaluation, self-awareness, and intellectual growth.

A secondary outcome of the Kok et al., study was the development of guidelines on how to effectively use reflective journal writing to promote the learner's reflective thinking skills in clinical education.[9] This included support for the integration of peer group dialogue to strengthen the link between the learning experience and reflective activity, and the use of directing concepts to assist the learner in focusing their journal reflections.

Using weblog technology, Bouldin, et al., conducted a study utilizing a convenience sample of second-year pharmacy students to reflect on course concepts and their application to the environment outside of the classroom.[13] Themes from learning objectives were derived from evaluated journal entries. The themes which emerged were: application of course concepts outside of class; development of communication skills through self-assessment; and positive influence on attitudes. Data on students' perceptions of their perceived achievement of learning outcomes was also gathered using an attitudinal survey rated with a Likert-type scale. When surveyed, 58% of the students agreed that this learning strategy assisted in fulfilling the goals of this course. The use of weblog technology was identified as favorable by both instructors and students. Bouldin et al., encouraged the continued refinement and integration of the use of technology for reflective journaling.[13]

The decision to incorporate reflective journaling also includes determining an appropriate format for implementation. Online, web-based technology is a mechanism which can meet the desired outcome of directed clinical reflection and sharing occurring outside of the face-to-face class session. Weblog or blog originally defined as an asynchronous (non-simultaneous) online journal is now thought of as an electronic bulletin board. It serves as a user-generated Web site where entries are made in journal style and displayed in a reverse chronological order. The ability for readers to post and reply comments in an interactive format is an important aspect of blogs. Blogs used for reflective journaling have the benefits of time and date stamping of entries, and the archiving of past entries.[16] They also allow for entries to be subdivided by category and by topic. The Web-based asynchronous blog format allows for student posting and replying via Internet at any time during the assigned discussion period.

The literature related to journaling suggests that students perceive journaling as a beneficial exercise if guidelines for reflection are provided, explained, and understood, and directed questions are used to facilitate reflection. Sharing of reflective experiences with the learning community is shown to enrich cognitive growth and socialization. Web-based (online) technology is a purposeful means of facilitating directed journaling.

Transitioning from preclinic to direct patient care presents challenges. The opportunity to reflect and dialogue about clinical issues is often limited due to patient scheduling and student course load. The purpose of this study was to evaluate the benefit of online directed journaling for dental hygiene students entering clinical patient care.

Methods

The University of Michigan Health Sciences Institutional Review Board determined that this study was exempt from review by the IRB. In a first year, second semester, clinical seminar course 28 dental hygiene students participated in online directed journaling for the last 8 weeks of the semester. Four guiding questions and topic categories were identified by the dental hygiene faculty and were provided to students biweekly by the clinical seminar course director. These included clinic experience, patient motivation, oral pathology, and oral rehabilitation (Table I). The sequencing of these topics was correlated with seminar course material. Students were asked to include in their journal entries what they learned, to identify challenges, and to explain how experiences assisted in expanding their patient care knowledge. They were asked to post reflections on 4 topic categories. Additionally, students were asked to reply to 2 of their classmates' postings in any topic category. In total, each student was to submit 6 entries during an 8-week period. Midway through the topic posting periods, both in-class and email announcements were provided to students, reminding them to participate in the online directed journaling. The University of Michigan's weblog technology, mBlog, was utilized for journaling because of student familiarity. In the previous semester, students received instruction in the use of this technology and utilized mBlog communication and collabo-

Table I. Online directed journaling reflection topics

Topic	Reflection direction
Clinic Experience	Identify 1 component of providing clinical patient care you find confusing/difficult and why. Identify 1 aspect of clinical patient care you find enjoyable and why.
Patient Motivation	Jahn CA. Firing up patients' home care motivation. RDH Magazine. 2002;(3) 72-75. Read and reflect on how this will assist you with patient education.
Oral Lesion	Identify an oral lesion or oral condition you have observed in clinic. Describe appearance, location, symptoms, and differential diagnosis process.
Oral Rehabilitation & Implants	Wilkins EM. Clinical Practice of the Dental Hygienist. 9th ed. Baltimore (MD): Lippincott Williams & Wilkins 2005. p. 485-499. Read your assigned section in Chapter 30 titled "Oral Rehabilitation & Implants." Select two important items of information to share with your classmates.

Table II. Examples of emergent categories of student reflection themes

Total postings	**n=176**
Relating didactic material to clinical experience • I am finding I have a better understanding how a patient's lifestyle affects their oral healthcare." • "It's just very difficult because you have so many different types of patients with different things wrong with them that if you miss a beat sometimes it can throw your whole game off. I just need to take a little more time to analyze the whole patient because some things are not as BOLD and right in front of your face as others. Sometimes you have to dig a little deeper." • "I hope with seeing more patients I will feel more comfortable and just be able to look in a patient mouth and be able to identify restorations off without second guessing myself! Practice makes perfect and I can't give up." • "As we've talked about in Head & Neck Anatomy, the body works in amazing ways! The fistula is created by the body, as a self-regulation of pain! Without the formation of a fistula, drainage from an abscessed tooth would continue to build up and cause considerable pain! The fistula allows a passageway for drainage." • "I had two female patients with oral lichen planus. Lichen planus is an inflammatory disease of the skin and mouth. It is commonly seen inside of the cheeks, but also affects the lips, tongue and the gums. My first patient had lichen planus on her gums and my second patient had it on her cheeks and around her tongue. It looks like fine white lines and sometimes white dots as well. My patients told me that it is very painful when it becomes inflamed. They do not know what causes it and it occurs randomly."	29% (n=51)
Student-patient interaction • "Even though this patient was difficult, he exposed me to new situations that I had to learn to handle." • "When I met my Down's Syndrome patient, that I gave him a lot of attention. I took my time and figured out everything he was saying to me. The appointment went by very well, and I was very proud of him, because he had great oral care." • "I believe it would be helpful for patient motivation, to arrange a display of self-care products in the office. This would be more realistic once we being working in a private practice. Patients would feel better about trying a new product if we provide them with information and allow them to try it out." • "One way to meet a patients primary dental health needs and promote self-direction is to ask the patients how they feel they are doing with their oral hygiene and what areas they are concerned with." • "I think it is great to get the patient comfortable and talking to me because it encourages us both to be honest and realistic."	16% (n=29)
Student-student collaboration • "Try to chart the whole mouth then ask a peer instructor to help evaluate what class restorations I charted" • "Thank you for sharing your experience with us, this way we can all gather knowledge about the situations we may face in our careers." • "I agree that it is difficult to find the line between merely giving our patients possible outcomes and scaring them. Often the outcome may be scary (at least to me). I trust that with experience that line will become clearer to us." • "It was a nice point that you brought up about them 'tuning out' to what we think if they don't even agree or understand themselves! I never really thought of it that way!"	32% (n=56)
Vision of the professional role of the dental hygienist • "Patients come to me with questions and concerns and I have the ability to help them and make an impact on their health, I really feel good about what I do." • "I have the privilege every Tuesday morning being in the cubicle next to you. You have really grown into your own. When you are in clinic, your outer layer is a calm, cool, and confident dental hygienist. You always handled yourself professionally with compassion. Keep it up!" • "I recently saw a teen patient with nicotine stomatits located on the hard palate. I consulted with the dental student prior to delivering any education, to have a better understanding of what the patient has been told in the past. I put an important emphasis on tobacco cessation since she was so young, and this was already developing." • "It is my goal, as a dental professional not to be Ms. Informative-- I much rather 'partner' with my patients and empower them to take charge of their oral health, and this is what I will keep trying to improve on each time I visit with my patients."	10% (n=17)

Table III. Student survey responses

Survey statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
mBlog reflection was a valuable supplement to patient care experiences.	29% (n=6)	48% (n=10)	19% (n=4)	0% (n=0)	4% (n=1)	0% (n=0)
Composing/posting reflections was valuable.	29% (n=6)	33% (n=7)	24% (n=5)	10% (n=2)	4% (n=1)	0% (n=0)
Reading other students' reflections was valuable.	29% (n=6)	57% (n=12)	10% (n=2)	0% (n=0)	0% (n=0)	4% (n=1)
Commenting on other students' reflections was valuable.	10% (n=2)	48% (n=10)	29% (n=6)	10% (n=2)	4% (n=1)	0% (n=0)
mBlog reflection helped me integrate course related information with direct patient care.	15% (n=3)	48% (n=10)	33% (n=7)	4% (n=1)	0% (n=0)	0% (n=0)
The ability to access mBlog at any time was valuable.	24% (n=5)	62% (n=13)	10% (n=2)	0% (n=0)	0% (n=0)	4% (n=1)
The availability of archived postings/comments was valuable.	4% (n=1)	19% (n=4)	62% (n=13)	15% (n=3)	0% (n=0)	0% (n=0)

ration for case-based assignments.

Qualitative data was obtained in the form of analysis of each posting and reply at the end of the semester. Two faculty members independently read each entry, compared results, and reached a consensus on emerging categories of themes. Students also completed a 7-question Likert-type survey (Table III) to evaluate their perception of the use of online (mBlog) journaling for reflective discussion. The survey was based on questions used in studies cited in the literature review.[6, 10]

Results

Student initial postings and replies totaled 176. Several students replied beyond the required number. One student did not contribute any journal entries or replies. The average student posts/replies remained at 6. Analysis of these postings/replies provided insight into the impact these directed topics had on the students. Four themes emerged: relating didactic material to clinical experience, student-patient interaction, student-student collaboration, and the vision of the professional role of the dental hygienist.

Relating didactic material to clinical experience was identified in 51 of the 176 journal entries (29%). Student-patient interaction was mentioned in 29 of the 176 postings (16%), and student-student collaboration in 56 of the 176 journal entries (32%). The vision of the professional role of the dental hygienist was cited in 17 of the 176 postings (10%). Examples of comments from each of these themes are included in Table II.

Results of the student survey responses regarding their perceptions of online journaling are identified in Table III. Twenty-one of the 28 students (75%) completed the survey at the end of the 8-week period. Student perception of online directed journaling for reflection on clinical experience found 77% agreed that this was a valuable supplement to their patient care experience. Sixty-two percent agreed that composing and posting journal entries was valuable. Reading other students entries was found by 87% of the students to be very valuable. Fifty-eight percent found commenting on other students' postings valuable, and 63% agreed that online directed journaling helped integrate course information with direct clinical care. The ability to access mBlog at any time was considered a positive aspect of this exercise by 86% of the students. Sixty-two percent of the students were neutral to the value of the archived reflection postings available on mBlog.

Discussion

The use of online directed journaling using mBlog, provided an opportunity for first year students to reflect upon and share clinical experiences. Student clinical concerns related to the dental hygiene process of care treatment planning, time management, and appropriate documentation and protocols were identified through the postings. Presentation of these concerns allowed for immediate and direct clarification from faculty either online or through in-class feedback. The students permitted the course director to share their mBlog Web site with the clinical dental hygiene faculty, and they were encouraged to read postings to assist in identifying students' need for additional individualized instruction. Data on faculty mBlog access usage for instruction was not collected. This has been identified as an area for further study.

Socialization and a sense of community were developed through on-

line, directed journaling. One student commented, "At first the journal entries were 'just another thing to do' but after patient care started, I found these postings were comforting!" Another student stated, "I didn't really have enough time to read all of the postings, but the ones I did read, made me feel like I wasn't alone."

Students found the online format attractive as postings and reading could be accessed and completed at any time. They also identified posting and reading what was pertinent to them allowed for individualized learning. In-class seminar time is designed to cover content outlined in a syllabus; however, the clinically related content of this course lends itself to discussion of student clinic concerns. This discussion is valuable, but time consuming. In the early weeks of the online journaling, 3 first year students approached the Clinical Seminar Course Director indicating they felt too much time was being spent in-class discussing clinic experiences. They perceived this as distracting from the course syllabus objectives and identified such discussions as "wasted time," especially if the discussion centered on an area they already understood. They preferred this discussion take place in the online format.

Students surveyed acknowledged the benefit of having time to construct and clarify their reflection and response postings in a written draft prior to posting. They found the online environment safe and supportive of total class participation. Guiding reflection with topics that aligned with clinical seminar content permitted an opportunity for students to better focus their thoughts. First year students with limited dental hygiene experience provided thoughtful insights in their online postings.

Conclusion

Online directed journaling is a beneficial reflective strategy that has the potential to enrich critical thinking and socialization skills essential in dental hygiene education and practice. It offers an opportunity for students to reflect upon and share clinical experiences, supporting the application of didactic material to patient care. In entry level dental hygiene education, journaling may be enhanced if strategies for reflection are provided and guiding (directed) questions are used. Web-based technology is a purposeful means of facilitating directed journaling. Further study is needed to continue to explore this effectiveness.

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Research

A Delphi Study to Update the American Dental Hygienists' Association National Dental Hygiene Research Agenda

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Abstract

Objective: The American Dental Hygienists' Association (ADHA) National Dental Hygiene Research Agenda (NDHRA) is a working document that guides research efforts of the dental hygiene profession. The purpose of this study was to update the NDHRA to reflect current research priorities aimed at meeting national health objectives and to systematically advance dental hygiene's unique body of knowledge.

Methods: Forty-nine dental hygiene experts and key opinion leaders representing all domains of the profession participated in the Delphi study to update and gain consensus on the NDHRA. The study was carried out electronically in 3 phases: a development phase, 2 rounds of mailed questionnaires to gain consensus on topics during the second phase, and a third phase to prioritize topics. Responses were analyzed using descriptive statistics and instrument reliability was analyzed using the Pearson Product Moment Correlation Coefficient and Cronbach's Alpha for internal consistency.

Results: One hundred twelve topics reflecting the research agenda categories were identified during Phase I. Through Phase II, 36 topics were eliminated and consensus was reached on 42 of the remaining 76 topics. Return rates of 95% and 100% were achieved for the 2 survey rounds. Instrument reliability was established at .76 and internal consistency at .87. During Phase III participants attempted to rank the 42 topics as to their level of priority, however results of this phase were not usable.

Each category comprising the NDHRA was represented by the 42 topics. Thus, consensus on the national agenda was achieved. Ideally, identified priorities on the revised NDHRA will be used to direct future research efforts, identify research funding initiatives, and guide education and practice. This project was funded by the ADHA.

Key words: dental hygiene research agenda, Delphi study, research

Introduction

In 1993, the ADHA Council on Research (COR) conceptualized the ADHA National Dental Hygiene Research Agenda (ADHA NDHRA), a working model that serves as a fundamental tool for guiding research efforts to purposefully expand the profession's body of knowledge (Appendix 1). In addition, the Agenda was created to encourage collaborative research, and to guide education and practice.[1] Development of a national research agenda is a strategy other health professions have used successfully to create their own unique body of knowledge and thus establish themselves as primary care providers in the health care arena.

Consensus on 37 specific research topics for the NDHRA was reached in 1995.[2] Using the Delphi technique, investigators from the National Center for Dental Hygiene Research (NCDHR) surveyed 48 dental hygienists nationwide with expertise in research, education, and practice to identify those topics deemed appropriate for testing the ADHA National Dental Hygiene Research Agenda. Through 3 extensive study phases, the panel initially identified 66 of 141 topics for investigation, and achieved consensus on 37 of these topics (Appendix 2). The investigational team from the NCDHR reported that each of the 5 categories from the ADHA agenda "was well represented by the 37 topics."[2] This landmark study was the first and only published study of its kind to identify research priorities for the dental hygiene community that can be used to test and validate the ADHA agenda.

In 2000, participants attending the Fourth ADHA National Dental Hygiene Research Conference were charged by the ADHA COR to discuss the prioritization of the existing agenda.[3] Participants reached con-

Appendix 1. The National Dental Hygiene Research Agenda (1994)

The ADHA National Dental Hygiene Research Agenda was created to address 5 primary objectives:

1. To give visibility to research activities which enhance the profession's ability to promote the health and well-being of the public;
2. To enhance research collaboration among the dental hygiene community and other professional communities
3. To communicate research priorities to legislative and policy-making bodies;
4. To stimulate progress toward meeting national health objectives; and
5. To translate the outcomes of basic science and applied research into theoretical frameworks which form the basis for education and the practice of dental hygiene.

Five categories were created under which research priorities were to be identified:

HEALTH PROMOTION/DISEASE PREVENTION – priorities concerned with health maintenance, disease prevention, public health policy, advocacy and legislation
EDUCATION – priorities concerned with theory development, educational models, curricula, students and faculty
CLINICAL/PRIMARY CARE – priorities addressing dental hygiene intervention, decision-making, dental hygiene diagnosis, quality of care, practice settings and interdisciplinary collaborative practice models
INDIVIDUALS/POPULATIONS – priorities which focus on the special needs of ethnic groups, children, the elderly, the poor and other target groups
BASIC/APPLIED SCIENCES – priorities which establish new knowledge and/or test existing theory in laboratory, field, clinical and educational settings

sensus that the 5 broad categories outlined in the 1994 agenda were still relevant and representative of the entire scope of dental hygiene research. After reviewing the information obtained from participant working groups and a review of *Healthy People 2010* and *Oral Health in America: A Report of the Surgeon General*, several specific topic areas were identified as priorities for future dental hygiene research efforts.[4,5] The 2000-2001 COR put forth a recommendation to ADHA that priority should be given to research related to 1) health services, 2) access to care/underserved populations, and 3) health promotion/disease prevention.[3]

However, identifying research priorities is only the first step in the process of building the body of knowledge. Long-range planning is needed to guide research efforts and to promote the purposeful development of a unique body of knowledge for the profession. A long-range plan must be broad enough in scope to address the multiple needs of the dental hygiene community, and serve as a means for securing the data necessary for accomplishing the goals of the ADHA Strategic Plan. To this end, dental hygienists must work together to gather information in a logical and structured manner in order to have the database capability to answer important questions related to the profession.

The establishment of a common research orientation is essential in order for the dental hygiene profession to systematically advance its scientific base and stimulate national research efforts.[2] Given that over a decade has passed since the only formal study was conducted to validate the priorities of the existing NDHRA, the present study was conducted to re-examine the categories and topics to determine whether these priorities reflect current global health care issues as well as issues that impact the profession today.

Limitations of the Existing Agenda

After careful examination, the investigators determined that the existing agenda appears to adequately address the needs of the profession and the needs of the community, as it targets national health issues. This focus is both relevant and appropriate. The majority of work efforts should be aimed at meeting national health objectives. However, the agenda fails to address characteristics of the profession, dental hygienists' own personal needs, and other relevant people issues. These issues extend beyond the contributions to the profession itself and to clients and communities. Specifically, these research issues address how dental hygienists are promoting their own health and well-being in terms of their personal and occupational safety and wellness. Further, research priorities identified outside of the profession for evaluating women's health needs apply directly to dental hygienists, who are predominately female. Dental hygiene investigators should also study how significant health issues affect the population of dental hygienists, and the quality of their personal and professional lives.

These issues are directly relevant to the recruitment and retention of dental hygienists in the workforce. It is important to note that there are many existing studies that have focused upon characteristics, attitudes, and behaviors of dental hygienists. However, little documentation that links these study results to recruitment and retention issues has been derived from this body of re-

Appendix 2. ADHA National Dental Hygiene Research Agenda 37 Topics (initial Delphi Study Results, 1995)

Health Promotion/Disease Prevention

Priorities concerned with health maintenance, disease prevention, public health policy, advocacy and legislation.

1. Assess the effectiveness of the communication process between the client and dental hygienist that leads to oral wellness.
2. Assess the effectiveness of dental hygienists in counseling patients regarding prevention and cessation of tobacco use.
3. Explore public policy issues related to oral health care.
4. Identify, describe and explain ways to promote equitable access to oral health care.
5. Assess the cost-effectiveness of various oral health interventions (fluorides, sealants) in promoting oral health.
6. Develop and test easy to use self-assessment instruments to assist individuals of all ages in learning the signs and symptoms of oral diseases.
7. Investigate ethnic/cultural group differences as they relate to the promotion of oral health and preventive behaviors.
8. Investigate legislative initiatives on issues such as those that promote autonomy and decision-making by dental hygienists.
9. Investigate the concept of oral health self-care among all age, social and cultural groups.
10. Describe, explain or predict the relationship between environmental factors (culture, society, income, education) and oral health behaviors.
11. Explain or predict client oral health attitudes, knowledge and behavior.
12. Assess the impact of third parties on access to and utilization of oral health care services.
13. Identify ways in which the unique role of the dental hygienist in the health care delivery system can be effectively communicated. .

Education

Priorities concerned with theory development, educational methods, curricula, students and faculty.

1. Develop a predictive model for future needs/demands for dental hygiene personnel.
2. Identify the factors leading to curriculum modification and reform in dental hygiene academic programs.
3. Investigate the extent to which new research findings are incorporated into the dental hygiene curriculum.
4. Investigate the extent to which students are taught critical thinking and decision-making skills.
5. Investigate the extent to which students are taught self-assessment and evaluation skills.

Clinical/Primary Care

Priorities addressing dental hygiene intervention, decision making, dental hygiene diagnosis, quality of care, practice settings, and interdisciplinary collaborative practice models.

1. Investigate the impact and effectiveness of alternative dental hygiene practice settings.
2. Assess methods of evaluating competency in dental hygiene.
3. Develop valid and reliable measures to be used in oral health research.
4. Assess the impact of emerging technology used by dental hygienists on the health outcomes of clients.
5. Design and evaluate alternative models for the delivery of oral health care.
6. Assess client compliance with recommended oral health care regimens.
7. Examine the extent to which knowledge derived from basic science and clinical research is used in clinical reasoning.
8. Assess compliance with established standards of practice by dental hygiene practitioners.

search. The dental hygiene research community is cautioned that while additional research is needed in the areas described above, the majority of dental hygiene research effects should remain focused on identified priorities that address national health objectives that improve the oral health of the public.

Other limitations included the repetition of topics under one or more categories of the agenda. This redundancy has contributed to difficulty in using the agenda by researchers, academicians, students, and clinicians. In addition, many new areas of global interest to the oral health care community are not represented on the existing agenda. Some specific examples include issues related to cultural competency, oral health literacy, technology use in practice, and occupational health and safety.

In order to align the NDHRA with those of other professional organizations, the existing agenda was updated and validated using the Delphi study technique. The Delphi technique was selected as an appropriate strategy to use, as it is a well accepted scientific method for obtaining group consensus in education, medicine, nursing, allied health, business, and the social sciences.[6-17]

The Delphi Technique

The Delphi study technique was developed by the RAND Corporation in the 1950s as a tool to predict short-term future events and technology in government and industry.[18,19] This method relies on the convergence of expert opinion to arrive at insights into a subject when empirical evidence is not

Individuals/Populations

Priorities which focus on special needs of ethnic groups, children, the elderly, the poor and other target groups.

1. Develop and test methods of primary prevention in adult populations at risk for primary and secondary enamel and root caries, with special attention to compromised, handicapped and institutional groups.
2. Develop and test methods for early diagnosis and screening of oral diseases for individuals at high risk for dental caries, periodontal diseases, and oral cancer.
3. Evaluate the efficacy of various oral hygiene regimens with institutionalized, handicapped, or otherwise compromised patients.
4. Develop and test preventive measures to reduce the incidence of oral disease in special at-risk populations.
5. Examine the prevention, diagnosis, and treatment of oral disease in underserved and at-risk populations.

Basic/Applied Sciences

Priorities which establish new knowledge and/or test existing theory in laboratory, field, clinical and educational settings.

1. Explore the effects of dental hygiene therapy on pathogenesis, wound healing and tissue repairs.
2. Test new products for use in dental hygiene practice.
3. Develop valid and reliable measures of quality dental hygiene care.
4. Test theoretical concepts in dental hygiene.
5. Assess the outcomes of client oral health self-care behaviors.
6. Develop assessment tools which provide indicators of dental hygiene care outcomes.

available.[20] The Delphi technique is adaptable to a variety of research questions, and has been used in formative evaluation, needs assessment, goal identification, priority setting, and policy formulation.[20-22]

The technique consists of a series of questionnaires with a group of experts, usually 50 or fewer, who evaluate the importance of specified items. The overall response of the group along with the individual's response is provided as feedback in subsequent rounds. Respondents are asked to reconsider their previous responses and to revise them if they choose. When an individual's response differs greatly from the group response, he/she is asked to state the reason for the variation from the judgment of the majority. Thus, the onus of justifying relatively extreme responses is placed on the respondent through a process of informed decision making. The number of rounds, usually 2 to 4, depends upon the time needed to reach consensus or to agree that consensus is not possible.[23,24] If not achieved by the fourth round, consensus may not be reached, although the majority and minority opinions will typically be clear by that time.

The Delphi technique offers a number of advantages. The method is well-accepted for reaching consensus on complex, controversial, and abstract content.[25,26] The anonymity provided permits the involvement of individuals who might not work together under different conditions.[19,23] Anonymity also allows respondents to express their views freely and minimizes the possibility of one individual influencing the opinion of others.[23] The technique is cost-effective because the investigator may work with individuals located in different geographic areas.[19] Finally, the process encourages reflective thinking, openness to new ideas and opinions, and sharing of responsibility for the outcome.[19,23,26]

The Delphi technique also has some weaknesses, including the process being slow and time-consuming.[25,26] Expert opinion used as the basis for forecasting is not always distinguishable from non-expert opinion.[27] However, "for findings to be accepted, members should be representative of their profession, unlikely to be challenged as experts, and have the power to implement the findings should they choose."[24]

The Delphi technique has been used in education, medicine, dentistry, nursing, and allied health as a method for determining curriculum content, developing skill sets and competencies for health care providers, establishing health policy and identifying research priorities for the health professions.[3,7,9,10-15,17,21,26,28] In nursing, the Delphi technique has been used by several investigators to determine research priorities that were later used in the development of the National Nursing Research Agenda (NNRA).[13,15,29] Because these priorities had been identified through group consensus and expert opinion, they were considered representative of the highest priority items for nursing research. This technique also was used in 1995 to validate the first ADHA NDHRA and again in this study to reach consensus on the importance of topics reflecting each of the 5 categories of the NDHRA.[2] Consensus was defined in terms of the mean, median, and mode.

Methodology

Study Design

Study approval was obtained through the USC Institutional Review Board. The research study was carried out in 3 phases. Phase I addressed instrument development and pilot-testing, as well as identifying the sample population. Phase II included 2 rounds of surveys during which subjects were asked to evaluate proposed

research topics in an effort to reach consensus as to the research priorities for the profession. Phase III asked subjects to rank each of the final research topics in order of priority under each of the 5 categories.

During Phase I, a preliminary survey was sent to all subjects in the sample population to assess their knowledge and use of the ADHA NDHRA. This preliminary survey also was used as the invitation to participate in the Delphi study. Completion and return of this preliminary survey served as consent to participate.

Surveys utilized throughout the study, were completed online and submitted electronically to the database developer and manager (a non-investigator in the Office of Academic Affairs, USC School of Dentistry) who maintained the master list of participants. Survey results were imported directly into a statistical program for ease of analysis (SPSS version 13). Participants were assigned a unique study identification number to maintain anonymity and an electronic password to enable access to the surveys online. The identification number allowed the data manager and the investigators to group participants by type of position held within the dental hygiene community while still maintaining confidentiality of the subjects. This identification number also allowed the data manager to track how many subjects had completed each survey round and send specific follow-up requests to those participants who had not submitted their survey by the due date.

Phase I – Sampling, Instrument Design, Pilot-Testing, Content Validity

Sample Population

Consistent with the purpose of the Delphi technique, the study utilized a purposeful sample, whereby individuals in the sample were specifically selected based on their expertise and positions of influence in the dental hygiene community. Careful attention was paid to invite participants representing all aspects of the profession, as well as representation from all geographic regions of the United States and 2 Canadian provinces, for a total of 51 dental hygiene experts and key opinion leaders. Of the 51, 49 agreed to participate, representing 26 states and 2 Canadian provinces. Experts included clinicians, graduate program directors, undergraduate program directors and faculty, hygienists employed in public health and government, dental hygiene researchers, independent educators, hygienists employed in private industry, and ADHA officers and trustees (Table 1).

Instrument Design

First, the investigators conducted a thorough review of the dental hygiene literature, research priorities and agendas from other health professions, and reports from major government agencies and foundations, to identify specific research topics that reflect current issues facing the profession and national health objectives.[30-55] Key health issues affecting the American public, particularly those related to oral health, were identified, resulting in 141 potential research topics for study. Each topic was then systematically evaluated for appropriateness for dental hygiene research and to determine the extent to which it had already been addressed by the research community. Those topics that had been examined extensively or were not considered relevant to developing a scientific base for dental hygiene were deleted. This process resulted in a final list of 112 topics for inclusion in the first survey round.

At the same time, the investigators reviewed the existing NDHRA to identify areas of redundancy, overlap of topics within one or more of the 5 categories, and omissions. Based upon their reviews, the 112 potential research topics for study were categorized according to 5 broad areas. It is important to note that these 5 categories were edited from the existing NDHRA to more accurately reflect current issues (Table 2). The investigators assigned each of the 112 potential topics to 1

Table 1. Representation of Dental Hygiene experts in the Delphi Study.

Position	Number of Invited Participants	Actual Number of Participants
Clinicians: pediatrics, periodontal, general practice, geriatrics	5	5
Graduate Dental Hygiene Program Directors	7	7
Undergraduate Dental Hygiene Program Directors and Faculty	9	9
Public Health, Government Employees	11	11
Dental Hygiene Researchers and Independent Educators	7	6
Private Industry: education, research, marketing/sales	9	9
ADHA Officers/Members of the Board of Trustees	3	2
Total	**n = 51**	**n = 49**

of 5 five categories of the agenda to ensure that each topic was mutually exclusive.

The 5 categories used for this Delphi study were listed and defined as follows:

Health Promotion/Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; and development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

Health Services Research: Studies in this category are designed to improve the quality of health care, reduce its cost, address patient safety, and medical errors, and broaden access to essential services. These include evidence-based information on health care outcomes, quality, cost, use, and access.

Professional Education and Development: Studies in this category are concerned with educational methods, curricula, students and faculty; recruitment and retention of students and faculty; and promoting graduate education and career path options.

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.

Occupational Health and Safety: Studies in this category focus on the practitioner as well as the patient exposure to risks, compliance and prevention issues; behavioral issues; and, workforce recruitment and retention.

Pilot-Testing of the Instrument and Content Validity

The initial survey instrument containing the 112 topics was posted in an electronic format and was pretested by 3 expert dental hygienists representing higher education, clinical practice and private industry. They evaluated each topic for appropriateness for dental hygiene research and relevance to the category under which it had been placed. Panelists also rated the importance of each topic to the advancement of the dental hygiene research mission using a scale of 1 to 4 with 1 = "unimportant" and 4 = "very important". A 4-point scale rather than a 5-point scale w as used to force respondents to make a decision about an item. A 5-point scale normally provides a neutral category. Since the Delphi technique relies on convergence of expert opinion, the intent was to reach a decision about a topic. Panel members were asked for suggestions for additional topics, clarification about the wording of items, and to actually rate each research topic using the electronic submission procedure. As a result of this process, all of the 112 topics remained for inclusion in the first survey round, with no omissions or additions suggested, no changes made to the 5 categories, and with only minor edits to the wording of the topics. Content validity of the overall instrument was established through all of these Phase I activities.

Table 2. Edits made to the five categories found on the ADHA NDHRA.

Existing ADHA NDHRA Categories (1994; 2000)	New ADHA NDHRA Categories in Delphi Study (2007)
Health Promotion/Disease Prevention	Health Promotion/Disease Prevention
Education	Health Services Research
Clinical and Primary Care	Professional Education and Development
Individuals/Populations	Clinical Dental Hygiene Care
Basic/Applied Sciences	Occupational Health and Safety

Phase II

The first Delphi survey instrument was constructed by the investigators. Two versions of the survey were constructed, one form with the questions in reverse order of the other. The 2 versions were used to determine if fatigue affected reliability of the survey.

Participants were electronically sent 1 of the 2 versions of the first survey instrument along with a cover letter explaining the purpose of the study and the Delphi technique. They were asked to rate each topic in terms of its importance to advancing the research mission of the profession. Rating was on a sca le of 1 to 4, with 1 being "unimportant" and 4 being "very important" (**Figure 1**). In addition, participants were given the opportunity to provide comments regarding any of the topics or suggest other topics of importance that were not included. Criteria used for retaining a topic for the second survey round were a mean, median, and mode of 3 or greater (see Statistical Analysis). Topics that did not meet these criteria were eliminated from the second survey.

For the second survey round, respondents were given the modal scores for each topic and their individual rating of each topic **(Figure 2).** They were asked to again rate each topic using the same scale after considering the group response. The respondents were asked to provide a rationale for their decision when their response on the first survey was more than one number away from the modal score and they still chose not to change their response. Criteria for retaining topics follow-

National Dental Hygiene Research Agenda
Delphi Survey - I

DIRECTIONS: The following questionnaire describes 5 broad categories of research. Included under each category are a number of possible research topics related to this broad category. We would like to solicit your opinion regarding the importance of each topic to the National Dental Hygiene Research Agenda. Also, after reviewing the entire survey, we would like to get your suggestions regarding additional topics not identified and the category under which they belong.

Please rate each of the topics on a scale of 1-4 in terms of its importance to advancing the research mission of the dental hygiene profession. In addition, if you believe any of the topics are not descriptive of the broad research category under which it is currently placed, please indicate a more appropriate category to the right of the question. Thank You!

1	2	3	4
Unimportant	Slightly Important	Important	Very Important
No Relevance	Some Relevance	Relevant	Most Relevant
No Priority	Tertiary Priority	Secondary Priority	Top Priority Major Issue

A. Health Promotion / Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; and development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

Examples of topics that relate to this category include, but are not limited to:

1. Assess strategies for effective communication between the dental hygienist and client.

1 2 3 4

Figure 1. Delphi Survey First Mailing

- Respondents were given their individual rating of the topic from Round 1 and the modal score for each topic. They were asked to again rate each topic on a scale of 1 to 4 after considering the group response. Also, they were asked to provide a rationale for their decision when the response on the first survey was more than one number from the modal score, and they chose not to change their response

1	2	3	4
Unimportant	Slightly Important	Important	Very Important
No Relevance	Some Relevance	Relevant	Most Relevant
No Priority	Tertiary Priority	Secondary Priority	Top Priority Major Issue

Studies which:

1. Assess strategies for effective communication between the dental hygienist and client.

Your Score	Modal Score	Your New Rating			
3	4	1	2	3	4

Figure 2. Phase II: Round 2 Mailing and Format

ing the second round were similar to those used in the first survey round, but were more stringent. Topics had to have a median score of 4 and a mode of 4. This allowed the investigators to identify those topics with the strongest level of agreement among the experts.

As indicated on both survey rounds of Phase II, participants rated each of the research topics on a scale of 1 to 4, according to the following criteria:

- a score of "4" indicates "very important" (most relevant, top priority, major issue)
- a score of "3" indicates "important" (relevant, secondary priority)
- a score of "2" indicates "slightly important" (some relevance, tertiary priority)
- a score of "1" indicates "unimportant" (no relevance, no priority)

Phase III

During Phase III, subjects were asked to consider each of the final research topics on which they had

gained consensus as to the level of priority in which they should be investigated. Subjects were instructed to use their judgment using the following 2 criteria:

- How important is this topic to improving the health of the public and advancing the profession of dental hygiene?
- How reasonable is it to address this topic given the experience and expertise available in the field of dental hygiene?

Subjects were to consider these criteria when assigning a priority ranking to each of the topics, using the following definitions of priority:

Immediate Priority: Those topics, given their importance and the current level of experience and expertise in dental hygiene, which could reasonably be investigated in the next 1-2 years.

Intermediate Priority: Those topics, given their importance and the current level of experience and expertise in dental hygiene, which could reasonably be investigated in the next 3-5 years.

Long Range Priority: Those topics, given their importance and the current level of experience and expertise in dental hygiene, which would reasonably require over 5 years to be investigated.

Statistical Analysis

Responses on the surveys were analyzed using measures of central tendency: mean, median, and mode.

- **Mean**: arithmetic average; sum of the scores divided by the number of scores
- **Median**: the middle score; half of the scores fall above and half fall below
- **Mode**: the most frequency occurring score

Reaching consensus during the first survey round was defined by those topics with a mean, median, and mode of 3 or greater. Although the mean is not the appropriate statistic to use with ordinal data, the investigators requested it be calculated for examining results for borderline or questionable findings. During the second survey round, reaching consensus was defined as at least half of the participants agreeing that an item was "very important" (median score of 4) and having the most frequent response or an item being "very important" (mode of 4). Instrument reliability was analyzed using the Pearson Product Moment Correlation Coefficient and Cronbach's Alpha for internal consistency.

Results

The results of the preliminary survey sent to invite members of the sample population to participate in the Delphi study are summarized in **Table 3**. Note that some chose not to answer all questions.

Survey Round One

A 100% return rate for the first electronic survey round was obtained. Responses were analyzed by computing the median, mode, and mean distribution. Of the 112 topics, 76 met the criteria of having a median and mode of at least 3 and were retained for the second survey (Table 4).

In addition, the alternate forms of the survey were analyzed using the Pearson Product-Moment Correlation Coefficient to determine differences in response patterns. The alternate form reliability was .76 and the instrument had an internal consistency of .87 using Cronbach's Alpha. Thus, an acceptable level of reliability for the instrument was established, and it was clear that fatigue did not affect the reliability of the survey. Thus, only one form of the survey was developed for the second survey.

Survey Round 2

A 95% return rate for the second electronic survey round was obtained. Again, responses were analyzed by computing the median, mode, and mean; however, for this round the requirements for keeping a topic were more stringent by requiring a median and mode of 4. Of the 76 topics, consensus was reached on 42 topics. See Table 5 for the results of second survey analysis and Appendix 3 for the list of the actual topics.

Table 6 illustrates how the results of the analyses were presented to the investigators. From this table, the modes and medians from both rounds can be seen along with the actual summary of Round 2 scores from all groups. In addition, the overall mean was calculated; however for ordinal data, the median and mode were more appropriate statistics for use.

Phase III Results

Subjects attempted to rank the remaining 42 topics as to their level of priority. Results of this phase were not usable, as the priorities were not clearly delineated during this process. Subjects expressed confusion with ranking prioritization due to the need for consideration of multiple criteria versus a single criterion, as well as how "immediate," "intermediate" and "long-range" were defined. The investigators feel that should establishing priorities be deemed important, this aspect of investigation will require a separate study.

Discussion

Reaching consensus on the dental hygiene research agenda is a prerequisite to any national program to advance the research efforts of the profession. Using a systematic approach to updating the agenda on

Table 3a. Preliminary Survey Results Assessing Knowledge and Use of the existing NDHRA

ITEM	Response	# of Respondents who answered Yes	Response	# of Respondents who answered No
1. Do you know that ADHA has a National DH Research Agenda?	Yes	41	No (if no, please skip to question #7)	2
2. Are you familiar with the content of the Agenda?	Yes	33	No	10
3. Have you ever used the Agenda?	Yes (if yes, how have you used it? Check all that apply)	29	No	14
	• Preparing a grant	6		
	• Incorporating into a course?	14		
	- Type of Course - Research Methods	12		
	- Professional Issues	12		
	• Manuscript preparation	8		
	• Research planning for your division, department, program or work setting	5		
	• Research planning for your own self-development, projects or programs	10		
	• Research planning for faculty development, projects or programs	7		
	• Research planning for students or in mentoring	15		
	• Research planning for an association	8		
4. Have you ever experienced any barriers to using the Agenda?	Yes (If yes, check all that apply)	15	No	28
	• Agenda format	4		
	• Scope of how your work fits within the agenda, or how the categories are defined	10		
	• Utility of the Agenda – sense of how to incorporate it into your work/ how helpful	3		
	• Language or taxonomy used	3		
	• User friendliness	4		
5. Have you ever cited or referenced the Agenda in a paper or presentation?	Yes	20	No	23
6. Have you ever seen the Agenda used by others?	Yes (If yes, how has it been used – check all that apply)	25	No	18
	• Preparing a grant	9		
	• Incorporating into a course: - Research Methods	14 12		
	- Professional Issues	10		
	• Manuscript preparation	7		
	• Research planning for your division, department, program or work setting	4		
	• Research planning for your own self-development, projects or programs	5		
	• Research planning for faculty development, projects or programs	4		
	• Research planning for students or in mentoring	10		
	• Research planning for an association	6		

an ongoing basis allows it to remain viable and responsive to changing needs. In the present study, this was achieved through an extensive review of the health-related literature and major governmental and foundation reports resulting in 112 topics, which were pre-tested by an external panel of dental hygiene experts prior to conducting the actual study. As the result of these procedures, content validity was established and consensus reached on 42 topics representing the 5 categories of the ADHA NDHRA.

Table 3b. Preliminary Survey Results Assessing Knowledge and Use of the existing NDHRA

Please rate the perceived value of a National Dental Hygiene Research Agenda using the following criteria:

1 = Greatest Value (GV) 2 = Valuable (V) 3 = Somewhat Valuable (SV) 4 = Not Valuable (NV) 5 = Not Applicable (NA)

ITEM	GV	V	SV	NV	NA
7. Developing a body of knowledge	25	16	1		1
8. Directing research priorities	26	12	3		2
9. Establishing funding priorities	16	16	8		3
10. Professional development or career enhancement	3	23	15		2
11. Enhancing ADHA's image	13	18	9		3
12. Achievement of ADHA's goals	9	25	7	1	1
13. Creating RFPs (requests for funding)	16	18	5	2	2
14. Directing student research	15	18	7	1	2
15. Establishing dental hygiene as a true profession	24	13	3		3
16. Indexing dental hygiene as a true profession	7	12	16	5	3

Table 4. Results of Delphi Survey Round I

Category	Original Number of Topics	# Cut (did not meet criteria)	# Remaining Topics for the 2nd Survey
Health Promotion/Disease Prevention	13	2	11
Health Services Research	28	4	24
Professional Education and Development	23	7	16
Clinical Dental Hygiene Care	29	10	19
Occupational Health and Safety	19	13	6
Total	**112**	**36**	**76**

Table 5. Results of the second survey analyses.

*Consensus on 42 Topics – approved for the NDHRA by the 2006-07 ADHA BOT

Category	# Remaining Topics for the 2nd Survey	# Topics for Which Consensus was Reached
Health Promotion/Disease Prevention	11	7
Health Services Research	24	14
Professional Education and Development	16	9
Clinical Dental Hygiene Care	19	9
Occupational Health and Safety	6	3
Total	**76**	**42***

Appendix 3. National Dental Hygiene Research Agenda Delphi Study Results - Consensus on 42 Topics (2007)

A. Health Promotion / Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; and development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

1. Assess strategies for effective communication between the dental hygienist and client
2. Identify, describe and explain mechanisms that promote access to oral health care, e.g., financial, physical, transportation
3. Validate and test assessment instruments/strategies/ mechanisms that increase health promotion and disease prevention among diverse populations
4. Investigate how diversity among populations impacts the promotion of oral health and preventive behaviors.
5. Investigate the effectiveness of oral self-care behaviors that prevent or reduce oral diseases among all age, social and cultural groups
6. Investigate how environmental factors (culture, socio-economic status-SES, education) influence oral health behaviors
7. Identify optimal time periods for interventions that influence pathology, function and oral wellness.

B. Health Services Research: Studies in this category are designed to improve the quality of health care, reduce its cost, address patient safety and medical errors, and broaden access to essential services. Includes evidence-based information on health care outcomes, quality, and cost, use and access.

1. Identify how public policies impact the delivery, utilization, and access to oral health care services.
2. Investigate how alternative models of dental hygiene care delivery can reduce health care inequities.
3. Evaluate strategies dental hygienists use to effectively influence decision-makers involved in health care legislation (e.g., to provide direct access to dental hygiene care, autonomy and self-regulation of dental hygienists).
4. Assess how third parties influence access to and utilization of dental hygiene services.
5. Evaluate strategies that position and gain recognition of dental hygienists as a primary care providers in the health care delivery system.
6. Determine the cost-effectiveness of various oral health interventions (e.g., fluorides, sealants, mouth guards), in reducing or preventing oral diseases/conditions.
7. Determine the cost-benefit of various oral health interventions (e.g., fluorides, sealants, mouth guards), in reducing or preventing oral diseases/conditions.
8. Determine if differences exist in patient outcomes and costs for a given oral condition when services are provided by dental hygienists vs. others.
9. Identify factors that predict supply, demand and need for dental hygiene services.
10. Determine the effect of availability, cost and payment source of dental hygiene services on patient outcomes.
11. Develop valid and reliable measures of quality dental hygiene care.
12. Assess the impact of dental hygiene services on the outcomes of care for patients with special needs.
13. Assess the impact of increasing access to dental hygiene services on the oral health outcomes of underserved populations.
14. Determine the extent to which dental hygienists working in collaborative practice settings with other health professionals or organizations improves the cost-effectiveness and quality of health care outcomes.

C. Professional Education and Development: Studies in this category are concerned with educational methods, curricula, students and faculty; recruitment and retention of students and faculty; and, promoting graduate education and career path options.

1. Evaluate the extent to which current dental hygiene curricula prepare dental hygienists to meet the increasingly complex oral health needs of the public
2. Investigate how other health professions have established the masters and doctoral levels of education as their entry level into practice
3. Identify the factors that affect recruitment and retention of faculty
4. Assess how educators are socializing students to research
5. Investigate the extent to which new research findings are incorporated into the dental hygiene curriculum
6. Validate and test measures that evaluate student critical thinking and decision-making skills
7. Investigate curriculum models for training and certification of competency in specialty areas (e.g., anesthesiology, developmentally disabled, forensics, geriatrics, hospital dental hygiene, oncology, pediatrics, periodontology, and public health)
8. Critically appraise current methods of evaluating clinical competency (dental hygiene graduation competencies, standardized national board testing, clinical board examinations)

The procedures developed and implemented in this study were consistent with other studies using the Delphi technique. For example, the sample selected was comprised of well-respected leaders, experts, and practitioners in the profession who are in positions to promote, support, and conduct research. In addition, many are in positions to foster ongoing development of faculty and clinician researchers, re-

9. Validate measures that assess continued clinical competency

D. Clinical Dental Hygiene Care: Studies in this category addresses the dental hygiene process of care (assessment, diagnosis, treatment planning, implementation and evaluation); decision-making and clinical reasoning; and data management systems.

1. Assess the use of evidence-based treatment recommendations in dental hygiene practice.
2. Assess how dental hygienists are using emerging science throughout the dental hygiene process of care.
3. Investigate the links between oral and systemic health.
4. Investigate how dental hygienists identify patients who are at-risk for oral/systemic disease.
5. Investigate how dental hygienists use emerging science to reduce risk in susceptible patients (risk reduction strategies).
6. Develop and test interventions to reduce the incidence of oral disease in special at-risk populations (diabetics, tobacco users, cardiac patients and genetically susceptible)
7. Assess which combinations of patient examination data can best be used to guide clinical decision-making.
8. Monitor the effectiveness of preventive measures (e.g., sealants, fluorides) in different patient populations.
9. Identify effective strategies for educating hygienists in how to evaluate research studies used to guide evidence-based practice.

E. Occupational Health and Safety: Studies in this category focus on the practitioner as well as the patient; exposure to risks, compliance and prevention issues; behavioral issues; and, workforce recruitment and retention.

1. Investigate the impact of exposure to environmental stressors on the health of the dental hygienist (aerosols, chemicals, latex, nitrous oxide, handpiece/ instrument noise)
2. Investigate how work-force stressors influence career satisfaction (ethical dilemmas, interpersonal relationships, communication, time management, etc.)
3. Investigate methods to decrease errors, risks and or hazards in health care and their harmful impact on patients.

vise curriculum, and influence policy and the delivery of healthcare services. As a result, the NDHRA and topics for the study reflect a consensus among leaders from major groups of dental hygienists and not any one particular segment of the profession. This strengthens the likelihood that the agenda and study topics will serve as a framework that can be used in different practice environments to systematically advance dental hygiene research and practice. However, findings from the preliminary survey on the knowledge and use of the former NDHRA indicate that work is needed to better promote, coordinate, and integrate its use by dental hygienists. For example, although almost everyone who answered the question if they knew that ADHA has a national research agenda, only 77% were familiar with the content and 67% had ever used it (Table 3). When asked to rate the perceived value of a NDHRA, the greater majority rated the survey items as either 'greatest value' or 'valuable' yet almost 40% did not rate it valuable for professional development or career enhancement, and 54% rated its value as somewhat or not valuable for indexing dental hygiene as a true profession.

Findings from this study were consistent with those identified in the current literature and the focus of dental hygiene. Unlike the first Delphi study conducted over a decade ago where the categories with the largest number of topics for study were Health Promotion/ Disease Prevention and Clinical/Primary Care, the largest number of topics in this study were found in the category of Health Services Research (HSR) (n=14). This is not surprising, given the research that has been conducted over the past 10 years, and the current emphasis on evidence based practice where the focus is on effectiveness and outcomes of care. Following the HSR category was Professional Education and Development (n=9) and Clinical Dental Hygiene Care (n=9), both representing an increase in the number of topics from the first Delphi study. Health Promotion/Disease Prevention (n=7) and Occupational Health and Safety (n=3) had the fewest number of topics.

Although the number of topics may have changed within the 5 categories of the agenda, topics now reflect current issues previously not included. Some of these topics relate to cultural competence and health literacy, which are now found within the category of Health Promotion/ Disease Prevention (e.g., Topics 1, 4 and 6); whereas other topics, such as technology, are implicitly part of emerging science, which is addressed in Clinical Dental Hygiene Care (e.g., Topics 2, 4 and 5).

Interesting to note is the low number of topics reached on Occupational Health and Safety, which is one of the main reasons dental hygienists leave or reduce their time in practice. This was the one new category added to the agenda that has direct relevance to the dental hygienists' own personal needs or characteristics of the profession and is part of the broad definition of this category. Although the major emphasis should remain focused on improving the oral health of the public, research on recruitment and retention re-

Table 6. Delphi study Results: Round Two

ALL Groups

Industry Clinic Educators Educators/MSProgDir UnivResearch/OtherEduc PubHealth/Gov/PtAdvocacy

Count of Responses: 45

A. Health Promotion/Disease Prevention: Studies in this category include those that are concerned with health maintenance and disease prevention; public health policy, advocacy and legislation; development, validation and testing of instruments, strategies and mechanisms that demonstrate effectiveness.

	MOD_1	MOD_2	Med_1	Med_2	*Round 2 Scores*				AVG
					1	*2*	*3*	*4*	
1. Assess strategies for effective communication between the dental hygienist and client.	4	4	3	4	*0*	*6*	*14*	*25*	3.42

lated to this category should receive attention, especially when others outside the dental hygiene profession are proposing new practice models with varying training definitions for "dental hygiene" practitioners.

This study used a Delphi technique to achieve consensus on the topics of importance to the ADHA NDHRA. Forty-nine dental hygiene experts representing different work environments participated in the study. Through 2 rounds of mailings, consensus was gained on 42 topics, which were distributed among the 5 categories comprising the national agenda. If there had not been a substantial number of questions rated "very important" for a category, then that particular category would need to be re-examined to determine whether it belonged as part of the agenda.

Conducting this Delphi study was a significant step in the process to continuously monitor and update the ADHA NDHRA to reflect contemporary issues that are relevant to advancing the body of knowledge for dental hygiene. As a result, some categories were modified or dropped and new ones added. These categories and specific topics should be used to guide research efforts that will improve clinical decision making and ultimately the quality of care provided to the public.

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***This award is sponsored by Johnson & Johnson Healthcare Products Division of McNeil-PPC, Inc.**

Utilization of the ADHA National Dental Hygiene Research Agenda

Ann Eshenaur Spolarich, RDH, PhD; Jane L. Forrest, RDH, EdD

In this issue of the Journal of Dental Hygiene, we are pleased to share with you research findings from our study entitled, "A Delphi Study to Update the American Dental Hygienists' National Dental Hygiene Research Agenda." This is the second time that the Delphi technique has been used to gain consensus on those topics deemed priorities for dental hygiene research, which will allow the purposeful building of the knowledge base needed to support education and practice. The following is an excerpt taken from our report submitted to the 2006-2007 ADHA Board of Trustees, in which we encouraged them to adopt this revised agenda as the 2007 ADHA National Dental Hygiene Research Agenda. The Board of Trustees accepted our recommendation, and this document is now available for use by the dental hygiene and global health care communities, by accessing http://www.adha.org/research/nra.htm. Here we propose a number of strategies for how our Association and the general dental hygiene community can use the Agenda to guide the work efforts of the profession. We welcome your comments and thoughts about these strategies, and on the revised National Dental Hygiene Research Agenda.

This update to the ADHA National Dental Hygiene Research Agenda (NDHRA) utilized the Delphi study technique, a structured, scientific approach used to gain consensus on those research topics deemed most critical by a sample of dental hygiene experts. We feel that the content is reflective of current national health issues, and is well-aligned with research agendas from other dental and health care professions. Further, the research priorities identified in this study closely parallel those of the initial Delphi study conducted in 1995.[1]

Identifying priorities with the Agenda is only the first step in the process of building our body of knowledge. Long-range planning is needed to guide research efforts and to promote the development of a unique body of knowledge for the profession.[2] A long-range plan must be broad enough in scope to address the multiple needs of the dental hygiene community, and serve as a means for securing the data necessary for accomplishing the goals of the ADHA Strategic Plan. To this end, dental hygienists must work together to gather information and research data in a logical and structured manner in order to have the database capability to answer important questions related to the profession.

Perhaps the most important aspect of having a national research agenda is its utilization as a working document. However, monitoring utilization is a difficult and cumbersome task, and requires significant dedication on the part of its users. How then does a profession monitor its progress in meeting national research objectives? There are several significant issues that must be addressed by the ADHA and other dental hygiene organizations in order for our profession to accomplish this task.

First, the professional community must commit to using the agenda to guide its research and other professional efforts. All dental hygienists, regardless of their practice settings and professional interests, must internalize the Agenda as their own. Achieving national health objectives should be an inherent part of their professional activities, both inside and outside of the research arena. This is especially important for practitioners, who provide the greatest representation of our profession to the public. The decisions that they make everyday must be firmly grounded in knowledge that is obtained from research and clinical experience, to improve their professional judgment and ultimately, to improve the quality of services provided.

Second, a consistent and reliable system must be in place to "track" and monitor the progress and outcomes of our research efforts, in training hygienists to conduct research, and in publishing research findings. We must develop a comprehensive database for information management that is utilized uniformly across the profession, by hygienists conducting research in academic institutions, private industry, public health organizations and clinical practice settings. In addition to individual hygienists, it is critical to include those organizations that are directly involved with conducting studies, publishing research findings and training dental hygiene researchers. These organizations include academic institutions, corporations, the National Center for Dental Hygiene Research, dental hygiene professional organizations, and publishing houses that create and distribute dental hygiene journals. It could be argued that this is unrealistic, as these groups will most likely have their own unique

agendas to be met as well. However, the ADHA NDHRA is broad enough to encompass the interests of these dental hygienists and organizations; thus, the development and utilization of a common tracking process should be advantageous to members of all of these subgroups. Further, this process will enable the profession to coordinate its research efforts given limited resources, foster collaboration and promote information sharing.

Third, it is not enough to simply identify the topics of ongoing and published research studies in the literature. The extent of the problem studied, as well as the scope and quality of the work also needs to be evaluated. The process of evaluating the merit and the utility of the research is the underlying premise of evidence-based decision making (EBDM) and is one of the first steps identified in the EBDM Model for Dental Hygiene.[3]

We encourage the global dental hygiene to use this revised agenda prior to making any changes or modifications. Utilization of the agenda is a critical component of building a strong research infrastructure. A research infrastructure:

- fosters the development and advancement of long-term research programs;
- enables discussion and dissemination of research findings; and
- supports the systematic building of a scientific knowledge base that informs practice.

There are 5 elements of a research infrastructure:

- A critical mass of researchers/scientists
- Research priorities that produce clinically relevant knowledge
- Funding mechanisms to support research
- Communication systems that promote linkages among researchers and increase access to research findings
- Demonstrated value for research and its relationship to practice[2]

In a future issue of the Journal of Dental Hygiene, we will more closely examine these 5 elements of a research infrastructure specifically as they relate to our profession.

Collaboration is also a critical component for successful utilization of the ADHA NDHRA. To this end, we propose several strategies to promote the use of the Agenda as a guide to our future association activities.

Role of the ADHA Councils

The fundamental purpose of having an agenda is to use it as a tool for guiding our work. If the agenda is not visible or incorporated into our professional activities, it is of limited value. It is counterproductive to undertake major work efforts or projects and then look back upon their completion to see where they can best "fit" into the agenda. If we commit to using the agenda as it is intended, then the agenda should be the driving force behind the work efforts of all ADHA Councils to ensure that all work of the Association is directed at meeting our stated objectives.

As each of the Councils is comprised of a panel of experts, the Council members should identify research needs, goals and objectives related to their specific areas of interest from the agenda. Given this structure, each Council could then identify internal and external resources to support the goals and objectives, design and implement related action plans, and then monitor the work undertaken towards meeting these goals and objectives. For example, the Council on Research (COR) could identify association, government, and potential corporate sponsors for a grant writing workshop to be held each year at the ADHA Annual Session. In conjunction with the ADHA Institute for Oral Health Research Grant Review Committee (RGRC), the COR can help to monitor the progress of funded studies targeted to address specific priorities identified by the Association.

The ADHA Strategic Plan sets forth the direction of the long-range plan for the Association, and includes action plans developed by each Council for accomplishing the stated goals and objectives. Using the Councils to systematically work with ADHA staff to manage the research conducted under their auspices adds an important accountability piece to the tracking process. Annual reports generated by the Councils should include a discussion about research progress pertaining to the NDHRA. Further, we recommend that each Council Chair or designee be present at Annual Session to present a report to the general membership about the status of their goals and objectives, work efforts, accomplishments, and recommendations for goals and objectives for the following year. A forum for discussion educates the membership about the significance of research projects deemed important by each Council, and lends accountability, continuity and consistency of thoughts and ideas to future Council members and to the Association. Further, the Council reports would provide an important check-and-balance system to help ensure that our knowledge database is being developed.

Role of Educators

Educators continue to assume an integral role in socializing students to the research process; and therefore, we must encourage educators to use the agenda throughout the dental hygiene curriculum. Educators should teach in a manner that reinforces the importance of research, so that research becomes

part of the inherent value system of our students. Undergraduate educational programs assume the responsibility for training and developing basic skills required by all dental hygiene students, and graduate programs can be used to further develop and refine these skills.

Graduate dental hygiene programs could also be used as "centers" for investigation, similar to those established in dental schools, with concentrated research efforts focused on a particular field of study. Using the agenda as a guide, these schools could serve as regional sites for multi-center research studies to conduct large scale investigations that add to our body of knowledge. Graduate students from across the country could work on the same project investigating regional differences in a given problem. This would encourage graduate students to work in a collaborative model, and teach them to network and communicate with their future research colleagues. Graduate students are also the logical choice for developing and testing the reliability and validity of new/existing measures, and for validating existing bodies of work. These are all examples of projects that could be funded through ADHA or the ADHA Institute for Oral Health. The ADHA COR is actively working in collaboration with the graduate program directors to explore these research initiatives.

Role of Clinicians

The agenda is also a critical guide to dental hygiene practice. This is especially important for practitioners, who provide the greatest representation of our profession to the public. The decisions that they make every day must be firmly grounded in knowledge that is obtained from research and clinical experience, to improve their professional judgment and ultimately, to improve the quality of services provided. Further, the agenda is a tool that supports ADHA's evidence-based practice philosophy. Research supports clinical practice by:

- advancing knowledge and technology for improved patient care;
- providing a framework for evidence-based decision making;
- establishing criteria for competency and continued competency;
- dictating public policy; and
- influences the regulations that govern dental hygiene practice.

Summary

Promoting and utilizing the ADHA NDHRA helps to position the profession in alignment with other major health professional organizations. This document also contributes to the credibility of the profession, by providing visibility and support to dental hygienists engaged in research. Further, sharing our scientific goals with the broader community will enable the profession to capture research data from other disciplines that supports our research objectives as well.

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Expanding Dental Hygiene to Include Dental Therapy: Improving Access to Care for Children

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This article is dedicated to the memory of Dr. Eric Spohn, professor, University of Kentucky; and Dr. Ralph Lobene, of the Forsyth Institute, Boston; who over 30 years ago pioneered in advocating for an expanded scope of practice for dental hygienists to provide restorative care for children.

Abstract

Oral Health in America: A Report of the Surgeon General, and the subsequent National Call to Action to Promote Oral Health contributed significantly to raising the awareness of the American public and the dental profession regarding the lack of access to oral health care by many Americans, especially minorities and low income populations, with resulting disparities in oral health. The problem is particularly acute among children.

The current workforce of dentists in the United States is inadequate to meet the oral health care needs of children in terms of numbers of dentists, as well as their distribution, ethnicity, education, and practice orientation. Dental hygienists trained in an expanded scope of practice, can help address the workforce inadequacy.

Dental therapists, educated in 2-year programs of postsecondary education, comparable to America's associate degree dental hygiene programs, have been used throughout the world to provide basic, primary oral health care for children. Research has documented that utilizing dental therapists is a cost effective method of improving access to care for children. Countries that have led the way in introducing dental therapists to care for their children are now integrating their separate 2-year curriculum in dental therapy and dental hygiene into a 3-year curriculum to prepare a clinician dually trained in both dental therapy and dental hygiene. This clinician is being designated an oral health therapist.

Expanding the education of dental hygienists in the United States to include skills of the internationally acclaimed dental therapist can produce oral health therapists, individuals capable of addressing the basic preventive, restorative, and minor surgical needs of children, but also able to continue to address the preventive and periodontal needs of adults.

Key words: dental workforce, access to care for children, dental therapist, advanced dental hygiene practitioner

Introduction

Oral Health in America: A Report of the Surgeon General, and the subsequent *National Call to Action to Promote Oral Health* contributed significantly to raising the awareness of the American public and the dental profession regarding the problems associated with gaining the benefits of oral health for all Americans.[1,2] *Oral Health in America* documented the lack of access to oral health care by many Americans, especially minorities and low income populations, with the resultant existence of significant disparities in oral health. The Surgeon General's efforts have prompted major discussions regarding how to improve access to care and reduce disparities.

While *Oral Health in America* addressed the issue of oral health for all Americans, the focus of this essay will specifically be the oral health of children. The ultimate goal in oral health is the prevention of disease; thus children are core to success. However, it would be naïve to believe preventive efforts can be completely successful. Therefore, a further goal must be ensuring that children who do experience oral disease are treated effectively and efficiently. The current workforce of dentists is inadequate to achieve these goals.

This essay will briefly review the evolution of dental hygiene in America; identify 2 models for educating an expanded oral health workforce; justify focusing an expanded scope of practice for dental hygienists on children; cite workforce barriers that exist in providing access to oral health care for children; characterize dental therapy as a recognized international approach for improving access to care for children; suggest that cur-

rent approaches to care are neither outcomes-effective nor cost-effective; and suggest that expanding the role of dental hygienists in America to include dental therapy is the most effective manner to address the workforce issues in order that access to oral health care for children can be improved and disparities reduced. It will also identify advantages of a merged dental hygiene/dental therapy curriculum as has evolved internationally--the oral health therapist model[3] —over the advanced dental hygiene practitioner model (ADHP) proposed by the American Dental Hygienists' Association (ADHA).[4,5]

Expanding the Scope of Practice for Dental Hygienists to Improve Access to Care for Children

Dental hygiene has continued to develop since Alfred C. Fones opened the first school of dental hygiene in 1913. For many years dental hygiene was understood as a preventive dentistry auxiliary for the dentist, with emphasis on oral hygiene instruction, calculus removal, and polishing of tooth surfaces. Through time, dental hygienists came to be viewed as periodontal co-therapists, "providing periodontal therapy consisting of bacterial plaque control instruction, soft tissue management, sub-gingival scaling and root planing, and follow-up and supervision."[6] With this evolvement dental hygienists became further trained to employ local anesthesia and nitrous oxide analgesia to control pain. Some dental hygienists have also learned to provide expanded function restorative skills for patients, including placement of rubber dams and amalgam and composite restorations. More recently, dental hygiene has advanced a collaborative practice model based on the assumption that oral health care is a complex process that requires collaboration between the dentist and dental hygienist working as a team. State dental practice acts have changed to permit dental hygienists to take on new clinical responsibilities.

Over the history of dental hygiene, licensure, and regulations have adjusted to accommodate to changing practice models. Dental hygienists were added to state dental licensing boards, several states modified practice acts to enable dental hygienists to practice in some settings with general supervision versus direct supervision. Some states have approved alternative dental hygiene practice models, and others independent practice by dental hygienists.

As a result of this evolution, dental hygienists are well-positioned with the knowledge, education, and skills to increase their role in caring for the oral health of America's children by adding the competencies of the international dental therapist--the provision of basic restorative and minor surgical care for children. The challenge is to determine the educational model by which dental hygienists can most efficiently and effectively expand their scope of practice to help meet society's need for an expanded workforce.

While multiple models exist for expanding the capacity of the nation's oral health workforce, this essay will focus on 2 related specifically to dental hygiene: dental hygiene and dental therapy integrated (oral health therapist), and the advanced dental hygiene practitioner (ADHP). The designation oral health therapist is being appropriated internationally to designate individuals whose education has been integrated to include the traditional scopes of practice of both dental therapy and dental hygiene. The advanced dental hygiene practitioner of the ADHA is a dental hygienist with an advanced scope of practice, including but not limited to the skills traditionally associated with the international dental therapist; but also providing restorative and surgical care for adults.[4,5] Arguments will be advanced that give preference to the oral health therapist model.

Focusing an Expanded Scope of Practice for Dental Hygienists on Children

Prior to discussing the details of the respective approaches to expanding the scope of practice for dental hygienists it is necessary to justify why any expanded scope of practice that advocates basic restorative and minor surgical competencies must focus primarily on children.

Loretta Kopleman and Michael Palumbo have published a thoughtful, compelling, and important article in the *American Journal of Law and Medicine* entitled: "The U.S. Health Delivery System: Inefficient and Unfair to Children.[7] The paper explores the four major ethical theories of social justice and concludes that no matter which theoretical stance you take, children should receive priority consideration in receiving health care. Norman Daniels, professor of bioethics and population health at the Harvard School of Public Health, argues that a just society should provide basic health care to all, but redistribute health care more favorably to children.[8] He justifies this conclusion based on the affect health care has on equality of opportunity for children, with equality of opportunity being a fundamental requirement of justice. As noted, poor and minority children, the most vulnerable individuals in our nation, have the highest prevalence of oral disease, the poorest access to oral health care, and the poorest overall oral health. Justice demands they be maximally benefited, in order that they ultimately have equal opportunity to succeed. The opportunity to realize one's potential in life is markedly affected by one's childhood. Presi-

dent Kennedy expressed it cogently and well: "Children may be the victims of fate….they must never be the victims of neglect." Moral considerations support an expanded scope of practice for dental hygienists focusing on children.

There is increasing concern that even dentists who are graduating from colleges of dentistry with four years of professional doctoral-level education are not adequately prepared to appropriately and safely address the oral health needs of the increasing numbers of adults who are chronically ill and are biologically and/or pharmacologically compromised. In 1995, the Institute of Medicine report on dental education, *Dental Education at the Crossroads: Challenges and Change*, called for enhanced curricula in clinical medicine to enable dentists to more effectively manage oral health care in the face of the changing health profiles of their patients.[9] Advocacy had previously been made for inserting a clinical clerkship year in general medicine in the dental curriculum to help future dentists integrate the basic biomedical sciences, including pathology and pharmacology, with clinical medicine, in order to better care for patients.[10] A number of dentists and dental educators have called for a required post-doctoral year of training to achieve this goal.[11,12] It is not reasonable to expect that any model of expanded education for a dental hygienist can address this issue adequately. It should be noted that while children also have debilitating diseases they are not as prevalent; nor are children generally as compromised biologically or pharmacologically as adults. Thus they do not present the same level of safety issues in providing care. Safety considerations support expanded scope of practice dental hygienists focusing on children.

The international experience of over 80 years of dental therapists providing basic, primary care is essentially all with children, not adults. All of the research on the effectiveness of care by dental therapists, and it is significant, is in relationship to children.[13-20] International experience and research support the expanded scope of practice dental hygienists focusing on children.

The American Dental Association has been opposed to any one other than a dentist providing restorative and surgical care ("irreversible surgical procedures"). This is evidenced by the aggressive stance taken against dental therapists practicing in Alaska.[21] Dentistry as a profession understands that society is becoming increasingly distressed with the profession's inability to effectively address the issue of access to care for our most vulnerable population, our children. While speculation, it is possible that organized dentistry will more readily accept a model of an expanded scope of practice for dental hygienists that is focused on children. Practical political considerations support expanded scope of practice dental hygienists focusing on children.

While the focus of an expanded scope of practice should be on children, legislation should also be encouraged to permit dental hygienists to extend traditional dental hygiene care to special populations such as individuals in nursing homes, with general supervision or a consultative agreement with a dentist. In addition to traditional periodontal care, dental hygienists could perform procedures that are not invasive, that is, procedures that do not require local anesthesia, cutting of tooth structure, or removal of teeth. Examples of such procedures include atraumatic restorative treatment (ART) and adjustment of prosthetic appliances.

Workforce Barriers to Accessing Care for Children

Multiple barriers have been identified in ensuring access to care for children. Significant among these barriers is the professional dental workforce--inadequacy in the number of dentists, as well as their distribution, ethnicity, education, and practice orientations.

The dentist/population is declining from its peak of 59.5/100,000 in 1990 and will drop from the current 58/100,000 to 52.7/100,000 in the year 2020—a decline of 10%.[22] One estimate suggests the ratio could fall as low as 45 dentists/100,000 people by 2020.[23] The number of pediatric dentists is not helpful in addressing the issue of access to care for children. While there has been a significant increase in the number of pediatric dentists over the past 30 years, there are only 4,357 such trained specialists practicing in the United States today. Paul Casamassimo, then president of the American Academy of Pediatric Dentistry, stated: "…even with a Herculean increase in training positions [or pediatric dentists] improved workforce distribution, and better reimbursement and management of public programs, pediatric dentistry [the specialty] will never be able to solve this national problem [of disparities] alone. We need help."[24]

Compounding the issue of the numbers of dentists is the location of dental practices. The overwhelming majority of dentists practice in suburbia and affluent areas of cities, with few practicing in rural and inner city areas where children with the greatest need live. The number of federally designated shortage areas increased from 792 in 1993 to 1,895 in 2002.[25]

While approximately 12% of the population is African-American, only 2.2% of dentists are.[26] Individuals of Hispanic ethnicity make up another 10.7% of the population, yet only 2.8% of dentists are Hispanic.[26] Fewer than 5% of entering student dentists are African-American and less than 5% are Hispanic.[27] The demographics of oral disease indicate that these two minority groups comprise a sig-

nificant proportion of the disparity problem.[28]

A further issue is the general lack of instruction and experience graduating dentists have had in treating children. The typical college of dentistry curriculum provides an average of only 181 clock hours of didactic and clinical instruction in dentistry for children.[29] A recent study found that 33% of dental school graduates had not had any actual clinical experience in performing pulpotomies and preparing and placing stainless steel crowns; common therapies required for children.[30] Official American Dental Association policy also questions the adequacy of the dental curriculum in preparing dentists to treat children. A 2000 ADA House of Delegates resolution called for "a review of the predoctoral education standard regarding pediatric dentistry to assure adequate and sufficient clinical skills of graduates."[31] The background statement supporting the resolution suggested that inadequate educational preparation for treating children could be a barrier to access. There is no evidence that there has been an increase in emphasis in children's dentistry in predoctoral education. In fact, in a recent study entitled "U.S. Predoctoral Education in Pediatric Dentistry: Its Impact on Access to Dental Care," the authors concluded "results suggest that U.S. pediatric dentistry predoctoral programs have faculty and patient pool limitations that affect competency achievement, and adversely affect training and practice."[30]

An additional workforce problem is the practice orientation of many dentists. The overwhelming majority of dentists do not treat children whose care is publicly insured by Medicaid or S-CHIP. A 1996 study indicated only 10% of America's dentists participated in the Medicaid program.[32] A more recent study indicates approximately 25% of dentists received some payment from Medicaid during a given year; however, only 9.5% received $10,000 or more.[33]

Dental Therapy as Practiced Internationally Improves Access to Care for Children

In 1921, New Zealand developed a 2 academic year program to train high school graduates to become school dental nurses.[34] These school dental nurses were then deployed to school-based dental clinics, which subsequently came to exist in all of the elementary schools of New Zealand. Today there are 610 dental therapists (the name was changed in 1988 from school dental nurses) in New Zealand caring for the countries 850,000 school children.[3] Almost 98% of New Zealand's children are enrolled in the School Dental Service where care is funded by the government. A recent report of the oral health of New Zealand's children documented that at the end of a given school year essentially none of the children in the School Dental Service had untreated tooth decay.[35]

The model developed in New Zealand has since spread to 52 other countries of the world.[3] Currently there are over 1,500 dental therapists practicing in Australia providing the overwhelming majority of dental care for children.[3] Malaysia employs dental therapists to provide government supported dental care for its 3 million children in 17,000 elementary schools and 2,000 secondary schools through a network of 2,000 public dental clinics for children.[3] All dental care for children in Malaysia is by dental therapists. There are 700 dental therapists practicing in the Great Britain in a variety of oral health care settings.[3] Dental therapists have practiced with Health Canada, Canada's Ministry of Health, since 1972.[36,37] There are currently 300 dental therapists practicing in Canada, with approximately 100 employed by Health Canada to treat Canada's First Nation people.[3] The remainder practice in Saskatchewan, where dental therapists are recognized as full members of the dental team, with many practicing in dental offices, complementing the work of dentists in much the same manner dental hygienists practice in the United States.

The typical curriculum to train dental therapists to provide basic restorative and minor surgical care for children has been of 2 academic years, each of approximately 32 weeks duration with 1,200 hours of instruction, for a total of 2,400.[38] During the first year topics of study include the basic biomedical sciences: general anatomy, histology, biochemistry, immunology, and oral biology; as well as clinical dental sciences: cariology, periodontal disease, preventive dentistry, patient management, radiography, local anesthesia, restorative dentistry, dental materials, and dental assisting. In the second year course-content includes: pulpal pathology, trauma, extraction of primary teeth, clinical oral pathology, developmental anomalies, health promotion/disease prevention, the oral health care delivery system, and record keeping, as well as administrative and legal issues associated with clinical care. In New Zealand approximately 760 hours of the 2,400 hour curriculum are spent in the clinic treating children, with most of this occurring in the second year.[38] Restorative and surgical techniques included in training are: intra-coronal preparation and restoration of primary and young permanent teeth; preformed stainless steel crowns; pulpal therapy including pulpotomies on primary teeth, and the extraction of primary teeth.

Educational Changes Occurring Internationally

New Zealand, Australia, and Great Britain have led the way in

Table 1.

Knowledge and Skill Competencies of a Dental Hygienist Inclusive of those of a Dental Therapist Providing Basic, Primary Care for Children	Knowledge and Skill Competencies of a Dental Therapist Providing Basic, Primary Care for Children Not Included in Current Competencies of a Dental Hygienist
Basic Biomedical Sciences Biomaterials Interviewing and Medical and Dental History Taking Communication Skills Behavior Management Dental Morphology Clinical Technique and Assessment: Clinical (Extra-oral and Intra-oral), Radiographic and Occlusal Examinations Risk Assessment Record Keeping Diagnostic Casts Infection Control Preventive Dentistry Theory Preventive Dentistry Skills: child and parent education; health promotion/disease prevention; prophylaxis (scaling and polishing); fluoride application, sealant application; dietary analysis Oral Pathology Instrumentation Suturing Special Needs Patients Local Anesthesia/Nitrous Oxide Analgesia Rubber Dam Application Placing and Polishing Restorations Public Health Dentistry	Intra-coronal Cavity Preparations for Primary and Young Permanent Teeth Preparation, Adaptation, and Cementation of Stainless Steel Crowns Preparation, Adaptation, and Cementation of Esthetic Anterior Crowns for Primary Incisors Pulpal Disease, Assessment, and Treatment for Primary and Young Permanent Teeth Urgent Management of Dental Trauma Extraction of Primary Teeth

developing a new paradigm for educating and training of dental hygienists and dental therapists. Previously dental therapy and dental hygiene were taught separately and independently from one another.

Since 2000 in Australia, the education for dental hygienists and dental therapists has been integrated. The academic program is now of 3 years duration with a bachelor's degree in oral health being awarded.[3] In 2006 in New Zealand, the curriculum for dental hygiene and dental therapy merged into a 3 academic year program, with resulting credentialing in both scopes of practice and awarding a bachelor's degree.[3] Great Britain developed a combined dental hygiene and dental therapy curriculum in the mid-1990s. Most training programs now offer the combined training varying in length from 27 to 36 months depending on whether a certificate is awarded or a baccalaureate degree. Currently over 200 students are accepted each year in 15 programs, most of which are affiliated or attached to dental schools/dental teaching hospitals.[3]

Recently, The Netherlands adopted oral health therapists as a major dimension of their dental delivery system, and are now matriculating 300 a year in their vocational schools.[39,40] The Netherlands is reducing by 20% the number of dentists accepted to its dental schools, but is also adding an additional year to the education of a dentist. The rationale is that in the future significant aspects of basic preventive and restorative care will be provided by oral health therapists, with dentists performing more complex procedures and treating the increasing number of medically and pharmacologically compromised patients. Their new policy reduces the absolute numbers of dentists to control the costs of dental education--a significant issue in the United States--and develops oral health therapists to both improve access to care as well as reduce the costs of care.

Creating Oral Health Therapists in the United States

In the United States there are 255 associate degree entry level dental hygiene programs, 48 bachelor's degree entry level programs, and 17 programs offering a master's degree in dental hygiene (MSDH) or a master's degree in a related discipline.[5] The total number of accredited programs is 286 since some programs offer multiple levels of education. Traditional dental therapy is not practiced in the United States other than the recently developed initiative for Alaskan Natives under the leadership and auspices of the Alas-

ka Native Health Consortium.[41,42]

Rather than establish separate 2 year training programs to develop dental therapists for children, identified previously in the literature as pediatric oral health therapists,[43,44] it would seem to be more rational and economical to build on the current educational infrastructure for dental hygienists by educating individuals in traditional dental hygiene competencies and adding new competencies in basic restorative and minor surgical care for children. Much of the curriculum of current dental hygiene programs is inclusive of clinical competencies of traditional international dental therapists' programs; few additional competencies would need to be added to the curriculum to qualify one as an oral health therapist. (Table 1)

Research in the United States has also demonstrated that dental hygienists can be trained in a relatively short period of time to provide primary care for children; certainly within one additional academic year and potentially less. In 1970, Forsyth Dental Center initiated what was subsequently designated, and described in a book by the same title, The Forsyth Experiment.[45] The study documented that hygienists could be taught to provide quality restorative care for children effectively and efficiently. Whereas the projected curriculum time to achieve the competencies was 47 thirty-hour weeks (1,400 clock hours), the project was able to achieve its desired training outcomes in 25 weeks (740 clock hours). The study's investigators concluded that advanced training in restorative care for children could be accomplished in the "traditional 2 year dental hygiene curriculum by adding two summer sessions and condensing and combining some courses."[45]

Between 1972 and 1974, at the University of Kentucky, another expanded functions project, supported by the Robert Wood Johnson Foundation, took place. This also involved the training of dental hygienists in restorative dentistry for children. Thirty-six students, who were completing a 4-year baccalaureate program in dental hygiene, participated in a compressed curriculum that provided 200 hours of didactic instruction in children's dentistry, as well as 150 hours of clinical practice. The program was specifically addressed to providing primary care for children, including administration of local anesthesia, restoration of teeth with amalgams and stainless steel crowns, and pulp therapy. On completion of the programs, the hygienists participated in a double-blind study comparing their restorative skills with fourth year dental students. No significant differences were found between the quality of their work and that of the graduating dentists.[46]

At the College of Dentistry at the University of Iowa a 5-year project, conducted between 1971-1976, and supported by the W.K. Kellogg Foundation, trained dental hygienists to perform expanded functions in restorative dentistry and periodontal therapy, for both children and adults. The results were the same as the studies at Forsyth and Kentucky. Hygienists could be effectively trained, in a relatively brief time period, to perform, at a comparable quality level, restorative procedures traditionally reserved for dentists.[47]

Integrating traditional dental therapy into the dental hygiene curriculum will not only help address the access to care problem for children, but it will also help address an issue that has been in the forefront of dental hygiene for some time. Dental hygienists, functioning as oral health therapists, utilizing new skills, expanding their scope of practice, and participating in new practice settings, will be able to experience enriched professional lives and work.

While expanding 2 year dental hygiene programs to 3 years can prepare oral therapists of the future, provision must be made for hygienists currently in practice who want to expand their skills to provide basic restorative and minor surgical care for children. This can be accomplished by establishing continuing professional development programs in dental therapy. While some significant period of time would have to be spent on-site at a clinical facility to gain required preclinical and clinical skills, the actual time required in such a setting could be reduced through distributive education strategies for much of the didactic course work basic to dental therapy.

The Advanced Dental Hygiene Practitioner

Since the initiation of training of Alaska Natives in dental therapy in New Zealand in 2003 and their subsequent deployment in tribal Alaska, the American Dental Hygienists' Association has realized the imperative of expanding the scope of dental hygiene practice to include basic restorative and minor surgical care. The resultant of this work has been the development of the proposed advanced dental hygiene practitioner (ADHP).[4,5] The ADHP is an individual who will have had a baccalaureate degree in dental hygiene with the advanced credentials in restorative dentistry and surgery for children and adults being earned in a master's degree program. The entry level credential for the ADHP is a master's degree, typically requiring 6 years of post-secondary education. The competencies of an ADHP as adopted by the ADHA Board of Trustees exist in 5 domains: provision of primary oral healthcare; health care policy and advocacy; management of oral care delivery, translational research, and professionalism. Clinically the ADHP would be able to: prepare

cavities and restore primary and permanent teeth using direct placement of appropriate dental materials; place temporary restorations; place preformed crowns; temporary re-cement restorations; pulp cap primary and permanent teeth; perform pulpotomies on primary teeth, and extract primary and permanent teeth. While competencies in leadership, administration, and research are included in the ADHP model, the additional clinical skills are consistent with those traditionally associated with the international dental therapist. As noted previously, the curriculum internationally for individuals with this scope of clinical duties is educated in 3 academic years.

Advantages of the Oral Health Therapist in Comparison to the Advanced Dental Hygiene Practitioner

The knowledge and skills necessary to expand the dental hygienist's scope of practice to include basic restorative and minor surgical care for children does not require nor justify what would ostensibly be a 6 academic year program versus the internationally developing standard of 3 academic years. In fact, the ADHP model offers several problems that would mitigate its effectiveness.

The ADHA has explicitly stated that the ADHP is being developed as a response to the Surgeon General's Report of 2000 in order to improve access to care and help reduce disparities of oral health among Americans.[4] However, structuring the ADHP with a postgraduate, master's degree entry level severely restricts the number of expanded scope of practice dental hygienists who could be trained to address the issue of access to care. This extended time period is not required to achieve the basic level of clinical skills necessary to provide the scope of care traditionally expected of a dental hygienist as well as those of a dental therapist.

While some of the programs currently offering a bachelor's degree could be expanded to offer a master's degree leading to advanced dental hygiene practitioner certification, only 17 programs (in 15 states) offer dental hygiene graduate education and are thus positioned in graduate education to do so.[5] An enhanced scope of practice would be limited to those individuals able to attend universities offering graduate education. Improved access to oral health care and a reduction in the disparities in oral health would be limited with the model of the advanced dental hygiene practitioner, as relatively few individuals would be able to meet the entry level requirements. Only a minority of dental hygienists hold a bachelor's degree. The model would effectively deny the majority of dental hygienists the opportunity to expand their scope of practice to include restorative/surgical skills. The need is for thousands of dental hygienists to be able to expand their scope of practice to provide primary care for children. All of the nation's 2 year dental hygiene programs could be expanded to 3 years to include dental therapy in the curriculum. All 50 states and the District of Columbia have entry level associate degree programs in dental hygiene.[5]

A critically important concern in the expansion of dental hygienist's skills to include dental therapy is the potential loss of significant numbers of individuals (or hours of care) to provide traditional dental hygiene services. Dental hygienists are in great need and demand absent the expansion of their scope of practice and role. It will be incumbent on society to dramatically expand the number of educational positions available for oral health therapists to ensure adequate numbers of clinicians are available to meet the needs of both adults requiring periodontal care and children requiring restorative care.

While providing documentation is beyond the scope of this essay, the costs to society of training oral health therapists in a 3 year program would be far less than that of educating a comparable number of advanced dental hygiene practitioners in master's degree programs. Economic considerations also strongly favor utilizing oral health therapists to provide primary care for children rather than dentists.

Practice Settings for Oral Health Therapists

The practice environment for oral health settings will be dependent on the evolving health care delivery system in the United States. Oral health therapists could practice in the private or the public sector.

Oral health therapists would be in demand in dental practices as dental hygienists traditionally trained are today. Oral health therapists could function in ways dental hygienists currently do, but also collaborate with dentists in children's primary care. It does not make economic sense for dentists to routinely perform scaling, root curettage and polishing of teeth, and other procedures able to be competently performed by dental hygienists. In like manner, it is not reasonable for dentists to perform basic restorative and minor surgical procedures for children when an oral health therapist can do so safely and effectively. There is an important role for dentists, that is, focusing on problems that cannot be managed by an oral health therapist; problems that only a dentist can address.

It is speculated that dentists who do not currently care for children in their practices might expand their

care to include children, should such care be able to be managed by another member of the practice's dental team. Adding an oral health therapist to the dental team could result in an increase in the numbers of dentists providing care for children, as well as expand the capacity for dentists already caring for children to see more children. Many dentists do not accept children in their practices whose care is publicly insured, ostensibly due to the inability to manage the costs of care given overhead considerations and the lower reimbursement schedule. Oral health therapists could help mitigate this issue as care could be provided in a more cost-effective manner for the practice. This situation is analogous to the economics of dental hygiene practice in a practice setting today. Few dentists would want to practice without the collaboration of dental hygienists due to their ability to enable the practice to provide more care.

It has also been suggested that oral health therapists could play a role in improving access to care for children by practicing in the offices of the nation's pediatricians. A dental hygienist in the state of Maine currently practices in the office of a group of pediatricians.[48] The results of a recent study of state, medical, and dental practice acts indicates that in many states physicians could provide dental care for children under their license to practice medicine.[49] Pediatricians and family physicians are now receiving training in oral health care in a number of settings around the country and are conducting oral exams and applying fluoride varnish to children's teeth, for which they are being remunerated. It is not unrealistic to envision physicians further expanding oral health care for children and utilizing oral health therapists as a method of doing so.

Oral health therapists could practice in the public sector in public health clinics, health departments, federally qualified health centers, and with not-for-profit organizations. Ideally, children should be engaged in environments in which they normally function, if the access problem is to be effectively addressed. As in New Zealand, the most logical place to capture this audience is in the school system. As James Dunning stated over 30 years ago, "any large-scale incremental care plan for children, if it is to succeed, must be brought to them in their schools."[50] It is reasonable to deploy oral health therapists in mobile facilities to provide primary care for children in a school; moving through the year from one school to another. Large schools could have their own clinical facility. School programs, initiated incrementally, with the youngest children (with the least carious experience and the greatest potential for implementation of preventive care), would be a cost-benefit effective way of managing the oral health needs of our poorest and neediest children. In New Zealand, the school dental therapist also provides care for preschool children from birth, thus enabling preventive therapies to be instituted among infants and toddlers to address early childhood caries.

The issue of supervision always emerges in discussions of dental hygienists having an expanded scope of practice. The international tradition for dental therapists has been one of indirect or general supervision. In New Zealand, school dental therapists care for children with general oversight by district dental officers who provide consultative services as well as visit and audit dental therapists' practices on a periodic basis. There is a similar tradition in other countries utilizing dental therapists. In New Zealand, Australia, Great Britain, and Canada recent legislation permits dental therapists (oral health therapists) to practice independently (with some variations) as long as they maintain a collaborate/consultative relationship with a dentist.[3]

The practice and supervision circumstances for oral health therapists will be varied, and will be dependent on state practice acts. However, for oral health therapists, as described herein, to be effective and have an impact on access to care for children they must have the ability to practice with general supervision, or with a consultation agreement with a dentist.

Conclusion

Inadequate access to oral health care for America's children has been documented, with resultant disparities in oral health among children. Children from low income families and minorities experience more oral disease and receive less care. The current dental workforce is inadequate in numbers, composition, location, education, and orientation to address this problem. Other countries in the world have utilized dental therapists, individuals trained in 2 year programs of post-secondary education, to provide basic, preventive, restorative, and minor surgical care for children. The care provided by dental therapists has been documented to be equivalent in quality to that of dentists, and is more economical. Recently, several of these countries have integrated the education of dental therapists and dental hygienists to create an oral health therapist. Developing and deploying oral health therapists is a viable strategy to improve access to care and reduce disparities among America's children. The American Dental Hygienists' Association can play a critical leadership role in addressing the inadequacy of the oral health care workforce, specifically for children, by endorsing a nationwide strategy to develop a 3 year curriculum to integrate dental therapy with the competencies of dental hygiene, thus creating oral health therapists for America.

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Linking Research
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individuals with moderate periodontal disease.

Scaling and root planing, coupled with professional plaque removal every two weeks results in similar improvement of periodontal disease in both healthy and diabetic patients and reduced levels of TF in diabetics.

Professionally delivered periodontal care did not impact blood glucose measures in the sample diabetics with poor metabolic control.

Summary

Dental hygiene clinicians are in a unique role to assist patients in managing the chronic diseases of periodontitis and type 2 diabetes. In doing so, it is important that the clinician have realistic expectations for the role periodontitis has in type 2 diabetes, as well as the expected outcomes to dental hygiene care in this group of patients. Results from the NHANES study suggests that moderate periodontal disease may predispose individuals to increased risk of type 2 diabetes, but not in isolation of other risk factors. Therefore, comprehensive patient evaluation that includes consideration of risk factors such as age, socioeconomic level, body-mass index, blood pressure and tobacco use, along with periodontal status can provide guidance in establishing appropriate periodontal maintenance intervals. Additionally, although it is critical for individuals with type 2 diabetes to have regular and thorough periodontal maintenance, expecting maintenance alone to achieve metabolic control is unrealistic. The dental hygienist is the primary professional in general and periodontal practice charged with providing non-surgical periodontal care and evaluating the results of such care. In order to provide optimal care and assist patients in achieving best outcomes requires an understanding of current and developing evidence. Evidence on the systemic / periodontal link continues to provide clinicians with excellent information that can guide practice, but it is only when clinician appropriately apply that evidence that patient care is optimized.

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Processes and Perspectives: The Work of ADHA's Task Force on the Advanced Dental Hygiene Practitioner (ADHP)

Deborah M. Lyle, RDH, MS; Dolores M. Malvitz, RDH, DrPH; Christine Nathe, RDH, MS

Since ADHA disseminated a document outlining specific competencies for an advanced dental hygiene practitioner (ADHP) in March 2008 (hereafter called "the ADHP competency document"), questions have arisen regarding the model underlying the ADHP's scope of practice and educational level, as well as reasonable paths for currently licensed dental hygienists to achieve these competencies.[1] The paper published in the current issue of JDH[2] serves as the most recent description of an alternate model for an oral health mid-level provider; the author questions certain aspects of ADHP education and practice. Certainly, members of the ADHA Task Force would agree with many statements in the paper, especially that existing literature and a long history of practice in other countries strongly suggest that non-dentists can learn to provide care using treatment procedures traditionally limited to dentists, at a level of quality equal to dentists.

In comparing the 2 proposals and evaluating the feasibility of each within the United States health care system, however, a critical reader must consider carefully: 1) processes used to develop the ADHP document and content of both proposals; 2) existing needs for dental care within U.S. populations likely to be served by the mid-level provider; 3) the cultural context of educational and care delivery systems into which the new U.S. mid-level provider must fit; and, 4) pragmatic issues surrounding adoption of a new provider. Thus, the purpose of this paper is to provide additional background regarding the processes and certain crucial perspectives used in developing the ADHP competency document.

Development of the ADHP Document

Work on the ADHP competency document stretched over 3 years, and began with the vision of extending primary oral health care to all. The ADHP Task Force of ten dental hygienists represents 9 different states (ID, MD, MI, MN, NJ, NM, TN, VA, WA); its composition reflected the current range of dental hygiene educational settings and legal definitions of dental hygiene practice. Early and often, the group reviewed: 1) relevant published literature, particularly research and evaluation; 2) curricula for existing mid-level dental providers in other countries and for expanded dental hygiene practice within the U.S.; 3) governmental and organizational policies likely to affect the new provider; and 4) other materials that provided information important for creation and acceptance of the ADHP. Examples of these latter materials included: Data on dental needs, demand for care, and dental personnel trends; history and current education of the nurse practitioner; and expert opinion on future dental scenarios.

The Task Force began by identifying competencies the ADHP must possess, if the provider is to help resolve current impediments to access. Periodically, drafts were submitted to an advisory group comprised of persons representing diverse backgrounds and holding a range of beliefs regarding mid-level providers, as well as to the ADHA Board of Trustees and to ADHA members. The Task Force received numerous comments from these multiple reviewers, thoughtfully considered all of them, and revised the document accordingly. Ultimately, the ADHA House of Delegates approved the Task Force's work, with its clearly defined competencies, scope of practice, and educational requirements. Thus, the existing ADHP competency document was reviewed by a large and diverse group of stakeholders and gained approval from the legislative body of ADHA.

The ADHP competency document builds on existing dental hygiene education and practice and the dental hygienist's unique orientation toward prevention; it adds procedures and competencies that can benefit those who currently experience difficulty in accessing the dental care system in the United States. Collaboration with other members of the health care team is emphasized. Because the ADHP expands substantially the scope of traditional dental hygiene practice, it requires acquisition of additional

knowledge and skills—all carefully specified in the document disseminated by ADHA. In contrast, the proposal for an oral health therapist remains a concept paper, with brief mention of curricular length.[2] That proposal limits its goal of improved access to a small proportion of those who need dental attention (i.e., children), and does not define an academic model that can serve as a robust foundation for an entirely new mid-level practitioner within the United States.

Existing Needs for Dental Services

As described by the Task Force, the ADHP will focus on providing services within community settings, such as school clinics, long-term care facilities, hospitals, and primary care clinics—thus, promoting the addition of oral health services within traditional health care organizations and leading to more diverse delivery of dental hygiene care. The sample curriculum encourages ADHP students to gain specialized knowledge appropriate for a particular population or setting.

The most recent oral health data from the National Health and Nutrition Examination Survey (NHANES)[3] offer a useful snapshot of those who are likely to have the most extensive oral health needs. The proportion of the poorest Americans (i.e., <100% of the federal poverty level) who reported a dental visit within the preceding year varied markedly by age: 57% of youths ages 2-11; 62% of adolescents ages 12-19; 44% of adults ages 20-64; and 30% of seniors age 65 and older. Likewise, the prevalence of untreated dental caries varied by age among these poorest Americans. One-third of youth ages 2-11 had untreated decay in their primary teeth, while just 12% of youth ages 6-11 had untreated decay in their permanent teeth; for adolescents ages 12-19, the prevalence (in permanent teeth) was 27%. Among adults ages 20-64, the prevalence of untreated decay was 44%, and it was 33% among dentate seniors age 65+--thus, among the poorest, the prevalence of untreated decay was exactly the same for primary teeth among youth and for dentate elders. Those groups who reported seeing a dentist least often were adults ages 20-64, and they also were found to have the highest prevalence of untreated decay. In addition, 14 and 17% of the adults and dentate seniors, respectively, met the case definition for periodontal disease. As more knowledge is gained regarding the associations between oral disease (particularly, periodontal diseases) and systemic diseases such as diabetes, pneumonia, and certain inflammatory diseases, it becomes unwise to ignore the health of the oral cavity--at any age.

In light of the current epidemiology of oral diseases, the ADHP competencies exclude no age groups, and no particular health history. They are not tailored to existing funding streams for oral health care. Instead, the focus is on identifying those with oral health needs where they seek health care, functioning as part of a multi-disciplinary health care team, and referring to appropriate practitioners whenever circumstances dictate (then following up, to ensure that care has been received). Increasingly, many children present with complex medical issues, stemming from conditions such as diabetes and asthma. Would the oral health therapist not provide care for such patients?

Cultural Context of U.S. Educational and Care Delivery Systems

The majority of dental hygienists now receive an Associate Degree (or its equivalent) at the completion of their entry-level education, a degree often not commensurate with the credit hours actually completed. By the time many dental hygienists are graduated from these associate-degree programs, their credit hour totals resemble those required for a baccalaureate degree.[4] Most dental hygiene education now occurs in community colleges or technical schools, isolated from the education of dentists or even from that of other health professionals within the same institution--who complete their clinical education in hospitals or other health care facilities, learning to interact with and respect those from multiple disciplines. Baccalaureate dental hygiene programs within dental schools have declined markedly over the past 20 years, and relatively few student dental hygienists now receive instruction from faculty members of dental schools. Given the value that Americans place on the baccalaureate degree as a "college education," it is important to move dental hygiene education closer to the norm of other health professionals with comparable responsibility. In order to participate fully—and be respected—within the multidisciplinary health care system, the ADHP must present education similar to other mid-level providers.

For these reasons, the ADHP Task Force developed parameters for a provider with a master's degree, similar to other mid-level professionals within health care, e.g., nurse practitioner, physical therapist, pharmacist, speech and language pathologist. In fact, a current trend in these professions is to move toward doctoral studies. In order to prepare dental hygienists adequately at the advanced level, it will take the equivalent of 2 years of full-time study beyond the baccalaureate degree, culminating in a Master of Science in Dental Hygiene. Many institutions have the capacity to deliver part of this instruction via distance education, reaching students within their own communities and promoting their acceptance into these local health care networks. Indeed, many uni-

versities already offer baccalaureate and graduate degree coursework through distance-learning options. As academic choices proliferate, this career path can only become more available to dental hygienists.

In the United States, the majority of dental care is provided in private practices--even when payment comes from governmental sources such as Medicaid or SCHIP, the provider most often is a private practitioner. Employed dental personnel, functioning within governmental systems to provide dental care for defined groups, are rare in the United States, but more common internationally. Providers cited as models for the oral health therapist were created many years ago, by dentists in those countries, to meet the needs of certain populations--much as a dentist in the U.S. created dental hygienists to accomplish prevention that was unavailable to school children early in the 20th century. These international providers often are educated within dental schools, by dental faculty, with substantial restorative resources available and upon graduation, they assume positions within the governmental system. So far, this level of consensus does not exist, regarding mid-level dental providers in the United States. Almost certainly, the first ADHP graduates will need to find or create positions in locations that do not fit current patterns for private dental practices. Thus, it would benefit the ADHP to resemble other mid-level providers within the U.S. health care system.

Pragmatic Issues Surrounding Adoption of the ADHP

Employment of dentists is not expected to keep pace with the increased demand for dental services.[5] In contrast, the number of dental hygienists is projected to increase significantly.[6] The ADHP, as detailed in the ADHA competency document, could help fill this forecasted need in the delivery of dental care.

Existing Masters' degree programs, many with established distance education options, could incorporate the ADHP curriculum and its thoroughly developed set of competencies to expand the dental hygienist's role in health care. The Task Force expected that the model would be implemented and evaluated to determine the ADHP's impact on access to oral health care and on the population's oral health status. As important milestones occur in implementation of the ADHP competency document, updates will be published in ADHA periodicals.

Summary

Although multiple strategies will be required to craft a lasting solution for existing and future access problems, the ADHP could contribute important knowledge and skills to address unmet oral health needs of the public. The concept of a mid-level practitioner is widely accepted in medicine and already integrated into current systems of health care; the ADHP offers a comparable, cost-effective model for provision of oral health care within diverse health care settings. Clearly, a professional with the ADHP competencies, functioning within the existing health care system, could offer underserved populations access to a provider who focuses on prevention, alleviates pain and infection, and coordinates more specialized care when needed, working collaboratively with dentists and other health professionals.

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