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## The Importance of Mentoring

R Wilder, RDH, BS, MS

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I received an email recently from a former dental hygiene student. My first teaching position was in Texas and I was a very green, young faculty member. The former student and I had not communicated in over 20 years so it was such a nice surprise to hear from her. In her email, she wrote, that I was "a role model to her then and to this day." I cannot think of a nicer compliment to my professional life than to be a role model and mentor to others. Are you mentoring other dental hygienists? Are you seeking mentoring from someone from whom you wish to learn about our profession? This editorial is to challenge you, if you are not doing so already, to take on that role of mentor or protégé.

The term 'mentor' comes from Homer's Odyssey. Odysseus had a son named Telemachus. When Odysseus left to fight in the Trojan wars he left Telemachus in the care of the nobleman Mentor. Assuming the form of Mentor, Athena, the Greek goddess of wisdom, was able to give Telemachus some useful advice. Thus, Athena, in the form of Mentor, acted as an advisor to the young Telemachus and helped him meet challenging obstacles.

What about the role of mentoring in our profession? Katherine Schrubbe, BSDH, MEd, wrote an excellent article in the *Journal of Dental Education* in 2004 on mentorship and its relationship to professional growth and academic success. In it, she describes mentors as:

- One who has the ability to inspire confidence in others, push them to their limits, and continue to develop them to their greatest potential;
- People who can see more in you than you see in yourself;
- One who creates a vision and development plan that takes advantage of the proteges's strengths, abilities, and potential for growth; and,
- A facilitator of independence, self-confidence, job satisfaction, and upward mobility.

When I reflect back to the professional mentors I have had in my life, I see several individuals. My first professional mentors in dental hygiene were my instructors in dental hygiene school. They worked tirelessly to teach me the skills and knowledge to become the best dental hygienist I could be. They stressed the importance of being an active member of my professional association and to speak up and help move the profession forward. I have an advanced degree today partially because one of my faculty members (who only had an associate degree herself) told me that I **COULD** and **SHOULD** do it! So...I did it. **The take home message here is...When you see potential in another dental hygienist or someone who could become a dental hygienist-TELL THEM! It might turn their world around.**

What about my mentors in writing? I was not born a natural writer. During my first couple of years of teaching, I had the privilege of working with the former editor-in-chief of the Journal of Dental Education. He offered a workshop to faculty to teach them how to become better authors. I asked him to critique a paper I was writing. The first critique was difficult to read because there was so much red ink on the pages. I swallowed my pride and worked on it some more. The second critique looked almost as red. By the next revision, I was ready to submit it for publication and it was accepted! Now, my role is to help others improve in their writing and research skills. Daily, either with students or with other dental hygienists who submit to the Journal, I have an obligation to facilitate their learning and desire to write, publish, and contribute to the dental hygiene body of knowledge. **The take home message here is...if you have a desire to be better at something, find someone who is excellent at it and open yourself up to learn from them. If you have exceptional skills in your profession, TEACH someone!**

I now have the privilege of mentoring future leaders in dental hygiene. I call it a privilege because I consider it an honor as well as one of my most important roles. The profession of dental hygiene has changed my life and provided more joy and intellectual stimulation than I could ever imagine. I want to thank my mentors for the gift of their time, encouragement, and enthusiasm that they gave me along the way. I want you to ask yourself...who am I mentoring, how can I encourage others to get involved, stay involved, contribute to the profession, contribute to the scientific literature, and become a productive change agent for the American Dental Hygienists' Association and all that it represents? I also want you to ask yourself how you can grow in the profession, who are the dental hygiene leaders you admire, and how can you learn from them. Ask one of them to be your mentor. **The take home message here is ... JUST DO IT! You have nothing to lose and much to gain!**

Have a great spring!

Sincerely,

Rebecca Wilder, RDH, BS, MS

Editor-in-Chief, *Journal of Dental Hygiene*

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## Upfront

Katie Barge

*Katie S. Barge is staff editor of the Journal of Dental Hygiene and staff writer for Access*

### **Dental X-rays Accurately Predict Osteoporosis Risk**

Ordinary dental x-rays may help to identify women at risk for osteoporosis, said a European research team who have devised a computer software program that analyzes bone formation found in dental x-rays.

This technique uses novel computer software developed by the Imaging Science and Biomedical Engineering Division of Manchester University in England. Specifically, the software is used to analyze bone characteristics, including thickness and fragmentation, in routine dental x-rays. The research team believes this information may point to trouble elsewhere in the body.

The study enrolled 651 women, with an average age of 55 years, at 4 clinical centers throughout Europe. The participants first underwent conventional bone mass density (BMD) measurements of the femur, hip, and spine, which are bones often affected by osteoporosis. Researchers also analyzed a small area of dental x-rays that showed a certain type of bone.

The researchers found that the examination of dental records was able to predict osteoporotic risk to the same degree as traditional BMD measures.

Osteoporosis, a disease in which bones become fragile and more apt to break, affects nearly 45 million older women worldwide. Until menopause, healthy bones maintain a fine balance between formation and resorption (breaking down). However, after menopause, bone breakdown outpaces bone formation, resulting in bone loss.

The incidence of the disease increases as women age, affecting 15% of women in their 50s, 22% of women in their 60s, and 38.5% of women in their 70s. Although women are 4 times more likely to develop the disease, men suffer from osteoporosis as well.

According to the study, wide-scale screening for the disease is costly and difficult to implement. The authors point out that this strategy requires no extra cost or time on the part of the dentist.

"Individuals will be given a probability that they have osteoporosis at the hip and spine based on radiographic and clinical information," said study author Hugh Devlin, a researcher with Manchester University's School of Dentistry. "The radiographic information currently used is the width of the mandibular cortex."

Devlin is now working to expand the computer search capability and the ability to diagnose osteoporosis to include other features of the dental x-ray.

## **Special Diet may Help Smokers Quit**

What do yogurt, a glass of water, and a plate of broccoli have in common? According to new research, consuming any of these foods seems to diminish the taste of cigarettes. Researchers at Duke University also found that cigarette taste is enhanced after eating meat or drinking alcohol or other caffeinated beverages. Taken together, the discoveries raise the possibility of devising a so-called "smoker's diet," which could help make quitting easier.

"Smoking is not just about the nicotine addiction, it's also about taste and sensory qualities of smoking," said study author F. Joseph McClernon, an assistant professor in the department of psychiatry and behavioral sciences at Duke University Medical Center in Durham, NC. "So, anything we find that can disturb or disrupt the smoking experience might make it easier for a smoker to quit."

McClernon and his colleagues administered an open-ended questionnaire to 209 smokers asking for reports of foods or beverages that worsen or enhance the taste of cigarettes. On average, the participants smoked 22 cigarettes a day and had been smoking for a little more than 21 years.

Almost 45% of the smokers mentioned some kind of food that worsened cigarette taste, while nearly 70% identified foods that improved taste. Commonly reported categories that worsen the taste of cigarettes were fruits/vegetables, noncaffeinated beverages, and dairy products. Commonly reported categories that enhance the taste of cigarettes were caffeinated and alcoholic beverages, and meat products. Regression analyses indicated that increased sensitivity to both taste worsening and enhancing were associated with smoking nonmenthol cigarettes.

Participants reported that specific situations also had a taste-diminishing impact, including taking medicines, hot weather, or smoking too much or too fast. Stale cigarettes and a smoky environment also dampened cigarette taste.

The researchers also found that younger smokers were more susceptible to foods that worsened tastes, whereas those who smoked fewer cigarettes were more susceptible to taste-enhancing foods.

"There's really no harm in smokers trying some of these things now," McClernon said. "Try drinking skim milk or other dairy products, drinking more water, eating fruits and vegetables before stopping smoking-and see if that makes smoking less pleasurable."

McClernon said that further research is needed to figure out exactly how foods affect cigarette taste and whether altering a diet might improve quitting success. "Any kind of clue that has the potential to lead to new treatments is important in dealing with the leading preventable cause of death and disability in the US."

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## **Review of: Essentials of Oral Histology and Embryology: A Clinical Approach**

Ruth Fearing Tornwell, RDH, MS

*Reviewed by Ruth Fearing Tornwall, RDH, MS, Instructor IV at Lamar Institute of Technology in Beaumont, Tex.*

### **Essentials of Oral Histology and Embryology: A Clinical Approach**

**Third edition**

**James K. Avery and Daniel J. Chiego, Jr**

**Mosby, 2005**

**St. Louis, Mo**

**256 pages, color illustrations, indexed, softcover**

**ISBN: 0-323-03339-3**

**\$57.95**

This is the third edition of *Essentials of Oral Histology and Embryology: A Clinical Approach* and is designed as a basic information text to help in the comprehension of the microscopic anatomy of the oral and facial tissues. The central purpose of this text is to educate students in the dental and dental hygiene professions with an explanation of the structures related to the masticatory apparatus. This new edition includes an additional author who had worked on revisions of previous texts and had made numerous contributions to the content in his area of expertise.

The area of head and neck embryology and histology is of extreme importance in the study of dental practice and dental hygiene. The authors feel that understanding histology is the first step in making the best treatment decisions for the patient. They state that "one must first understand what is normal in order to gain a better awareness of what is abnormal." This sets the tone of the text.

There are 16 chapters in this text. The authors begin in Chapter 1 with the development and structure of cells and tissues. Chapter 2 discusses the structure and function of cells, tissues, and organs, and how they function in making up organs and organ systems. This chapter has been specifically modified in this edition to provide more critical information about the building blocks of the body's systems. Chapters 3 through 5 cover the development of the oral-facial region, the face and palate, and the teeth. Chapter 6 discusses the eruption and shedding of the teeth. The enamel, dentin, dental pulp and cementum are discussed in depth in chapters 7 through 9. The next 2 chapters discuss the periodontium. Chapters 13 through 16 describe the temporomandibular joint, its anatomy, histology, and function, the oral mucosa and its components, the salivary glands and tonsils, and biofilms and their development in the oral cavity, respectively. Each chapter area is thoroughly discussed but is not overwhelming in its detail, making it also of practical value to dental hygienists who wish to review this information.

There are a number of features in each chapter which help student learning. Each chapter begins with learning objectives and key terms. Learning objectives identify the main ideas discussed in each chapter and what the student can be expected to know by reading its contents. It also helps students and instructors to set goals for comprehension and provide for a more directed learning at the outset of the chapter. Key terms are listed alphabetically and are then bolded in the chapter where they are discussed. At the end of the text, is a glossary providing definitions that will enable students to use the terms competently in their clinical vocabulary.

Throughout the chapters are special features, which include "clinical comment" boxes and "consider the patient" boxes. Clinical comment boxes provide clinical tips and notes of interest pertaining to the chapter content. Consider the patient boxes show the application of the chapter concepts by presenting the student with situations and patient questions that could occur in clinical practice. Each patient box has a corresponding discussion box at the end of the chapter providing answers to the questions or possible recommendations and explanations showing the student how they might respond to similar situations in clinical practice. They also help to set the stage for further discussion. Other features to help the student to understand chapter content include self-evaluation questions at the end of each chapter and tables and boxes throughout the text, which quickly summarize important information. The text is also supported by an Evolve Web site that accompanies and enhances the texts' material.

The text is very clear and easy to understand. Photographs, diagrams, illustrations, and drawings complement the text. The authors have positioned these features as close as possible to their associated content descriptions. Most illustrations are presented in color to enable students to better correlate the structure with its function by observing histology as they would view it in reality. The drawings and diagrams are of exceptional quality and contribute highly to the success of the text.

The third edition of *Essentials of Oral Histology and Embryology: A Clinical Approach* is very successful in its presentation and would be a valuable asset to any dental professionals. I highly recommend this text.

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## **Review of: Practice Management for the Dental Team**

Anne Gwozdek, RDH, BA

*Reviewed by Anne Gwozdek, RDH, BA, adjunct faculty member, University of Michigan, Ann Arbor, Mich. and Lansing Community College, Lansing, Mich.*

### **Practice Management for the Dental Team**

**Sixth Edition**

**Finkbeiner BL and Finkbeiner, CA**

**Mosby, 2006**

**St. Louis, Mo.**

**558 pages, illustrated, indexed**

**ISBN: 0-323-00886-0**

**\$59.95**

*Practice Management for the Dental Team* details instructions for performing front office skills. Noting at the beginning of the text that knowledge and best practices in this field are constantly changing, the authors have provided current, comprehensive information reflecting dental practice business office protocols, technologies, and federal regulations.

Spiral bound and paperback, this text is divided into 5 parts: Dentistry as a Business, Communication Management, Business Office Systems, and the Dental Assistant in the Workplace. Each of the 18 chapters includes a list of learning outcomes and boxes highlighting important information and specialized terms. Photographs and figures are in color and compliment the written body of material. Learning activities summarize chapters and provide practical application to concepts presented.

Case studies are included within each chapter assisting students in applying knowledge to realistic situations. Also included with the textbook is a Patterson Eagle Soft Demonstration CD, providing the reader with basic experience using practice management software. CD icons provide the reader with identified areas to utilize this interactive software. Student resources are available on an Evolve Elsevier Web site which includes crossword puzzles, weblinks, and working forms coinciding with each chapter.

All members of the dental team should be knowledgeable of and participate in the business aspect of the dental practice. Practice management, however, does encompass a broader premise than the operations of the business office. Incorporation of material related to staff meetings/morning huddles, the business model of overhead, salaries, and provider percentage of production (eg, hygiene production percentage related to dentist production) would be valuable content. Dental hygiene-specific topics such as individualizing patient recall appointment scheduling, assisted verses traditional patient care, and compensation models (salary, hourly, or commission) would serve to enhance the "dental team" focus indicated in the title.

The authors successfully integrated the latest concepts in instructional design with state-of-the-art business management content. *Practice Management for the Dental Team* is not only a valuable textbook but serves as a beneficial resource for any dental practice.

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## **Review of: Diet and Nutrition Sourcebook**

Mary Danusis Cooper, RDH, MSED

*Reviewed by Mary Danusis Cooper, RDH, MSED, professor, Dental Hygiene Program, Indiana University-Purdue University Fort Wayne, Ind.*

### **Diet and Nutrition Sourcebook**

**Third edition**

**Edited by Joyce Brennfleck Shannon**

**Omnigraphics, 2006**

**Detroit, Mich.**

**634 pages, indexed, hardcover**

**ISBN: 0-7808-0800-2**

**\$78.00**

Almost two-thirds of Americans are overweight or obese, increasing the onset of several conditions such as diabetes, stroke, osteoporosis, certain cancers, and heart disease. One of the challenges Americans face with nutrition is avoiding the availability of pre-packaged foods and fast-food restaurants. In our fast-paced lives, it is often more convenient to consume such products, which tend to be high in fat, sugar, and calories. Most Americans eat enough food, but not foods that the body needs to remain healthy. Increasing physical activity and eating right by incorporating proper nutrition can be challenging to most and, seeking such knowledge, can be overwhelming. One only needs to visit the health section in the library or bookstore to understand the multiple resources available to the consumer. Most consumers want to find that perfect resource that is easy to follow and understand. *Diet and Nutrition Sourcebook* provides that foundation.

This comprehensive, hardback text offers 70 easy-to-read chapters that are divided into 9 parts. The consumer's interest in nutrition will determine which part(s) to read. If the reader has an interest in how to provide healthy eating habits for children, then Part III-Life Stage Nutrition Issues, should be examined.

Part I of the text provides information on the latest *Dietary Guidelines for Americans 2005* and MyPyramid. Both provide guidelines for making good food choices. There are also individual chapters on essential nutrients and understanding the importance of these nutrients. Readers are also cautioned about misinformation about nutrition and nutrition myths.

In Part II, the reader can learn about the difference between servings and portions. It is interesting to note that portion sizes have increased in the past few years. We are eating much larger portions than ever before, thus providing additional, unnecessary calories and fat. This may be surprising to most readers.

In Part III, information is presented on age- and gender-related nutrition concerns, such as pregnancy, menopause, and aging.

Part IV addresses how to eat healthy when eating alone, at a restaurant, or with a family. It also addresses concerns between physical activity and the nutrition needs of the body.

Part V addresses weight control—a topic in which most are interested. What specifies a safe weight-loss program? Why is obesity of concern? What conditions are associated with obesity?

Part VI offers information on supplements and vitamins. Consumers need to be aware of the safety and possible adverse health risks of supplements.

Part VII provides guidelines for individuals who have chronic diseases and disorders, including diabetes and cancer. Diet is important in the treatment of diseases and conditions.

Part VIII provides valuable information on government food programs such as WIC and the federal food stamp program. It also addresses nutrition programs available for senior adults.

Besides the information provided in each section listed above, there are some outstanding resources chapters listed in Part IX. One is the Directory of Nutrition Information Sources chapter. It contains contact information of government agencies and organizations. The chapter on Nutrition Resource List of Consumers offers a list of cookbooks, newsletters, and magazines, as well as general nutrition books. For those who like to surf the internet, there is a chapter, *Finding Useful Nutrition Information Online*, which directs patients on how to do so as well as a list of online information. Another valuable chapter is the glossary of Nutrition and Dietary Terms.

This textbook is a valuable resource tool for any individual. Oral health care providers know that a healthy body begins with the mouth. It is our responsibility to educate our patients on how to prevent disease. Sometimes, just knowing where to refer our patients for additional information can help them in making lifetime changes that will be essential for their overall health.

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## **Review of: Dental Drug Reference with Clinical Implications**

Ann Eshenaur Spolarich, RDH, PhD

*Reviewed by Ann Eshenaur Spolarich, RDH, PhD, Arizona School of Dentistry and Oral Health; Arizona School of Health Sciences; USC School of Dentistry; University of Maryland Dental School*

### **Dental Drug Reference with Clinical Implications**

**Frieda Atherton Pickett, RDH, MS, and Géza T. Terézhalmy, DDS, MA**

**Lippincott Williams & Wilkens, 2006**

**Baltimore, Md**

**834 pages, illustrated, softcover, with CD-ROM**

**ISBN 0-781-77762-3**

**\$45.95**

*Dental Drug Reference with Clinical Implications* is a chair-side reference text for use by dental professionals in clinical practice. The book and its CD-ROM contain a wealth of information related to the use of drugs in dentistry and the management of patients taking medications. Although the authors state that the content of the book focuses on commonly prescribed medications, and thus, not all available medications are included, this text contains over 3500 drug monographs, and as such, is fairly comprehensive in its scope. The book is highly relevant to practicing dental professionals, easy to use, and affordable.

The layout of the book lends to its ease of use. Section 1 contains 7 chapters that review essential background information, almost like a "refresher" course on pharmacology and clinical medicine. These chapters provide information used to aid in diagnosis and treatment planning of medicated patients. Dental professionals will appreciate that they can obtain 2 continuing education credits for each of these 7 chapters upon the successful completion of self-study and examination through the Dental School at the University of Texas Health Science Center at San Antonio.

Chapter 1 presents the general principles of pharmacology, which is very well written and serves as an excellent review for both recent graduates and established practitioners alike. Chapter 2 focuses on adverse drug events, with detailed explanations as to the mechanisms of adverse drug reactions, including drug interactions, clinical manifestations, as well as tips for diagnosing these reactions, and guidelines for reporting adverse drug events. To supplement the detailed discussion of the chapter, a wide array of clinical photographs on the CD-Rom serve as a valuable resource for clinicians who may be unfamiliar with the numerous drug-related oral adverse effects. Faculty will be able to use these photographs for teaching these concepts to students.

Chapters 3 and 4 are found on the CD-ROM, with content devoted to the medical management of acute odontogenic pain and infections. Clinical images are provided to aid in diagnosis and sample prescriptions are included to assist with treatment. A detailed discussion of the safe and appropriate use of antibiotics is both timely and useful, especially the sections discussing both the need and rationale for antibiotic premedication for medically complex patients.

Chapter 5 reviews the management of 15 oral conditions, ranging from common oral problems such as xerostomia and candidiasis, to less commonly encountered conditions, such as pemphigus, osteitis, and burning mouth syndrome. Diagnostic criteria and decision-trees are especially helpful for clinicians, who will also appreciate the sample prescriptions listed under the management and treatment sections for each of these conditions.

Chapter 6 provides a comprehensive review of clinical medicine, and focuses on common medical conditions that are treated with medications. Again, the format of this chapter lends itself well as a resource in clinical practice. Each topic is presented with the same structured content for consideration: medical history considerations, vital signs, treatment strategies, preventive strategies, and potential medical emergencies. Drugs used to manage these common conditions are highlighted in boxes throughout the text with bulleted key points that focus the reader's attention to the most relevant information. This format is a time saving tool that will allow clinicians to easily access the most important information quickly, which is the very hallmark of a chair-side resource.

Chapter 7 reviews the diagnosis and interventions necessary for medical emergencies that occur in the dental care setting. Again, this chapter follows a specified format: predisposing factors, prevention, signs and symptoms, and treatment. The bulleted, concise text makes it simple to find the most relevant information quickly. Especially noteworthy in this chapter is the discussion about the importance of being prepared for a medical emergency, with specific strategies that all dental professionals can use to improve their own skills, to reduce risk, and to ensure the proper and efficient management of an emergency situation.

Each of these 7 chapters contains a list of references to support the content presented in the text. The references are current, and where applicable, are organized by subject heading. Not surprisingly, many references are original publications by Géza T. Terézhalmy, which is a testimonial to the author's expertise in this subject area.

Section 2 contains the alphabetical listing of drug monographs, with a format found in other similar drug reference texts. Drugs that are prescribed in dentistry are identified by a tooth symbol preceding the drug name. Drugs are listed alphabetically by generic name, followed by brand names, classification, and where appropriate, information as to whether the drug is a controlled substance. Each monograph reviews pertinent pharmacology, including a brief discussion of the mechanism of action, indications/contraindications, and pharmacokinetics. Dental professionals will most likely refer to the sections on drug interactions relevant to dentistry and adverse effects. Oral adverse effects are highlighted at the beginning of this section. Dental hygienists will especially like the section on oral health education, which details specific information that should be taught to patients who are taking a particular medication.

Finally, the appendices offer many useful tables, including drug lists arranged by condition (eg, drugs for migraine headache), dental products, and common abbreviations. There is also a nice review of herbal supplements, drug-herb interactions, and related dental implications. A list of references to support the information on herbals is included with the discussion. A new and beneficial appendix that is unique to this text is a table that translates commonly asked questions in English to Spanish, a valuable tool for use during a comprehensive health history review. An appendix that lists normal values for common laboratory tests is found on the CD-ROM.

In summary, the authors are to be commended on writing such a useful clinical pharmacology resource text for students, faculty, and clinicians. It is very well written and its format supports its use in clinical practice. Dental hygienists should consider adding this resource to their personal libraries to improve their care and management of medicated patients.

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## **Review of: Behavioral Dentistry**

Lisa Shaw, RDH, MS

*Reviewed by Lisa Shaw, RDH, MS, residential health care coordinator at Faxton-St. Luke's Healthcare, James M. Rozanski General Practice Residency Program, Utica, NY.*

### **Behavioral Dentistry**

**D. I. Mostofsky, A.G. Forgione, and D.B. Giddon**

**Blackwell Publishing Professional, 2006**

**Ames, Iowa**

**320 pages, illustrated, indexed, softcover**

**ISBN: 0-813-81213-7**

**\$79.99**

Behavioral medicine and health psychology are 2 disciplines that focus on the use of psychological theory, principals, and techniques to impact health and illness, with the goal of reducing risk factors, promoting health behaviors, and providing workable interventions. Mostofsky, Forgione, and Giddon have brought together more than 30 experts to provide dental students and practitioners with a comprehensive text that explores psychological theory, principals, and techniques as they relate to dentistry. The text presents 21 chapters under 4 general headings: Biobehavioral Processes, Anxiety, Fear, and Pain, Changing Behaviors, and Professional Practice.

Within Biobehavioral Processes, Giddon and Anderson provide valuable insight into the importance of the mouth in interpersonal attraction, survival, socialization, and self-actualization. Understanding the subjective and objective information that both clinicians and patients bring to the dental relationship with regard to the craniofacial area can significantly impact treatment and outcomes. Inglehart expands on Giddon and Andersons concepts with her discussion of Oral-Health-Related Quality of Life (OHRQoL). She defines OHRQoL as the "part of a person's quality of life that is affected by the person's oral health." More specifically, it addresses how functional, psychological, and social factors, as well as how pain and discomfort, affect a persons overall well being and quality of life. Inglehart takes the guesswork out of assessing these factors by providing readers with an overview of 3 different assessment techniques and tools (social indicators, global self-rating, and multiple-item surveys). OHRQoL is an important concept as it attempts to shape and direct the efforts of researchers, clinicians, and educators towards truly workable patient-centered care. The Biobehavioral Processes heading concludes with chapters that address the bidirectional relationship between stress and inflammation, saliva in health and disease, biofeedback in the treatment of myofascial pain disorder and tempromandibular joint pain, and finally, hypnosis in dentistry.

The second heading, Anxiety, Fear, and Pain, provides chapters that primarily discuss the emotional and environmental determinants of dental pain, stress, and behavioral change. McNeil, Sorrell, and Vowles, in their chapter, Emotional and Environmental Determinants of Dental Pain, provide an excellent overview of how dental pain is affected on all levels by the emotions of fear, anxiety, and depression. In addition, they discuss how emotional processes such as catastrophizing,

an individual's sensitivity to and memory of pain, a patient's perception of predictability and control over the process, sociocultural factors, and environmental factors such as the dental setting and individual and dental staff attitudinal and communication issues impact dental pain.

Regarding behavioral change, Koerber, in her chapter, *Health Behavior and Helping Patients Change*, acknowledges that "increasing a patient's knowledge is often not enough to cause patients to make the necessary changes to maintain their own oral health." The goal of the chapter is to describe and discuss counseling skills that practitioners and students can use that will facilitate patients making better choices that will positively impact their oral and systemic health. In reviewing health behavior models, she concludes that knowledge, as stated, does not directly determine behavior. For knowledge to impact behavior, one must change individual attitudes and values, those changes must be strong enough to withstand surrounding cultural and social norms, and the individual must believe that they are capable of the behavior. She provides a brief overview of the popular Transtheoretical Model of Change by Prochaska & DiClemente, an overview of Rollnick's recommendation with regard to advice giving, a table that provides a contrast between statements that arouse resistance and those that do not, and finally, an overview and table that outline the principals of the process of motivational interviewing.

The third heading, *Changing Behaviors*, includes chapters on the Behavioral Management Of Thumb Sucking, the Management of Children's Disruptive Behavior, the Nonpharmacological Approaches to Managing Pain and Anxiety, Self-Efficacy Perception in Oral Health Behavior, and Behavioral Issues in Geriatric Dentistry. Allen, in his discussion of the management of children's disruptive behavior during dental treatments, notes that many studies have been unable to identify reliable predictors of disruptive behavior, and that the only "reliable, good predictor of disruptive behavior was [the] age of the child." He further concludes that dentists have no control over any outside factor that may be impacting behavior, and thus their focus should be on affecting variables within the dental environment that can impact change in a child's behavior. Finally, he offers 5 simple approaches that he believes over time have demonstrated the ability to provide a more pleasant experience for children. Those suggestions include:

1. The use of topical anesthesia and slow injections.
2. Allowing parents of young children to accompany them into the operatory and asking the parents to either be silent or limit their discussions to nonprocedural related topics.
3. Offer pleasing distractions, such as TV, DVDs, Music CDs, headsets, etc. In addition, the children should have control over these devices.
4. Simple and positive communication, focusing praise on observed cooperative behavior. Efforts should be made to have 3 to 4 times more positive comments than negative or controlling comments. In addition, threats or promises about either negative or positive consequences to come at the end of treatment should be kept at minimum, as children live in the moment.
5. Brief breaks should be offered frequently regardless of how the child behaves.

Additional chapters in the *Changing Behaviors* heading provide excellent overviews of the biological and cognitive perception of pain, fear, and anxiety, as well as how improving the dental patient's self-efficacy can ultimately improve oral health behaviors. Hittelman and Bahn provide excellent tables that include educational, pharmacological, behavioral/interpersonal, and biomechanical strategies for the management of pain experiences. In addition, they provide tables regarding pain factors affecting experience, approaches to pain control in treatment, pain threshold responses, and behavioral strategies to raise pain response thresholds.

Finally, the *Professional Practice* heading provides valuable information with regard to treating individuals with special needs and community efforts to impact the delivery of care, health behavior and the treatment of individuals with diabetes, effective communication training in dental education, and community health promotion. Overall this is an excellent working text that would be a welcome addition to any dental library. It is, as Mostofsky, Forgione, and Giddon note, "an entry [in]to the impressive literature on behavioral dentistry." It provides a wealth of information that will, if given time and practice, "offer practical solutions that can be implemented without burdensome cost or effort to both the dental team and the patient."

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## **Dental Hygiene Research Center Old Dominion University**

Gayle McCombs, RDH, MS

*Gayle McCombs, RDH, MS, associate professor and director, Dental Hygiene Research Center, Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University.*

On October 3, 2006, Gov Timothy Kaine joined Old Dominion University President Roseann Runte and Dean Andrew Balas for a ribbon cutting ceremony to mark the grand opening of the Dental Hygiene Research Center (DHRC) and the newly renovated Health Sciences Building. Gayle McCombs, director of the DHRC, was on hand to welcome the governor and share the significance of the Center. The DHRC, established in 2000, is the first facility dedicated solely to dental hygiene research, located within a dental hygiene program.

The \$9.3 million, 2-story facility allowed the consolidation of the College of Health Sciences into one building. More than 1800 students are enrolled in the college's programs in dental hygiene, nursing, physical therapy, environmental health, nuclear medicine, cytotechnology, community and public health and medical technology. The 80 000 sq ft building now features the DHRC, laboratories, classrooms, and a 30-station dental hygiene clinic. In addition, the building hosts a hospital ward, assessment and motion analysis labs, human diagnostic research center, and fully mediated classrooms and labs.

The DHRC, a stand alone facility housed adjacent to the Dental Hygiene Care Facility, provides designated clinical and laboratory space whereby faculty and students can conduct clinical and laboratory research. Typically, research is centered around the development of safe, effective measures to prevent and treat common oral conditions; expand knowledge of occupational risk assessment and ergonomic issues related to the practice of dental hygiene and other healthcare professionals; support claims related to dental techniques, products, and devices; and explore the relationship between oral and systemic health. The Center is dedicated to conducting quality, clinical, and population-based research to explore diagnosis, pathogenesis, and treatment of conditions that are related to overall health in order to advance oral and general health through inter- and multidisciplinary research in collaboration with academic institutions, medical facilities, private industry, and the community. The DHRC represents a dental hygiene research paradigm, unique for undergraduate and graduate education because currently no other dental hygiene program maintains such a facility.

Research is an integral and essential component of the School of Dental Hygiene's educational mission whereby students experience the link between theory and practice. The faculty believe that, broadly defined, research is one of the most valuable parts of the education experience, which helps build a foundation for students' life long learning. Students and faculty work together to create new knowledge through discovery, and disseminate research findings through scholarly publications and presentations. The faculty strongly believe that mentoring and experiential learning are important educational tools. This complementary relationship has the ability to bring together real life experience and learning. Through the mentoring process, faculty help move students through the rigors of the curriculum while fostering research experiences.

The program has initiated several strategies to increase research activity. For example, undergraduate students who are interested in graduate school are identified early in the program so they can be linked with a faculty mentor who will help guide them through the educational process. Faculty help students choose a topic, design and implement a research project, and facilitate the scholarly dissemination of findings. All students are enrolled in a research course, which is one of the core courses in the accelerated BSDH to MSDH curriculum, during the fall of their senior year. Accelerated courses allow

undergraduate students to enroll in a course for graduate credit that can be applied to requirements for both BSDH and MSDH programs. If students are interested in the graduate program, they are encouraged to develop an undergraduate research proposal, which will become their thesis or non-thesis project during graduate school. Students enrolled as a graduate student, will be mentored in a similar manner and most likely will become involved in a current line of research.

To support the mission of the DHRC, faculty prepare dental hygienists for leadership roles in health care, research, education, and industry through an innovative curricula leading to baccalaureate (entry-level and degree completion) and master's degrees. The sense of excitement and accomplishment that students feel as they move through the program is obvious.

Currently there are several projects underway looking at toothwhitening:

Vital Tooth Whitening Effects on Tooth Color Satisfaction, Self-Perceived Dentofacial Appearance, and Self-Esteem

Vital Tooth Whitening Effects on Dental-Health Related Quality of Life in Older Adults

Effects of Over-the-Counter Tooth Whitening on Oral Health Interests and Values

Exploring the Relationship Between Tooth Whitening and Obsessive Compulsive Behavior

Selected other research activities include:

In Vitro Comparative Evaluation of the Traditional Rotating Disposable Prophylaxis Angle with the Newly Designed Reciprocating Disposable Prophylaxis Angle on Extrinsic Stain Removal

Effects of Five Different Finger Rest Positions on Arm Muscle Activity During Hand Scaling by Dental hygiene Students

Concentration of Bisphenol A in Blood After Placement of Dental Sealants

Bacterial Effects of Cold Plasma Technology on *Geobacillus Stearothermophilus* and *Bacillus Cereus* Microorganisms

ADHA's commitment to providing funding for so many student and faculty research projects over the years has helped expand the research body of knowledge in dental hygiene and allowed for growth of the Center.

For More information visit the Dental Hygiene Research Center webpage at: <http://www.odu.edu/dental>

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## Effect of Treating Periodontal Disease on Cardiovascular Markers

Karen B Williams, RDH, PhD

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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 infections cause changes in traditional and novel cardiovascular risk factors: results from a randomized controlled clinical trial

**D'Aiuto, Francesco. Parkar, Mohamed. Nibali, Luigi. Suvan, Jean. Lessem, Jan. Tonetti, Maurizio S. American Heart Journal. 151(5):977-84, 2006 May.**

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#### **Abstract**

**Background.** Chronic infections, such as periodontitis, are associated with increased risk of systemic diseases driven by a persistent low-grade systemic inflammation and metabolic changes. Severity of periodontitis has also been associated with increased systolic blood pressure (BP). However, the issue remains poorly investigated. We aimed to estimate the effect of periodontal therapy on traditional and novel cardiovascular risk factors in systemically healthy individuals who have periodontitis.

**Methods.** We enrolled 40 otherwise healthy patients with severe chronic generalized periodontitis in a 6-month pilot intervention trial. Individuals were randomized either to a standard course of periodontal therapy (subgingival scaling and root planing) or an intensive one including the adjunctive use of a locally delivered antimicrobial (IPT).

Results. Compared to control, IPT produced significant reductions in a cluster of inflammatory markers at 1 month (P = .041) and 2 months (P = .006) months together with an improvement in lipid markers at 2 months (P = .032) and 6 months (P = .043) after therapy. Intensive periodontal therapy (IPT) produced greater reductions in IL-6 at 1 (0.4 ± 0.2 ng/L difference, 95% CI 0.03-0.9, P = .0284) and 2 months (0.3 ± 0.2 ng/L difference, 95% CI 0.1-0.8, P = .028), together with decreases in C-reactive protein (0.4 ± 0.2 mg/L difference, 95% CI 0.01-0.8, P = .044) and total cholesterol (0.3 ± 0.1

mmol/L difference, 95% CI 0.04-0.6,  $P = .025$ ). Moreover, a  $7 \pm 3$  mm Hg decrease in systolic BP was observed at 2 months in the IPT group (95% CI 1-12,  $P = .021$ ), and this difference was greater in current smokers ( $14 \pm 5$  mm Hg 95% CI 3-25,  $P = 0.012$ ). Intensive periodontal therapy subjects exhibited a  $1.53\% \pm 1.20\%$  (95% CI 1.05-2.24,  $P = .029$ ) and  $2.00\% \pm 1.42\%$  (95% CI 0.98-4.09,  $P = .057$ ) decreases in cardiovascular risk scores (Framingham) at 2 and 6 months, respectively, when compared to those in the standard group.

**Conclusions.** Our findings suggest that intensive periodontal treatment reduces systemic inflammatory markers and systolic BP, and improves lipid profiles with subsequent changes in cardiovascular risk when compared to standard therapy.

### **Commentary**

In recent years, considerable attention has been given to the link between periodontal infections and cardiovascular health. Much of the current knowledge regarding the association between periodontitis and cardiovascular problems has been derived from observational studies (primarily cohort and case-control designs). While these studies suggest that periodontitis may increase the risk of myocardial infarction and stroke, as well as be a contributing factor to atherosclerosis and endothelial function, there is also the possibility that these associations are confounded by other common risk factors for cardiovascular diseases. This study was one of the first to experimentally examine the impact of 2 periodontal treatment interventions on common systemic markers of inflammation (that are related to adverse cardiovascular outcomes). The key feature of this study was the random assignment of subjects, who had at least 50% of their dentition with pocket depths exceeding 4 mm and radiographically evident bone loss, to either the 'standard of care' or 'intensive' intervention. The standard of care intervention was comprised of scaling and root planing with local anesthesia completed at one visit lasting between 4 hours and 6 hours. The intensive intervention included scaling and root planing similar to standard of care but with adjunctive use of local delivery of minocycline microspheres (Arestin®, OraPharma). Patients were reexamined and had blood drawn for assessment of inflammatory markers at 2 months and 6 months. An important factor in this study was that the authors determined that the groups were equivalent with respect to their demographic, systemic health, and inflammatory marker values. This is important because any changes that are observed at 2 months and 6 months are more likely attributed to the effect of the intervention, not the fact that groups were not equal at the onset of the project. Results from this study suggest that the addition of Minocycline microspheres resulted in minimal differences in clinical outcomes between the groups at 6 months. Change in periodontal pathogens was not evaluated in this study, so one cannot determine if this lack of difference between the 2 treatments extended to subgingival flora. However, there was a different pattern observed for markers of inflammation. Six months after treatment was completed, the C-reactive protein, IL-6, and lipid markers were significantly lower for the intensive treatment group compared to the standard treatment group. Since C-reactive protein, IL-6, and lipid markers have been shown to be significant predictors of future cardiovascular events, reduction of these markers could have clinical implications. One cannot necessarily conclude that intensive periodontal treatment will reduce future adverse cardiovascular events in all patients; however, reducing systemic inflammation by aggressively treating periodontal infections may be important as part of an overall plan for reducing risk in otherwise healthy patients. The authors caution readers not to over generalize these results to all patients with generalized periodontitis as the sample was small and because this study did not establish that severe periodontitis has a systemic effect.

### **Treatment of Periodontitis and Endothelial Function**

**Maurizio S. Tonetti, D.M.D., Ph.D., Francesco D'Aiuto, D.M.D., Ph.D., Luigi Nibali, D.M.D., Ph.D., Ann Donald, Clare Storry, B.Sc., Mohamed Parkar, M.Phil., Jean Suvan, M.Sc., Aroon D. Hingorani, Ph.D., Patrick Vallance, M.D., and John Deanfield, M.B., B.Chir. *New Eng J Med* 356(9): 911-920; 2007 March.**

Department of Oral Health and Diagnostic Sciences, University of Connecticut Health Center, Periodontology Unit, Eastman Dental Institute and Hospital, University College London, Center for Clinical Pharmacology, University College London, and the Vascular Physiology Unit, University College London and Great Ormond Street Hospital for Sick, London.

## **Abstract**

**Background.** Systemic inflammation may impair vascular function, and epidemiologic data suggest a possible link between periodontitis and cardiovascular disease.

**Methods.** We randomly assigned 120 patients with severe periodontitis to community-based periodontal care (59 patients) or intensive periodontal treatment (61). Endothelial function, as assessed by measurement of the diameter of the brachial artery during flow (flow-mediated dilatation), and inflammatory biomarkers and markers of coagulation and endothelial activation were evaluated before treatment and 1, 7, 30, 60, and 180 days after treatment.

**Results.** Twenty-four hours after treatment, flow-mediated dilatation was significantly lower in the intensive-treatment group than in the control-treatment group (absolute difference, 1.4%; 95% confidence interval [CI], 0.5 to 2.3;  $P=0.002$ ), and levels of C-reactive protein, interleukin-6, and the endothelial-activation markers soluble E-selectin and von Willebrand factor were significantly higher ( $P<0.05$  for all comparisons). However, flow-mediated dilatation was greater and the plasma levels of soluble E-selectin were lower in the intensive-treatment group than in the control-treatment group 60 days after therapy (absolute difference in flow-mediated dilatation, 0.9%; 95% CI, 0.1 to 1.7;  $P=0.02$ ) and 180 days after therapy (difference, 2.0%; 95% CI, 1.2 to 2.8;  $P<0.001$ ). The degree of improvement was associated with improvement in measures of periodontal disease ( $r=0.29$  by Spearman rank correlation,  $P=0.003$ ). There were no serious adverse effects in either of the two groups, and no cardiovascular events occurred.

**Conclusions.** Intensive periodontal treatment resulted in acute, short-term systemic inflammation and endothelial dysfunction. However, 6 months after therapy, the benefits in oral health were associated with improvement in endothelial function.

## **Commentary**

This recently reported study provides additional experimental evidence that periodontal treatment of patients with severe generalized periodontitis has an impact on systemic health. Otherwise healthy subjects ( $n=120$ ) were invited to participate if they had probing pocket depths of  $> 6$  mm and alveolar bone loss of  $> 30\%$  evident on more than 50% of their teeth. Patients were randomly assigned to receive either supragingival scaling and polishing (control) or intensive periodontal therapy, comprised of scaling and root planing with anesthesia, removal of hopeless teeth, and local drug delivery with minocycline microspheres (Arestin®, OraPharma). At baseline and again at 2 months and 6 months, subject received comprehensive periodontal examinations along with assessment of their endothelium-dependent vasodilatation and serum samples of endothelium activating factors and markers of systemic inflammation. Endothelium-dependent vasodilatation (a measure of vascular function) is an important marker as it occurs early in the development of arterial disease, and like the collected inflammatory markers, has been shown to be a predictor of future cardiovascular events. Once again, groups were equivalent at the beginning of the study with regard to factors that might influence the markers of inflammation and vascular function outcomes. Results showed that the intensive periodontal treatment resulted in significantly ( $p<.05$ ) lower plaque scores, less gingival bleeding, and fewer periodontal lesions than observed in the control group. Additionally, vascular function was significantly better in the intensive treatment group than in the control group at both 2 months and 6 month evaluations; although, at 24 hours after the periodontal intervention, the intensive group had a transient decrease in function compared to the control. Markers of endothelium activating factors followed the same trend as vascular function measures. Markers of systemic inflammation (C-reactive protein and IL-6) showed a transient increase at 24 hours, but were not different between the 2 intervention groups at 2 months and 6 months. This study adds to the body of evidence regarding the periodontal-cardiovascular connection. The authors hypothesized that one possible mechanism for this effect may relate to direct effect of pathogens and their by-products on endothelial cells during the transient post-treatment bacteremia. Laboratory studies have shown that *P. gingivalis* has the potential to invade endothelial cells. Also, periodontal pathogens might initiate a systemic inflammatory response that affects the cells lining vascular pathways. Clinically, these results suggest that aggressive treatment of periodontal disease does impact predictors of cardiovascular events; whether these changes would contribute to actual differences in disease rates of atherosclerosis and cardiovascular events in the population remains to be determined.

## **The Bottom Line**

There continues to be a large body of evidence investigating the possible relationship between periodontal disease and adverse cardiovascular outcomes. Early studies showing equivocal results on the relationship between chronic periodontal infections and systemic health often did not have clear criteria for the diagnosis of periodontitis. These 2 studies can certainly be considered best evidence based on numerous factors. The diagnostic criteria for study entry allow readers to have a clear understanding that participants in the 2 studies had moderate and severe chronic periodontal infections, respectively, when the studies were initiated. Additionally, the experimental designs, which used random assignment for allocation of subjects to treatment groups, along with assessment of baseline equivalence between groups, provides further confidence that the observed differences at the end of the study can be attributed to the interventions. The clinical implications of this study to day to day dental hygiene practice may not be directive for treatment planning but have logical value to patient management. Logically, these results suggest that chronic periodontitis is an inflammatory event that may have both direct and indirect effect on systemic markers of inflammation. Systemic inflammation is known to predispose individuals to various health risks. Any intervention that reduces chronic infection and reduces signs of systemic inflammation cannot be bad. This suggests that intensive treatment (scaling and root planing with anesthesia and local drug delivery) for subjects with moderate to severe disease may have a positive impact on systemic inflammation. For dental hygienists, this is critically important. Recent literature suggests that patients with moderate to severe periodontal disease are not receiving appropriate care, nor continuing supportive care at appropriate intervals in general dental practices (Cobb et al and Dockter et al). Since this is the most common practice site in which dental hygiene care is rendered, this also suggests that hygienists may be responsible for the substandard care. The literature is unequivocal about the need for anesthesia for providing thorough scaling and root planing. When patients express discomfort with scaling and root planing, clinicians back off and opt for less aggressive care, even when it's indicated. Dental hygienists must consider periodontitis a chronic infection that requires intensive therapy with anesthesia and local drug delivery when appropriate. Routine prophylaxes at 6-month intervals, then, would not only be considered inappropriate but would constitute neglect.

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

Intensive treatment of moderate and severe periodontal disease has an impact on markers of systemic inflammation at 2 months but has the greatest effect 6 months after treatment.

Markers of systemic inflammation have been shown to be predictive of adverse cardiovascular future events. Although the evidence does not directly support that treating periodontitis intensively will improve cardiovascular health, it does suggest that treatment is associated with concomitant reductions in systemic inflammation.

## **Summary**

Dental hygiene clinicians must begin to think of periodontitis as a chronic disease, similar to diabetes or hypertension, that requires a different approach to management. Historically, the culture of dentistry has been procedure-based rather than disease-based. If patients have caries or fractured teeth, defined restorative procedures can "repair" the dental defects. A prophylaxis will not "repair" the chronic periodontal infection any more than cleaning an infected wound will cure the infection. Thinking of periodontitis as a chronic infection that can impact systemic health is a different paradigm for practice. Dental hygienists are responsible for the level of care most patients in general practice receive, and need to be aware of the implications of less than ideal care. Intensive periodontal therapy for moderate to severe disease may serve to reduce risk factors for adverse systemic conditions.

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## Life-Long Learning: Lessons from a Journal Study Club

Christine P Klausner, RDH, BS, MS and Anne E Gwozdek, RDH, BA

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*Evaluation of scientific literature, promoting the delivery of evidence-based care, became the focus of a group of dental hygiene colleagues. The "Journal Study Club" (JSC) was established from this concept. JSC members discuss and evaluate professional issues utilizing research-based literature. Topics include patient care, public health/access to care, technology, modalities of treatment, and professional issues. For each topic, one member serves as a program facilitator researching the scientific literature on an agreed upon topic, chooses appropriate articles, and disseminates the articles to the members to read prior to meeting. Discussion at the study club event follows the format of examining literature content, relevance, significance, evidence accuracy, and application to clinical practice. This process supports dental Hygienists' commitment to life-long learning and the practice of evidence-based care, while providing a valuable venue for continuing dental hygiene competence and professional development.*

**Keywords:** evidence-based care life-long learning, study club journal club

### Introduction

The dental and dental hygiene professions are characterized by a number of recognized study clubs that bring local colleagues together to enhance knowledge and skills related to their profession. Christiansen refers to the study club as "a tradition in dentistry that has been lost and needs to be revived."<sup>1</sup> Leser writes that study clubs "provide an incentive for personal and professional growth, leading to better patient care."<sup>2</sup> Marchant-Turner describes a 23-year experience in a dental hygiene study club as an experience in which she "learned, and continues to learn, about all aspects of dentistry that otherwise would have been missed."<sup>3</sup>

Research is the scientific basis for health care-related practice. Exposure to research information and understanding the research process is important for translating these findings into clinical practice. Computerized databases, journals, continuing education meetings, and study clubs can provide assistance in finding the best evidence.<sup>4</sup>

A small group of dental hygienists in Ann Arbor, Mich, are using a journal club as a way to evaluate clinical treatment modalities, enhance critical assessment skills, and consider peer-reviewed literature to remain abreast with topics related to a professional body of knowledge in dentistry and dental hygiene. The Journal Study Club (JSC) serves as an alternative to the traditional continuing education programming by offering several advantages. The format promotes interactive participation, permitting topic selection relevant to needs and interest of the members. The JSC also provides flexibility of scheduling and allows the group to determine the number and professional diversity of the membership to best serve the group.

The JSC, with proper organization, planning, expertise, interest, and commitment, provides a format for the enhancement of knowledge and skills for the dental hygiene practitioner. The club's discussions are based primarily from articles selected from peer-reviewed journals. Peer-reviewed journals include manuscripts that have been critically analyzed and reviewed by experts in the field prior to approval for publication. This review format serves to ensure the quality and relevance of the topic and the appropriateness of the science and research. Evaluation of scientific literature, promoting the delivery of evidence-based care, is the focus of one group of dental hygiene colleagues. The purpose of this paper is to provide a brief review of the literature on the topic of journal study clubs and to describe an innovative approach to a study club in Michigan.

## **Review of the Literature**

The American Dental Association Positions and Statements defines Evidence-based Dentistry (EBD) as "an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient's oral and medical condition and history, with the dentist's clinical expertise and the patient's treatment needs and preferences."<sup>5</sup> Keeping abreast of the latest information requires that clinicians read extensively, attend courses, and take advantage of the Internet and electronic databases to search for scientific articles.

Clinicians are expected to provide safe and effective care based on the evidence. In a guest editorial in the *American Journal of Critical Care*, Kleinpell states, "Nursing research promotes a scientific basis for clinical nursing practice. Yet, many nurses are hesitant to read research, often citing uncertainty about how to critique research and difficulty with interpretation. Reading research and promoting understanding of the research process is important for translating research findings into clinical practice."<sup>6</sup>

A strategy to increase awareness of evidence-based decision making methodology is to offer professional development programs that teach these concepts and skills, including asking precise questions, online searching of databases and developing, or strengthening critical analysis skills.<sup>7</sup> Study clubs support a professional development format while embracing the concepts of adult learning.

Lieb describes the adult learner as autonomous and self-directed, goal-oriented, relevancy-oriented, and practical.<sup>8</sup> Kuhne identifies adults as pragmatic learners who prefer taking control over personal learning and drawing on their experiences as a resource for learning.<sup>9</sup> Educational research identifies learning principles important to the adult learner, which include relating the task to the immediate work experience or long term goals of the learner, presenting the learning objectives in the form of actual situations or patient problems, use of problem solving, use of multiple teaching formats, active learner involvement, and use of frequent, constructive feedback.<sup>10</sup>

In 1999, a survey was sent to 35 dental hygienists in British Columbia, who participated in 3 separate study clubs from September 1998 through June 1999. All study clubs employed a similar format but differed in content covered. Twenty-six surveys were returned (74% response rate). Results of the study indicate that all respondents made changes in clinical practice as a result of study club participation. Forty-two percent perceived that information supported by research was important to sustain a case for change (evidence-based). The most often reported reasons for choosing a study club format were: (1) control over topics (65%); (2) small group/personal atmosphere (65%); (3) social interaction with peers (62%); and (4) convenience 31%.<sup>11</sup>

A variation of the study club format is the journal club. A journal club is broadly defined as a group of individuals who meet regularly to discuss articles in current medical journals. The primary role of the journal club is to benefit the individual through increased reading and critiquing skills.<sup>12</sup> Sheehan found that participation in a journal club developed members' analytical, critical, evaluative, reflective, and presentation skills.<sup>13</sup>

This club format is most often attributed to the medical and nursing professions and integrated within graduate medical education.<sup>14,15</sup> The first documented organization of a journal club in North America appears to be Osler's, created in 1875

in Montreal.<sup>14</sup> The primary purpose of initial journal clubs was to improve physicians' knowledge related to scientific advances.<sup>11</sup> Over time, the purpose of journal clubs expanded to include ways to develop or enhance the student's critical appraisal skills and educate the student in research design, medical statistics, clinical decision theory, and clinical epidemiology.<sup>13</sup>

The importance of evidence-based practice and the use of journal clubs for nursing professional development and knowledge transfer to clinical practice have been documented in the literature. Dissemination of information alone is insufficient to improve the practice of health care providers. Behavior change strategies, which have shown an impact on practice, include workshops providing interaction among participants.<sup>16</sup> The journal club has been cited as a bridge between research and practice, fostering application of research to the clinical setting.<sup>17</sup>

In 2002, the American Journal of Critical Care (AJCC) debuted with the "AJCC Journal Club." Each issue features an AJCC Journal Club article with a Web site link that provides questions and discussion points to stimulate formation of a journal club and resulting discussion in which participants can evaluate new research and its applicability to clinical nursing practice.

A search of the literature found one publication related to the use of journal study in dental education. The paper described the use of literature study in a General Practice Residency (GPR) program at St. Joseph's Hospital Health Center in Syracuse, NY.<sup>18</sup> The authors emphasized that review of scientific literature is important in post-graduate dental education as it chronicles the advancement in each of the specialties providing the foundation for critical analysis and an evidence-based approach to research. Advanced Education in General Dentistry (AEGD) and post-doctoral dental education programs incorporate journal clubs within their curriculum, with residents focusing on integrating the results of research analysis within their delivery of oral health care.

Based on literature that considered the use of journal clubs in post-graduate health care education, key features of successful journal clubs emerge. Alguire and Sidorov reviewed formal research studies when examining journal club effectiveness in resident medical specialties.<sup>10,19</sup> Key characteristics contributing to successful internal medicine journal clubs were identified by Sidorov and parallel those cited in the British Columbia dental hygiene study club survey.<sup>11,19</sup> These include club longevity (2 or more years) and levels of attendance (50% or more attendance of eligible participants). Other factors included provision of food, selection of original research articles, mandatory attendance, and perceived importance of the club by the program director. The small number of participants (program size) and formal instruction in biostatistics and clinical epidemiology were also considered important.<sup>19</sup>

A major goal of most journal clubs is to teach critical evaluation skills.<sup>13</sup> This skill is important for any health professional reviewing information related to their field of practice. The journal club format demands an understanding of research design, research methodology, and statistics. There are resources that can assist with educating a group regarding these basic components to literature evaluation. Jane L. Forrest, RDH, EdD, and Syrene A. Miller, BA, have authored a series of articles published in the *Journal of Dental Hygiene* and the *Journal of Contemporary Dental Practice* related to evidence-based decision making, evidence-based practice, research analysis, and critical appraisal.<sup>20,21,22,23</sup> Once these areas are comfortably mastered, they can be applied to literature review.

There are additional resources available that can assist the group with the critical evaluation of the literature. Checklists often provide a simple, organized approach to literature review. Burnstein, Hollander, and Barlas demonstrated that the use of a structured review instrument (formalized checklist) prompting participants to review methods and design of the study reported in an article, significantly improved the perceived educational value of journal clubs.<sup>24</sup> The application of this organized form of study is a viable mechanism for reviewing scientific literature in a systematic fashion. A number of resources are available formatting a systematic review and analysis. Key word Internet searches provide relevant links to sources often associated with research-based institutions. In the first 6 issues of the year 2000, *The Journal of Prosthetic Dentistry* presented a series of articles offering the practitioner different paradigms for clinical decision making. These articles were written to assist the reader in determining whether information presented in the dental literature is valid and/or technically correct and whether it is applicable and usable for a specific treatment in question.<sup>25</sup>

## **Journal Study Club Organization**

The Journal Study Club (JSC) based in Ann Arbor, Mich, has a formal document outlining goals, administration, financing, educational objectives, and evaluation. Members are required to prepare for the JSC event by reading and critically analyzing up to 5 research articles prior to the meeting date. A member serves as president and is responsible for surveying members requesting information on topics for future consideration and providing the results of event evaluation in an annual report.

Table I provides an outline for the framework for the development of the JSC.

**Table I: Framework for the development of the Journal Study Club (Ann Arbor, Mich)**

<b>Framework for the development of the Journal Study Club (JSC)</b>
Identify small group (5-8) of professional colleagues and formally invite to participate.
<p>Develop framework for:</p> <ul style="list-style-type: none"> <li>• Administration             <ul style="list-style-type: none"> <li>○ Composition                     <ul style="list-style-type: none"> <li>▪ Dental hygienists from different practice environments</li> <li>▪ Dental hygienists from local component</li> <li>▪ Dental hygienists with a variety of expertise</li> </ul> </li> <li>○ Format                     <ul style="list-style-type: none"> <li>▪ Meal with social time</li> <li>▪ Business meeting</li> </ul> </li> <li>○ Structure                     <ul style="list-style-type: none"> <li>▪ Formal organization with officers</li> <li>▪ Rotating positions of leadership</li> <li>▪ Informal gathering</li> </ul> </li> <li>○ Leadership                     <ul style="list-style-type: none"> <li>▪ President/Chairperson</li> <li>▪ Secretary/Treasurer</li> <li>Rotating positions                             <ul style="list-style-type: none"> <li>▪ Host</li> <li>▪ Program facilitator</li> </ul> </li> </ul> </li> </ul> </li> <li>• Finances             <ul style="list-style-type: none"> <li>○ Formal dues structure</li> <li>○ Donations as needed</li> </ul> </li> <li>• Needs assessment format             <ul style="list-style-type: none"> <li>○ Topic identification</li> <li>○ Current issues, specific interests</li> <li>○ Hosts, facilitators, meeting dates</li> </ul> </li> <li>• Membership criteria/responsibilities</li> <li>• Educational objectives and methods             <ul style="list-style-type: none"> <li>○ Topic identification</li> <li>○ Guidelines for critical appraisal of professional research</li> <li>○ Format for session (round table discussion, lecture, field trip, guest presenter)</li> </ul> </li> <li>• Instructors/facilitators (members, guests)</li> <li>• Evaluation format</li> </ul>
<p>Elect President of JSC. Responsibilities include:</p> <ul style="list-style-type: none"> <li>• Maintain membership records and JSC meeting records</li> <li>• Submit of necessary information to Michigan Board of Dentistry to maintain JSC status as CEU provider. Distribute CEU certificates to participating members</li> <li>• Obtain Needs Assessment and Program Evaluation surveys from members</li> <li>• Submit written annual reports to members</li> </ul>

Additional JSC benefits include Continuing Education Units (CEU) and cost control of registration fees associated with professional programming. In 2006, the American Dental Hygienists' Association (ADHA) reported that 48 states require some form of continuing education for dental hygiene license renewal.<sup>26</sup> Most continuing education courses require that organizations apply to a credentialing body for approval to present, host, or sponsor programs that meet continuing education requirements. Organizations, professional societies, and educational institutions provide continuing education programming. The intent of most programs is to focus on an area of professional development and grant CEUs for relicensure. The participant expects the presenter will provide accurate, clear, and reliable information. The hope is that the information is "evidence-based," supporting the concept that some kind of research has been connected to the body of knowledge presented to support the legitimacy and accuracy of the information.

Registration fees related to such a program are assessed and intend to cover the costs associated with the program, providing a profit for the sponsoring group. Participants attending a continuing education course must select from a preexisting list of topics, may have to travel a significant distance to attend a program, and will incur some expense.

The JSC is a Michigan Board of Dentistry approved provider of continuing education. Since its inception in 1994, the JSC has followed the protocol prescribed by the Michigan Board of Dentistry for obtaining approval and has provided associated CEUs to its members participating in JSC activities. Expenses are limited to costs associated with hosting a meeting within a member's home (food/beverages) and fees for copying and postage for distribution of articles to members. The JSC does not assess dues nor maintain any monetary fund.

The JSC small group format allows for incorporation of adult learning principles through member consensus directing topic selections. The group effort provides an environment that supports a collaborative, critical evaluation of literature considered. The professional experience of each participant and the collective knowledge shared by the members of the group provide a rich resource of information and interchange.

## **Journal Study Club Sessions**

For all Journal Study Club (JSC) sessions, a topic and facilitator are chosen, with another member volunteering to host the event. The facilitator is responsible for selecting the research articles associated with the topic, developing a topic outline with questions to consider when reading, and disseminating materials to the members. A member facilitator may also choose to invite a "professional expert" to lead the discussion. Merits of the research articles are evaluated on the research question identified, the research design considered, methods and materials examined, evaluation of results and conclusions, and clinical application determined. Sessions also include examination of the literature content, relevance, significance, evidence accuracy, and application to professional activities. An outline for JSC meeting preparation and formatting is provided in Table II.

**Table II: Meeting preparation and format for the JSC (Ann Arbor, Mich)**

<b>Journal Study Club Meeting Preparation and Format</b>
<p>Through the use of Needs Assessment and Educational Objectives:</p> <ul style="list-style-type: none"> <li>• Topic identified</li> <li>• Program facilitator identified</li> <li>• Meeting date and host chosen</li> </ul>
<p>Program facilitator:</p> <ul style="list-style-type: none"> <li>• Researches topic</li> <li>• Provides members with up to 5 evidence-based articles</li> <li>• Develops topic outline and proposes questions</li> </ul>
<p>Member responsibility:</p> <ul style="list-style-type: none"> <li>• 2 hours reading preparation and individual critical appraisal of literature</li> <li>• 2 hours meeting/discussion</li> </ul>
<p>Meeting agenda/format presented and utilized as a discussion guide</p> <ul style="list-style-type: none"> <li>• Review of literature presented</li> <li>• Additional sources identified/presented</li> <li>• Critical analysis of literature/discussion</li> <li>• Application to clinical practice</li> <li>• Evaluation</li> </ul>

JSC discussion is engaging and spirited. Diversity of expertise of members fosters enhanced learning. Personal experience of clinicians related to practical application adds to the discussion. Evidence-based information from other sources is often submitted for consideration during discussion. Table III lists the content of JSC topics covered.

**Table III: Content covered in Journal Study Club sessions  
(Ann Arbor, Mich)**

<b>Journal Study Club Topics</b>
Vitamin A and Oral Cancer
Periodontal Debridement: Use of Ultrasonics
Dental Implants: Procedure
Dental Implants: Care and Maintenance
Selective Polishing: What is the Evidence?
Hormonal Influence on Oral Health
Dental Hygiene Process of Care: A Paradigm Shift
Dental Hygiene Process of Care: Implementation
Caries Control: In-office Fluorides
Electronic Anesthesia
Microabrasion
Teeth-Whitening: Vital Bleaching
Burning Mouth Syndrome
Periodontal Infections and Systemic Diseases
Transoral Topical Anesthesia
Managed Care in Oral Health: Does it work?
Evidence-Based Approach to Dental Hygiene Care
Exploring the Internet for the Dental Health Professional
Cultural Diversity Issues for the Health Care Provider
Bosnia: A Dental Service Mission
Periodontal Risk Factors-Risk Assessment
Aboriginal Issues with Health Care
Biofilm vs. Plaque: New Concepts
American Academy of Periodontology: Exploring the Web Site

One of the challenges of a journal club is maintaining the momentum. The organization requires individuals who will share all aspects of JSC responsibility. It requires advance preparation by participants to promote productive discussions. Communication among members is essential. Electronic means of communicating and disseminating information is streamlining this process.

## **Conclusion**

The volume of printed material and Web-based information published demands timely, critical evaluation of sources and content to ensure accuracy and relevance of information. For a group of professional colleagues, a journal club serves as

a beneficial forum to critically review scientific literature, promoting evidence-based oral health care. Commitment to life-long learning and professional development are enhanced by journal club participation.

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## **Notes**

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## **Predictors of Student Success in an Entry-Level Baccalaureate Dental Hygiene Program**

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***Purpose.*** The purpose of this study was to measure the utility of various predictors used by the Old Dominion University Gene W. Hirschfeld School of Dental Hygiene baccalaureate degree dental hygiene program in selecting dental hygiene students who are most likely to graduate and be successful in passing the National Board Dental Hygiene Examination (NBDHE). The following factors were examined: grade point average (GPA); science GPA; final grade in various prerequisite courses; final grade in first-year dental hygiene courses; academic setting where prerequisite courses were completed; multiple attempts to achieve a passing course grade; and admissions criteria points (ACP).

***Methods.*** The sample selected for study consisted of the academic records of dental hygiene students admitted to the program from 1998 to 2002 ( $n = 235$ ), who would have been eligible to take the NBDHE from 2000 to 2004. Data were analyzed using multiple logistic regression to determine success as measured by graduation ( $n = 146$ ). With NBDHE as the criterion variable, data were analyzed using the multiple linear regression to determine successful entry into the profession ( $n = 130$ ); significance was predetermined at the 0.05 level.

***Results.*** Data analysis revealed that final course grade in oral pathology was a significant predictor of successful graduation ( $P = 0.0008$ ). Variables that predicted NBDHE success were final course grade in oral pathology, final course grade in oral anatomy and histology, and the ACP rating ( $P < .0001$ ,  $P < .0001$ , and  $P = .0245$ , respectively). There was no statistically significant relationship for other variables.

***Conclusion.*** Final grades in oral pathology and oral anatomy and histology can significantly predict graduation and NBDHE success at this institution, suggesting that educators look to improving student performance after admission to the program to improve the likelihood of success. Additionally, when this institution's admission variables were combined into a cluster of variables (ACP), they proved significant at predicting success.

**Keywords:** Dental hygiene education, admissions, student success, graduation, National Board Dental Hygiene Examination

### **Introduction**

Predicting academic success is a persistent challenge for dental hygiene programs whose lock-step curricula make replacing students who drop out midway through the program difficult, if not impossible. Selecting students from a pool of qualified

applicants who are most likely to succeed is the goal of dental hygiene educators throughout the country. Success is often defined as graduation within a specified time frame following enrollment. An equally challenging goal is to graduate competent oral health care providers who will pass the National Board Dental Hygiene Examination (NBDHE) and enter into the profession able to meet the needs of the community.

Numerous studies have attempted to identify what variables predict academic and professional success. Investigations of cognitive variables such as grade point averages, science course grades, and scores on standardized tests have produced mixed results in determining correlation between the variable of interest and academic success.<sup>1-5</sup> Studies of noncognitive variables, such as dental assisting experience, personality tests, and admissions interviews, have produced equally mixed results.<sup>4</sup> Other variables, such as custom-designed ranking systems utilized by some admissions committees to organize applicants prior to selection, and academic settings where an applicant took the required prerequisite courses, have been the focus of recent research.<sup>2,10-11</sup>

At the time of this investigation, there were 273 entry-level dental hygiene programs in the United States, 34 of which offered the baccalaureate degree as the entry-level credential. While accrediting agencies and institutional requirements direct that certain variables be utilized to select incoming applicants, there remains a need for each institution to be cognizant of research that will help the admissions committee make selections that benefit the institution and the community it serves as well as the prospective student.

The purpose of this study was to measure the utility of a variety of predictors that can be used to assist Old Dominion University, Gene W. Hirschfeld School of Dental Hygiene and possibly other baccalaureate dental hygiene programs in selecting dental hygiene students who are most likely to graduate within the expected time frame and pass the NBDHE. Specifically, this study sought to determine whether or not overall grade point average (GPA) at the time of application for admission; GPA in prerequisite science courses; individual final grade in prerequisite science courses, chemistry I and II, human anatomy and physiology I and II, and microbiology; individual final grade in first year dental hygiene courses, oral anatomy and histology and oral pathology, academic setting where prerequisite science courses were completed; multiple attempts to achieve a passing final grade in prerequisite science courses; and ranking score produced by a custom-designed program called admissions criteria points (ACP), are reliable predictors of success in an entry-level dental hygiene program as evidenced by graduation, and are reliable predictors of entry into the profession as evidenced by passing the NBDHE.

## **Review of the literature**

### ***Grade point average***

The study of grade point average (GPA) as a predictor variable appears often in the literature. Researchers have studied high school GPA, college course preprofessional program GPA, science and other prerequisite course GPA, and dental hygiene GPA at specified intervals and at graduation. Incoming GPA, cumulative GPA, early course average, and interim course average, are among the names that researchers use to refer to the different calculations. While the literature supports a strong correlation between GPA and success in a given dental hygiene program, the exact definition of GPA varies widely.

Thirty years ago, Rowe et al found, among other variables, that overall high school GPA and high school science GPA were significant predictors of performance in a dental hygiene certificate program.<sup>12</sup> Since that time, changes in program admissions requirements and the applicant pool have produced potential students who present with a variety of college credit.

In 1989, Shannon investigated the predictive reliability of American College Test score, high school GPA, dental hygiene GPA, college cumulative GPA, and individual college course grades. A regression equation analysis found that cumulative dental hygiene GPA was the best predictor of success on the National Board Dental Hygiene Examination (NBDHE) and that neither high school nor college cumulative GPA was a significant predictor of NBDHE success.<sup>13</sup> However, Shannon's

parameters for dental hygiene GPA included college chemistry, anatomy, physiology, nutrition, and sociology, 13 courses that another researcher might define as prerequisite or science or overall GPA.

Metzger et al examined the admissions criteria used to select students for the dental hygiene program at the University of Maryland at Baltimore to determine if a relationship existed between 4 variables and success on the NBDHE and Northeast Regional Board clinical test scores.<sup>8</sup> Total college GPA and college science GPA (both defined as the GPA for the first 2 years of undergraduate education prior to admission to the program) were analyzed along with scores on the Dental Hygiene Aptitude Test science section and a score from a 25-question personal interview. Results of the study indicate that college science GPA was the most important determinate of admissions into the program. The researchers point out that the usefulness of what they called the total college GPA may be limited, since the number of credits and types of courses that a student may have taken can vary considerably.<sup>8</sup> One high or low grade may be more likely to significantly affect the overall GPA for a student with a limited number of college courses, versus a student who has accumulated more college credits, possibly allowing the GPA to inaccurately represent student academic abilities.<sup>8</sup>

Downey et al examined the predictive reliability of GPA and Scholastic Aptitude Test scores in predicting dental hygiene program success and NBDHE score.<sup>1</sup> A retrospective review of 134 dental hygiene graduates of the Medical College of Georgia from 1996-2001 revealed that incoming overall college GPA at the time of admission was a significant predictor of a student's dental hygiene GPA, and the only variable tested that was significant at predicting NBDHE scores. Incoming overall college GPA at the time of admission to the dental hygiene program was found to be more accurate at predicting dental hygiene program success than incoming math and science GPA. The researchers did not define how many or what specific courses made up the overall GPA, incoming college GPA, or incoming math and science GPA.

Bauchmoyer et al obtained data on 173 graduates of the dental hygiene program at The Ohio State University from 1998-2002 to examine the relationship between pre-admission requirements, site of academic preparation, cumulative dental hygiene GPA, and NBDHE scores.<sup>2</sup> The purpose of this study was to investigate traditional variables such as GPA and individual course grades used by admissions committees to select applicants that had not been studied since the NBDHE format changed in 1998 to include case-based questions. Using Pearson's *r* correlations, regression analysis, and analysis of variance (ANOVA) the authors concluded that entering cumulative GPA had the strongest correlation with program success as defined as cumulative dental hygiene GPA and was closely followed by science GPA (made up of course grades in biology, chemistry I and chemistry II). NBDHE success was strongly predicted by the cumulative dental hygiene GPA, followed by the science GPA and the entering cumulative GPA.

DeWald et al analyzed the records of a sample of dental hygiene students (n=168) at Caruth School of Dental Hygiene, Baylor College of Dentistry from 1998-2003 to determine if enrolling in a board review course affected performance on the NBDHE and to confirm or reject the hypothesis that entering and/or existing GPA can be used to predict performance on the NBDHE.<sup>14</sup> Pearson's correlation coefficient was used to find the relationship between both entering and exiting GPA and NBDHE. Entering GPA was not found to be a predictor of NBDHE performance, while exiting dental hygiene GPA was found to be a strong predictor of performance on the NBDHE.

Edenfield and Hansen sought to determine if a relationship exists between dental hygiene GPA made up of different core dental hygiene course grades and scores on a mock national dental hygiene board examination and the NBDHE.<sup>15</sup> The researchers sampled 130 dental hygiene student records at Armstrong Atlantic State University between and among the years 1989 and 1995 to obtain grades in clinical dental hygiene I, II, III, and IV, periodontics, dental materials, dental anatomy and oral histology, general and oral pathology, and preventive periodontics. An early dental hygiene course average was determined from these grades. Grades were also obtained for clinical dental hygiene V and dental public health, courses taken by the students after taking a mock national dental hygiene board examination, but before taking the NBDHE. Multiple linear regression techniques were utilized to determine that the early dental hygiene course average, the interim dental hygiene course average, and the mock national dental hygiene board examination score can not predict NBDHE scores, but may play a role in estimating the probability of achieving a passing score. There was a 98% NBDHE pass rate by those students in the top 75% of high early dental hygiene course average, while those students in the bottom 25% exhibited a 62% pass rate.

Schutte and Smith investigated the predictive reliability of the American College Test score, high school GPA, first-year dental hygiene GPA, age, and dental assisting experience.<sup>3</sup> Following statistical analysis utilizing Pearson's *r* correlation coefficients and coefficients of determination, P-values were calculated and a regression equation was developed to analyze the variance associated with each predictor variable. All of the variables, including both the high school GPA and first-year dental hygiene GPA were determined to be weak predictors of NBDHE success.

### ***College Course Grades***

In addition to examining the predictive ability of (grade point average) GPA, researchers have indicated that individual course grades may have predictive ability when examined as single variables. Studies of individual course grades have included final course grades for high school courses, pre-professional college courses, college science courses, performance in online courses and performance in dental hygiene courses.<sup>2,3,11,13</sup>

Along with GPA, Shannon examined college courses in the behavioral, biological, and physical sciences for predictability.<sup>13</sup> Data were collected from 219 dental hygiene student records at 3 associate degree programs from 1983-1986 on individual course grades in human anatomy, physiology, chemistry, microbiology, psychology, pharmacology, nutrition, and sociology to determine possible predictive ability of individual courses. A stepwise multiple regression analysis demonstrated positive correlations for predicting success in the dental hygiene program for human anatomy, nutrition, sociology, chemistry, and physiology, while grades in sociology, psychology, and anatomy were most likely to predict NBDHE success.

Bauchmoyer, Carr, Clutter, and Hoberty studied 10 individual courses that comprise the preadmissions requirements and basic college science requirements for the dental hygiene program at The Ohio State University to determine whether or not a correlation existed between course grades and program and NBDHE success.<sup>2</sup> Pearson's *r* correlation was used to analyze individual course grades in program-required courses, including, biology, chemistry I and II, English, math, and psychology. The strongest correlation with program success was demonstrated by course grades in biology and chemistry and the strongest correlation with NBDHE success was demonstrated by course grades in biology and psychology. Additionally, the researchers sought to determine whether or not a correlation existed between grades in courses required after matriculation, including, anatomy, nutrition, microbiology, and physiology. Among these courses, the course grade in nutrition was found to have the strongest correlation with program success, followed in decreasing order of correlation, by anatomy, physiology, and microbiology. The course grade in physiology demonstrated the strongest correlation with NBDHE success followed in strength by anatomy, microbiology, and nutrition.

### ***Academic Setting and Multiple Attempts***

Inconclusive evidence regarding what predicts success prompts admissions committees to look beyond traditional variables used to select students who are most likely to graduate and pass the National Board Dental Hygiene Examination (NBDHE). One of the variables Bauchmoyer et al examined in their study at The Ohio State University, was the possible affect the academic setting where the prerequisite science courses were completed (4-year university or 2-year community college) had on academic achievement.<sup>2</sup> The researchers grouped students into 3 categories: those who completed all prerequisite science courses at a 4-year university; those who completed a fairly equal number of courses at both a 4-year university and a 2-year community college; and those who completed all or almost all of the prerequisite science courses at a 2-year community college. Results of analysis of variance (ANOVA) comparison revealed no significant difference in success rates for NBDHE for the 3 groups. A post-hoc Scheffé comparison indicated a significant difference for dental hygiene program success between the group who completed all prerequisite science courses at a 4-year university and the group who completed a fairly equal number of courses at both settings. The researchers suggest that consistency in site where prerequisite science courses were taken was significant to predict program success.

There is no evidence in the literature of an investigation into the possibility that passing the prerequisite science courses the first time is predictive of success. For the purpose of this study, it was hypothesized that students who needed to repeat any of the prerequisite science courses to achieve a passing grade might take longer to successfully master the dental hygiene curriculum. To efficiently educate a student and prepare him/her for success on the NBDHE, admissions committees

would like to admit individuals who will be successful in achieving the goal of entering the dental hygiene profession with the minimum resource expenditure.

### ***Custom-Designed Admissions Rating Tools***

Observation suggests that individual dental hygiene programs have developed their own rating or point system to assist in ranking applicants to determine those who will be most likely to succeed. However, limited publications are found that discuss the use of an institution's custom-designed rating system. In 1981, Metzger et al combined 4 variables: Dental Hygiene Aptitude Test science section score, science grade point average (GPA), total (GPA), and score assigned on a personal interview, into a total admission score to rank applicants for acceptance into the Dental Hygiene Program at the University of Maryland at Baltimore. The researchers sought to determine what role the total point score obtained from the 4 variables plays in selecting applicants for admission and whether or not this score predicts dental hygiene program success.<sup>8</sup> However, the statistical analysis, Pearson product-moment correlation and stepwise multiple regression routine, were performed on each of the 4 variables separately, negating the ability to confirm or reject the rating system as a predictor of success.

Edenfield and Tanenbaum sought through an ex post facto study to determine if the Admission Point Index rating system used for selection of applicants to Armstrong Atlantic State University could be used as a reliable predictor of dental hygiene program success and success on the NBDHE.<sup>10</sup> The researchers gathered data on student applications for the years 1995 through 1997, and noted the retention and graduation rates and NBDHE scores. While the custom-developed index was determined to be a reliable predictor of success, the abstract does not fully describe what variables make up this custom-designed rating system.

The goal of dental hygiene educators is to prepare competent oral health care professionals who can contribute to the profession; thus, determining what predicts success has been a persistent goal among dental hygiene admission committees. Success is achieved most efficiently when students enter the program and progress through the sequence of classes to achieve clinical competencies, and satisfy accreditation and university credit requirements within a specified time frame. Students who stop-out of the program because of a failed course, the need for extra time to complete clinical requirements, or require remediation to bring skills to a competency level, tax resources and may prevent another candidate from entering the program.

Additionally, in most all licensing jurisdictions in the United States, successful graduates must then achieve a passing score on the NBDHE as a step to becoming a licensed dental hygienist. Educators want to know whether or not certain variables that predict academic success as defined as graduation are the same as those that predict NBDHE success. Valid and reliable methods for selecting potential students who are most likely to succeed in both graduating and passing the NBDHE are sought.

## **Methods and Materials**

The variables under investigation were chosen based on the following: their prevalence as traditionally collected data on dental hygiene program applications; the evidence in the literature regarding their importance to academicians and institutions; the reported conflicting results of studies found in the literature; and the special interest of the faculty at this institution. A convenience sample was chosen using the academic records for all students admitted to Old Dominion University, Gene W. Hirschfeld School of Dental Hygiene, for the academic years 1998 through 2002 (n=235). Students are admitted to this entry-level baccalaureate degree program after having completed 2 years of prerequisite and general education courses. Students admitted to the dental hygiene program would be expected to be become eligible to take the National Board Dental Hygiene Examination (NBDHE) 2 years after admission.

Prior to initiation of the study, an exempt status proposal was submitted to the Old Dominion University, Institutional Review Board, and was approved. The following variables were extracted from admissions applications and transcripts and placed into a custom-designed spreadsheet: incoming college grade point average (I-GPA), defined as GPA at the time of application submission; grade point average in prerequisite college science courses (S-GPA), defined as chemistry

I, chemistry II, human anatomy and physiology I, human anatomy and physiology II, and microbiology; individual final course grade in college chemistry I, chemistry II, human anatomy and physiology I, human anatomy and physiology II, and microbiology; individual final course grade in first-year dental hygiene courses oral anatomy and histology and oral pathology; academic setting where prerequisite science courses were completed (4-year university or 2-year community college); multiple attempts to achieve a passing final grade in prerequisite science courses (chemistry I, chemistry II, human anatomy and physiology I, human anatomy and physiology II, and microbiology); admissions criteria points (ACP) generated by a custom-designed applicant ranking system used by the admissions committee; graduation or non-graduation within 2 years of enrollment; and NBDHE score.

The ACP combines an applicant's I-GPA, S-GPA, grades in prerequisite and general education required courses, significant educational achievements, oral health care experience, and quality and completeness of application, and ranks each applicant with an ordinal score. This instrument assigns quantitative numbers to the required admissions data and tallies the numbers into a total score. This total score is utilized to assist the admissions committee with selecting applications.

Students who completed 3 or more of the 5 prerequisite science courses at a 4-year university were categorized as 4-year university students. Students who completed 3 or more of the five prerequisite science courses at a 2-year community college were categorized as 2-year community college students. Data were extracted from student transcripts regarding science courses that were repeated to achieve a passing grade. Students who did not qualify for graduation within 2 academic years from the time of admission into the program were non-graduates and students who did not pass the NBDHE on the first try were considered to have failed.

This study investigated the relationship among quantitative variables; therefore, a regression approach was used to determine whether admission variables are reliable predictors of success in an entry-level baccalaureate dental hygiene program as evidenced by graduation from the program and reliable predictors of successful entry into the profession as evidenced by the NBDHE. Means, percentages, and frequencies were used to analyze the data. Multiple logistic regression analysis was used to determine the relationship between variables and graduation. Multiple linear regression analysis was used to determine the relationship between variables and NBDHE. In all cases of analysis, a p-value of less than or equal to 0.05 level was tested to determine significance. To confirm the results of the initial regression analysis, the following additional approaches were employed: backward elimination method of selection of variables and R-square method, residual analysis, and analysis of variance.

## **Results**

Following data collection, frequency tables were examined to determine sample sizes of complete records for statistical treatment. Multiple logistic regression to determine success as measured by graduation was performed on a sample size of 146 complete records and multiple linear regression to determine NBDHE success was performed on a sample size of 130 complete records. The frequency tables revealed that a significant number of missing data values occurred for individual final course grades in chemistry II and human anatomy and physiology II. At the time of application submission, many candidates are enrolled in these courses, making final grades unavailable at the time of data collection. Therefore, these 2 variables were omitted from analysis to avoid further reducing the sample sizes.

Because the dependant variable, graduating within 2 years of beginning the program or not graduating within 2 years of beginning the program, is a dichotomous variable, a multiple logistic regression model was used to analyze the variables. The variable, academic setting where prerequisite science courses were completed (4-year university or 2-year community college) was analyzed independently from the other 9 variables because this data set had 2 relating or complimenting values, 4-year university and 2-year community college. Regression analysis performed on this separate data set (n=235) revealed no statistically significant relationship between the academic settings and graduation or NBDHE success.

Multiple logistic regression analysis of the other 9 variables indicated that all but one, individual final course grade in oral pathology, were not significant at 0.05 (Table I). A backward elimination of selection of variables approach was applied to determine a smaller set of variables. Table II displays the variables removed from the data set during backward elimination analysis, indicating the removal of 8 of the 9 variables until the remaining variable, individual final course grade in oral pathology, was significant at the 0.05 level of significance (p-value 0.0008) (Table III).

**Table I. Results of multiple logistic regression: variables associated with graduation**  
 (n = 146; df = 1)

Variable	Estimate	Standard Error	Wald chi-square	Pr > ChiSq
API	0.0253	0.0572	0.1962	0.6578
I-GPA	0.4957	1.1356	0.1905	0.6625
S-GPA	-0.6177	1.4897	0.1719	0.6784
Multiple Attempt	-.0606	0.3864	0.0246	0.8753
Chemistry I	-0.4975	0.6298	0.6240	0.4296
Microbiology	-0.5773	0.5521	1.0932	0.2958
Anatomy I	-0.3987	0.6398	0.3882	0.5332
Oral Anatomy	0.7684	0.4938	2.4221	0.1196
Pathology	1.6491	0.5013	10.8226	0.0010*

\*significant at the 0.05 alpha level

**Table II. Results of chi-square for cross tabulation between variables and graduation**

Step	Variable removed	Number In	Wald chi-square	Pr > ChiSq
1	Multiple Attempt	8	0.0246	0.8753
2	S-GPA	7	0.1712	0.6790
3	ACP	6	0.1361	0.7122
4	I-GPA	5	1.3493	0.2454
5	Anatomy I	4	1.3527	0.2448
6	Oral Anatomy	3	2.3890	0.1222
7	Chemistry I	2	1.8452	0.1743
8	Microbiology	1	3.2298	0.0723

**Table III. Final results of multiple logistic regression: variables associated with graduation**

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Pathology	1	1.0967	0.3285	11.1492	0.0008*

\*significant at the 0.05 alpha level

The dependent variable, NBDHE score, was measured in ratio scale, prompting the use of multiple linear regression analysis, which revealed that 2 variables, individual final course grade in oral pathology and individual final course grade in oral anatomy and histology, are significant predictors (Table IV). A backward elimination method of selection of variables yielded 3 significant variables with an R-square value equal to 0.5581 (See Table V). Additional analysis utilizing the backward elimination method indicated the removal of 5 variables until the 3 variables remaining were significant. A selection of variables R-square test confirmed this selection as appropriate on which to perform further analysis. Multiple linear regression testing was run a second time to determine the most significant predictors of the 4 variables selected by backward elimination. The second multiple linear regression analysis yielded the variables, individual final course grade in oral pathology, individual final course grade in oral anatomy and histology, and ACP, as statistically significant predictors of NBDHE success (Table VI).

**Table IV. Results of multiple linear regression: variables associated with NBDHE (n= 130; df = 1 )**

Variable	Parameter Estimate	Standard Error	t-Value	Pr >  t  (P-value)
ACP	0.05874	0.07212	0.81	0.4169
I-GPA	-0.01884	1.51758	-0.01	0.9901
S-GPA	1.32570	1.96683	0.67	0.5016
Multiple Attempt	0.23502	0.48021	0.49	0.6254
Chemistry I	-0.49961	0.79467	-0.63	0.5307
Microbiology	0.25762	0.78067	0.33	0.7420
Anatomy I	-1.40194	0.80624	-1.74	0.0846
Oral Anatomy	3.26012	0.57915	5.63	<.0001*
Pathology	3.21109	0.66405	4.84	<.0001*

\*significant at the 0.05 alpha level

**Table V. Results of chi-square for cross tabulation between variables and NBDHE**

Step	Variable removed	Number In	Partial R-Square	Model R-Square	C(P)	F value	Pr > F
1	I-GPA	8	0.0000	0.5581	8.0002	0.00	0.9901
2	Microbiology	7	0.0004	0.5577	6.1092	0.11	0.7408
3	Multiple Attempt	6	0.0012	0.5565	4.4349	0.33	0.5662
4	Chemistry I	5	0.0037	0.5528	3.4413	1.03	0.3127
5	S-GPA	4	0.0019	0.5509	1.9506	0.52	0.4722

**Table VI. Final results of multiple logistic regression: variables associated with NBDHE**

Variable	Parameter Estimate	Standard Error	t-Value	Pr >  t  (p-value)
ACP	0.07253	0.03197	2.27	0.0245*
Anatomy I	-0.66257	0.43107	-1.54	0.1260
Oral Anatomy	3.31188	0.44447	7.45	<.0001*
Pathology	2.98093	0.49788	5.99	<.0001*

\*significant at the 0.05 alpha level

## Discussion

This study questioned whether or not certain variables have the ability to predict academic success as defined by graduation from the program within a specified time frame and whether these same variables have the ability to predict success on the NBDHE. No statistically significant relationship was found between incoming college grade point average (I-GPA) and grade point average in prerequisite college science courses (S-GPA) and graduation and NBDHE success. These results support findings by Schutte and Smith,<sup>4</sup> Shannon,<sup>13</sup> and DeWald,<sup>14</sup> but do not concur with other researchers,<sup>1-2,8</sup> who found a correlation between GPA and success. Comparing the I-GPA and S-GPA defined in this study with other researchers' definitions of GPA may not lead to accurate conclusions. Additionally, it is possible that incoming GPA extracted from an associate degree program may be based on only a few courses. Theoretically, a student who completes one course with a grade of "A" achieves a high GPA. However, a student who has completed 20 courses with grades of "B" will have a lower GPA. The question becomes, which GPA is a more true reflection of ability to succeed. Studies investigating GPA that are comprised of similar courses may be more likely to produce similar results. For the purpose of this study, I-GPA was defined as all coursework completed at the time the candidate submits an application for admission to the dental hygiene program. However, the number and type of courses making up this GPA were not identified and may have varied significantly between students.

The definition closest to the S-GPA used in this study was the GPA used by Bauchmoyer et al which was based on grades in college biology, chemistry I, and chemistry II, and was found to be a predictor of program and NBDHE success.<sup>2</sup> Factors that might have contributed to these conflicting results include demographic differences between the 2 sample populations and whether the students took the courses on a full-time or part-time basis, which may possibly influence the student's ability to maintain a high GPA. The average age of the undergraduate student population at Old Dominion University at the time of this study was 24 years, suggesting that incoming students may have completed prerequisite coursework on a part-time basis over a longer period of time. It can be hypothesized that taking a difficult science course on a part-time basis may provide a student with extra time needed to achieve success. The part-time student must adjust to a full-time course load once accepted into the dental hygiene program.

It is unknown as to whether or not final course grade in chemistry II and final course grade in human anatomy and physiology II predict success for either graduation or NBDHE. Due to a significant lack of data, these hypotheses could not be tested. The inability to collect this data was unique to this study. The records chosen for review typically would not have this data recorded. This was not identified until data collection had already begun because it was not possible to examine the records

prior to the start of study. Access to these confidential records needed to be approved by the Institutional Review Board, hence the proposal for the study was submitted without knowing that a significant amount of this data would be unavailable. Furthermore, it was determined that applying for access to additional confidential records to look up these grades, and recalculating GPA and S-GPA based on this additional data, would be beyond the scope of this project. Omitting these 2 variables at this time, for this project, was justified by the fact that admissions committees would most likely be making decisions to accept or reject candidates without final course grades in chemistry II and human anatomy and physiology II, possibly increasing the realistic approach of this research.

A statistically significant relationship was found to exist between the dental hygiene core curriculum course oral pathology and both program and NBDHE success, while individual final course grade in oral anatomy and histology was found to be a predictor of NBDHE success. These findings support other researchers,<sup>2,13-15</sup> who have indicated that dental hygiene core courses or dental hygiene GPA are potential predictors of success. Many researchers who study predictor variables have focused on pre-dental hygiene course grades such as those available at the time an application is reviewed for admission. Identifying dental hygiene courses as significant predictors of success lends support to recommendations made by Edenfield and Hansen that performance in significant dental hygiene courses be monitored to assist with student success.<sup>15</sup> While admissions committees' desire to identify pre-dental hygiene program variables that predict success, the importance of performance in dental hygiene courses should not be overlooked.

An important outcome of this study is that oral pathology final course grade was determined to be a significant predictor of both graduation and NBDHE success. One explanation for this outcome may be that the oral pathology course offered at this institution was taught by the same instructor over the course of the study period. Oral pathology was the only course variable that was consistent for all students in the sample. In addition to different instructors, all of the other courses studied, except oral anatomy and histology, could have been taken at other universities or community colleges possibly, introducing other variables not controlled for in this study.

While final course grade in pathology was found to be a significant predictor of both graduation and NBDHE success, oral anatomy and histology was not a significant predictor of NBDHE success. One explanation for this finding might be that oral pathology may require higher level critical thinking skills than oral anatomy and histology, an important skill needed for success on the NBDHE, especially the case-based section. For example, oral pathology requires the use of discrimination, comparison, and contrast in order to evaluate oral findings, while oral anatomy and histology may rely more on the memorization of facts.

The academic setting where prerequisite science courses are completed is a complicated variable. Curriculum, faculty, credit hours, course requirements, physical infrastructure, and conducting methods, such as televised or online courses versus traditional face-to-face on campus classroom, all reflect the nature and mission of the institution. Because of the different missions of 4-year universities and 2-year community colleges, it was hypothesized that where a student completed the required prerequisite coursework may affect the student's ability to be successful in an entry-level baccalaureate dental hygiene program. However, the results of this study support research by Bauchmoyer et al<sup>2</sup> and show no statistically significant relationship between academic settings where prerequisite science courses were completed and success.

It has been reported that consistency in site where prerequisite science courses were taken was more significant to predict success than dividing the prerequisite science courses between a 2-year community college and a 4-year university.<sup>2</sup> It may be valuable to investigate whether or not students who completed these courses were enrolled part time or full time. Often, students who attend 2-year community colleges do so on a part-time basis, speculating that the difficult science-based prerequisite courses may have been taken alone or with only 1 or 2 other courses in these settings. Enrolling in only one course at a time would allow the student to devote time to the requirements of the course, possibly increasing the likelihood of success. Dental hygiene program attendance is usually on a full-time basis, requiring that students balance the time and resources needed for successful completion of multiple courses.

For the purpose of this study, it was hypothesized that students who had to repeat a prerequisite science course to achieve a passing grade would be less likely to be successful in the dental hygiene program and on the NBDHE. However, the analysis of data collected from student transcripts regarding multiple attempts to achieve a passing course grade revealed no statistically significant relationship between multiple attempts and success. It was not known whether or not the multiple attempts occurred recently or many years ago when the student may not have identified dental hygiene as a major and

may not have been as interested in the coursework or as motivated to succeed. Additionally, multiple attempts were not cross-referenced to see if they occurred when the student was enrolled on a full-time or part-time basis. Both of these parameters might affect a student's true ability to succeed.

While most of the variables under investigation in this study were not found to be predictors of success when tested alone, when these variables were combined into one ACP score they proved significant at predicting NBDHE success. This outcome supports Edenfield and Tanenbaum who found a positive relationship between their custom-developed admission selection rating tool and NBDHE, 10 suggesting that while the study of individual variables tend to produce mixed results, there may be certain combinations of variables that predict success when combined. Success may be better predicted through the use of a cluster of variables instead of relying on performance in only one area. Which individual variables to cluster together remains unknown.

The most basic of clustering variables is GPA, which combines grades for individual courses. Researchers have also combined noncognitive with cognitive variables to determine the predictive value of adding such variables as personality traits and attitudes into a cluster to determine ability to predict success.<sup>5,9</sup> While there is limited research in this area, anecdotally, one would assume that admissions committees utilize a tally sheet or other summary to tabulate information on program applicants. Often collected singularly, this information may be more predictive when clustered together.

The ACP was identified as a predictor variable for NBDHE success. Further investigation is recommended to analyze the criteria used by the ACP to determine if the weights assigned to each variable adequately correspond to their ability to predict success. The findings of such an investigation might enable the admissions committee to modify the ACP point assignments through evidence-based decisions.

While the ACP was determined to be a significant predictor of NBDHE success, it was not found to be a predictor of successful graduation from the program. This outcome is not easily explained. This study purposely posed 2 research questions, each asking whether or not the variables showed predictability for graduation and for NBDHE success. The ACP used by this university to aid the admissions committee in selecting program applications appears to be collecting the appropriate data on an applicant to predict the candidate's ability to succeed on the NBDHE, the ultimate goal of the program. However, some of the individuals were not able to progress through the program in the set time frame, indicated as not successful for the graduation criteria. It is evident from the results of this study that variables that predict success on the NBDHE may not be able to predict which students will require more assistance in achieving that goal.

## **Conclusion**

Attrition encountered in dental hygiene programs impacts the individual, the institution, and the community at large. When a student is not successful, the financial, time, and emotional impact on the individual and his/her family can be enormous. Retention of students is particularly important to institutions whose programs are evaluated and funded based on retention and graduation. When graduation rates decrease, the community's supply of competent oral health care providers decreases, impacting the public's access to care. While the findings of this study may not be generalized to other entry-level accredited baccalaureate programs, the results suggest support for the use of dental hygiene coursework (oral anatomy and histology and oral pathology) after admission to predict graduation and NBDHE success. It may be suggested that educators look to improving student performance after admission to the program to improve the likelihood of success.

Additionally, at this institution, when admission variables were combined into a cluster of variables (ACP), they proved significant at predicting success on the NBDHE. Collecting, analyzing, and utilizing variables that are not predicting success is time consuming and add cost to the program budget, and may inappropriately affect admissions committee decisions. Research shows that the evaluation of admission criteria should be continued in relation to each institution.

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## **Notes**

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## **Dental Hygienists' Contributions to Improving the Nation's Oral Health Through School-Based Initiatives from 1970 through 1999: A Historical Review**

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*Purpose. The purpose of this literature review is to document the contributions dental hygienists have made over the past 3 decades to improve the nation's oral health. This historical review encompasses selected literature that acknowledged dental Hygienists' direct involvement in U.S. school-based or school-linked oral health programs from 1970-1999.*

*Methods. Five researchers independently searched MEDLINE, PubMed, and other electronic databases to identify relevant literature for the years 1970-1999. The search aimed to locate articles authored by or that documented dental Hygienists' involvement as "service provider" in U.S. school-based oral health programs. For the purpose of this review, service provider was defined as educator, administrator, clinician, examiner, or any other unspecified service performed by a dental hygienist.*

*Results. Fifty-seven articles were retrieved, of which 36 (63%) directly linked dental hygienists to U.S. school-based activities. Twenty-seven articles specifically identified dental hygienists as service providers. Dental hygienists were listed as either primary or contributing author on 19 of these articles.*

*Conclusion. The decade of the 1970s revealed very little literature documenting dental Hygienists' involvement in U.S. school-based oral health programs. The 1970s, however, were instrumental in laying the foundation for service in the years that followed. As public health initiatives expanded in the 1980s, dental hygienists were identified in the largest number of papers as key personnel in the areas of education, management, service provider, and author. The decade of the 1990s yielded less literature than the 1980s, yet recognized dental Hygienists' involvement in all aspects of oral health care delivery, program development and management, and authorship. The authors of this review theorize that dental hygienists were engaged in more school-based programs than reported and were involved in the authorship process more frequently than documented. Due to lack of credentials, or the omission of the words "dental hygienist," "RDH," or "LDH," in favor of "health care provider," "auxiliary," or "trained health care educator," it is unknown what portion of contributions made by dental hygienists remain undocumented.*

**Keywords:** School-based programs, dental hygienists, community health, school-linked programs

### **Introduction**

The purpose of this retrospective review was to document dental Hygienists' roles and contributions to improving the oral health of America. Step one in this process was to review what has been reported in the literature regarding school-based or school-linked programs-beginning in 1970 and progressing to 1999. This report was prepared by the 2003-2004 American

Dental Hygienists' Association (ADHA) Council on Research (COR) to provide an overview of dental Hygienists' involvement in expanding oral care in the United States utilizing public school-based settings. As a health-related organization, it is important to show where and how our profession has been able to affirm its fundamental commitment to better oral health for all people.

In a country where the best quality dental care is available, the delivery of this care is not well-distributed; therefore, utilizing school-based programs offers an approach for expanding health care delivery. Unfortunately, dental disparities among children still exist, along with the common misconceptions that children's poor oral health no longer presents a problem, and that all children have equal access to oral health services.<sup>1-4</sup> While tremendous progress has been made in improving the oral health of Americans (ie, community water fluoridation), not all people have benefited equally. The utilization of school-based health care provides comprehensive services in places where children normally congregate, in a nonthreatening environment. This eliminates some of the barriers that prevent individuals from receiving dental care, such as lack of transportation, parents taking time off from work, and lack of insurance coverage.

Community school-based programs are a public health measure that benefit children of all socioeconomic strata. The Surgeon General's Report, *Oral Health in America* (2000), stated "there are striking disparities in dental disease by income. Poor children suffer twice as much dental caries as their more affluent peers, and their disease is more likely to be untreated." However, the report recognized the "significant role that ...dental hygienists... played in the prevention of oral disease..."<sup>5</sup> as affirmation of our profession commitment. This review seeks to document the contributions that dental hygienists have made in improving the nation's oral health through school-based oral health programs.

## **The 1970s**

The decade of the 1970s illustrated an effort to reduce the high prevalence of dental disease and caries through prevention. Caries reductions were achieved through water fluoridation, school-based fluorides, oral health and dietary education, and pit and fissure sealants. Research demonstrated that combining several approaches to "primary prevention" provided communities the most effective measures to prevent dental caries.<sup>6-10</sup> Several long-term studies took place throughout the 1970s to investigate the effectiveness of preventive interventions in school-based settings, utilizing dental hygienists as educators, coordinators, and clinicians.

In 1972, a long-term school-based program designed to prevent dental caries using student-administered methods of applying fluorides was initiated in Nelson County, Va, an area where the water was fluoride deficient.<sup>10</sup> A dental hygienist, serving as part of the research team, supervised students on a regimen of daily fluoride tablets and weekly rinses with a 0.2% neutral sodium fluoride, along with fluoride toothpaste and toothbrushes for use at home. Initially, the program was offered to all children in the 6 Nelson County elementary schools (first through sixth grade). When the county opened a kindergarten program in 1976, these children were added to the dental program. In 1978, the program was extended to the county's junior high schools, and by the 1979-1980 school year, seventh and eighth graders were participating. This program was designed to measure the total, long-term effects of a combination of student-applied fluoride, fluoride tablets, and fluoride toothpaste in school-aged children living in rural areas with low concentrations of fluoride in drinking water.

Eleven years after the program started, dental examinations were performed on 1007 children who had continuously participated in the program for 1 to 11 years.<sup>10</sup> At the time, 6-year-old children had taken part in the program for one year, while most 17-year-old children had taken part in the program for 11 years. The investigators, one of whom was a dental hygienist, found reductions in caries prevalence as follows: 18%, 35%, 45%, 49%, and 65%, after 2, 4, 6, 8, and 11 years of the program, respectively.<sup>10</sup> By the time data were collected, nearly 39% of the school children in Nelson County experienced a caries-free permanent dentition.

In 1973, a 4-year school-based preventive dentistry demonstration project was initiated in an urban area of Michigan to test the combined effect of several preventive and therapeutic measures on dental caries.<sup>6</sup> This study involved approximately 1200 first and sixth grade children who had limited access to dental care. Dental hygienists served as educators and trained classroom teachers to serve as dental health educators in their classrooms. The children in the treatment group (1) consumed

fluoridated water, (2) received oral hygiene education, daily supervised brushing, and flossing, (3) dental examinations, prophylaxis, and topical fluoride, (4) sealants, and (5) necessary restorative care. Children in the comparison group consumed fluoridated water, were provided with oral hygiene education, supervised brushing and flossing, and received dental examinations, but no restorative care. Parents were notified if carious lesions were detected. The investigators found that after 1 year, decayed, missing, or filled teeth (DMFT) was significantly lower in the treatment group, thus demonstrating improved oral health.

In a 3-year follow-up, the treatment group was randomly divided to provide a cluster that did not continue with treatment and served as a comparison.<sup>11</sup> After 5 years, the researchers observed 3 groups: (1) treatment group that received the complete program for 5 years, (2) treatment comparison group that received the complete program for 3 years and discontinued for 2 years, and (3) comparison group that did not receive any treatment other than the oral hygiene program for 5 years and fluoridated community water. Results showed that the treatment group, which received the complete program for 5 years, received maximum benefit (ie, had the lowest incidence of caries). The treatment comparison group experienced less caries than the comparison group, but higher caries incidence than the 5-year treatment group. Caries reductions were not sustained in those children who discontinued care at 3 years. The researchers concluded that, to be successful, preventive programs should be continuous rather than limited to a few years. The health education component, coordinated by a dental hygienist, helped demonstrate that school-based programs effectively reduced caries incidence in children with a low to middle socioeconomic status (SES), mixed ethnicity, and limited access to care. This study, funded through National Institute for Dental Research (NIDR), suggested that with governmental and community support, oral health care services could be made available to individuals who lacked access to care in the traditional private practice setting.

In 1975, The National Caries Program (1971-1983), sponsored by NIDR, initiated one of the largest standardized community projects ever conducted, focusing on caries control through school-based fluoride rinse programs. Seventeen sites across the country were selected to participate in the Community Caries Prevention Demonstration program because they had little or no fluoride in the communal water supply.<sup>12</sup> While each of the sites could determine its own administrative scheme and staffing pattern, 6 sites hired a dental hygienist as central coordinator. The school settings varied from one site that included a single, large county school district with more than 30 schools and 7500 children, to a rural mountain school district that included 13 schools and fewer than 1500 children. The island of Guam was the single largest site, with more than 15 000 children participating. Approximately 75 000 children in more than 3500 classrooms (kindergarten through sixth/eighth grades) volunteered for the rinse program. The proportion of children participating was used as the primary indicator of community acceptance. Since over 82% of eligible children across all sites participated for the 4 years, the program was deemed successful in terms of community acceptance. Additionally, caries inhibition ranged from 11% to 54% across the sites. At the conclusion of the demonstration program, 5 state departments of health reported the incorporation of the models into larger community efforts or statewide programs; furthermore, 4 of the larger demonstration sites fluoridated their community water supplies as a result of their participation. On the basis of the participation rates, caries inhibition, community acceptance, and the expansion of the model programs, NIDR considered the Community Caries Prevention Demonstration program a success. This program demonstrated that utilization of dental hygienists in a school-based setting provided preventive oral health care services to large numbers of children, at a participation rate that would be difficult to duplicate in private practice settings.<sup>12</sup>

Between the fall of 1977 and the spring of 1982, the American Fund for Dental Health (AFDH) administered the largest comprehensive school-based preventive dentistry program in the world.<sup>13-15</sup> The National Preventive Dentistry Demonstration Program (NPDDP) was developed to determine the costs and effectiveness of several school-based preventive dental procedures. Initially, approximately 25 000 elementary and secondary school children (first through sixth grades), in 10 geographically distributed states, with both fluoridated and nonfluoridated water, participated in the study.<sup>14</sup> Children received sealants, prophylaxes, topical fluorides, and dental health education. Clinical staff at each site consisted of a 7-member team: a program director who was either a dental hygienist, nurse or teacher; 2 clinical dental hygienists; 2 dental assistants; a clerk; and a part-time supervising dentist. Final results were not available at the time the article was written; however, impressions based on program experience suggested that school-based clinical programs were well accepted by children, parents, and school personnel and that dental auxiliary personnel were able to provide high-quality care with minimal supervision. During a 4-year period, approximately 8500 children received 95 000 sealants, applied by

a team of dental hygienists and dental assistants, utilizing a mobile facility in school-based settings. It was reported that dental hygienists working in dental teams were able to effectively apply sealants.<sup>14</sup> Furthermore, investigators selected dental hygienists to place sealants during this project because "it had been demonstrated that they applied sealants as well as dentists and at a reduced cost."<sup>14</sup>

As a result of the NPDDP project, Bohannon et al emphasized the need to deliver oral health care to vulnerable populations in community-based settings in the most cost-effective and efficient manner possible.<sup>16</sup> Investigators concluded that the most realistic approach to extending resources would be the application of preventive measures targeted to specific populations. As a result of this study, researchers concluded that community-based programs should include sealants, and that dental hygienists possess the knowledge and skills necessary to determine which teeth should be sealed. Their recommendations, based largely on the NPDDP data, noted that the highest caries prevalence areas within communities were in neighborhoods of low SES, frequently populated by large numbers of minorities. This study concluded that in order to maximize operating efficiency, school-based preventive programs should include both sealants and fluorides to achieve optimal benefits for those most likely to experience disease.

By the mid 1970s, the American Dental Association (ADA) Council on Dental Materials and Devices had reviewed the status of pit and fissure sealants and published its supportive opinions.<sup>17</sup> Sealants were now recognized as an effective management strategy for occlusal pit and fissure caries, while fluoride was shown to have the least benefit on these surfaces. Based on a large body of research, school-based community programs were structured around combination therapies, which included education, fluoride sources, and pit and fissure sealants. During the decade of the 1970s, researchers continued to examine the effectiveness and economics of providing dental services for children.<sup>18-20</sup> The cost of care varied significantly among private practice, public-fixed clinics, and public-mobile clinics; delivery of oral health care to indigent children through mobile clinics; however, were the least expensive mode, while private practices were the most expensive. Researchers suggested that alternative practice models could meet the oral health needs of indigent children, demonstrating that there is a role for both public and private sectors.<sup>18-19</sup>

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## **The 1980s**

The decade of the 1980s yielded more literature documenting school-based initiatives with dental hygiene involvement than the previous decade and the one to follow. In a review of primary health care delivery in American public schools from 1890-1980, Michael Kort suggested that the biggest challenge for the future would be to "find formulas that reconcile expanded needs and scarce resources to maximize the benefit to the nation's children."<sup>21</sup> With schools already overburdened and facing tight budgets, finding ways to expand the scope and efficiency of school-based programs became difficult. Yet, recognizing that not all individuals have equal access to oral health services, government and public officials investigated ways to improve access to care.

Houle, studied the impact of 5 years' exposure to school-based dental health education programs (grades K-5).<sup>22</sup> One hundred forty-seven children were screened and tested for oral hygiene behavior (plaque scores) and dental related cognitive knowledge. A 40-question multiple-choice examination, prepared by the American Dental Association (ADA), was administered to participants. Dental hygienists were utilized as health educators during this project. Researchers concluded that when reinforced on a long-term basis, a well-designed dental health curriculum resulted in better skill performance, as indicated by a better performance of overall plaque removal and higher oral health knowledge.

In the mid 1970s, through a cooperative effort between with the school district of Juniata County and the University of Pennsylvania School of Dental Medicine, the Rural Dental Health Program (RDHP) was initiated. A study of 1859 children (K-6) compared the effects of delivering children's dental care utilizing school-based programs and community-based private dentists.<sup>23</sup> Two "professionally trained health educators" developed and delivered the dental health education component. Based on the data collected by the RDHP, investigators concluded that children who participated in the school-based delivery mode "were more likely to utilize dental services in a pattern which could lead to improved oral health." Being assigned to school-based programs that offered enriched dental health education "significantly increased the probability children would have regular preventive and restorative care."<sup>23</sup>

Seven years after the RDHP ended, a follow-up study conducted by Feldman et al measured the long-term effects of the 2 dental delivery systems-school-based and community-based.<sup>24</sup> Clinical examinations were conducted on the original participants who were in grades K-2 during the RDHP program. Based on the 406 children located, findings suggested that children who utilized community-based delivery programs were higher users of professional dental services. Researchers postulated that children in school-based programs had to seek out new patient-doctor relationships, whereas those in community-based settings had already established this relationship, yet long-term oral health effects might not be apparent for many years. Even though school-based programs meet community needs, once programs end or children are no longer eligible, they remain less likely to seek dental services than children in nonschool-based programs. The composition of the dental health teams providing services were not clearly defined, listed only as "professionally trained health educators."

Incorporating findings from large national studies conducted throughout the 1970s, New Mexico began programs that provided dental sealants for children in school-based settings.<sup>25-28</sup> The state of New Mexico utilized dental hygienists to apply pit and fissure sealants to children in areas of the state with limited or no access to private dental care. Calderone and Davis published a progress report on this initiative. They found that sixth graders who received sealants as first, second, or third graders, had 6% of the occlusal surfaces of their first permanent molars either decayed, missing, or filled (DMF). Their classmates who had not received sealants in the program had 27% DMF of the same tooth surfaces.<sup>27</sup> Retention rates for completely retained sealants placed in first molars were compared, revealing 67% after 6 years, 79% after 5 years, 79% after 4 years, and 94% after 1 year.

In a follow-up study, the New Mexico program researchers were able to obtain data from 482 high school students who participated in the New Mexico project during the 1980-1981 school year.<sup>28</sup> Brown, Calderone, and Mueller found that of the 813 sealants placed in permanent first molars, 460 (57%) of the sealants were completely retained, and 53 (7%) partially retained, with an overall retention rate of 63% after 10 years. The researchers concluded that a preventive public health program, utilizing dental hygienists in field settings, could achieve long-term results comparable to those found in a controlled practice environment.

In 1983, controversy arose over the utilization of dental hygienists to place pit and fissure sealants in the New Mexico project. The New Mexico Board of Dentistry ruled that the New Mexico Health and Environment Department's sealant program violated rules and regulations concerning the supervision of dental hygienists. For that reason, the state was forced to reduce the number of children served by the program to comply with this decision.<sup>29</sup> Initial attempts to secure a revision of the rules and regulations to accommodate the needs of public programs were unsuccessful. As a result of an extensive legislative effort involving the New Mexico Dental Hygienists' Association and the Health and Environment Department, general supervision became law in April 1985. Despite controversy, the programs illustrated dental Hygienists' ability to provide oral health care services to individuals with limited access to care through community based programs, in a cost-effective manner. Since that time, New Mexico has implemented a collaborative practice act allowing dental hygienists to practice in less restricted settings.

Most studies had evaluated sealant placement in the permanent dentition. Because of limited information for primary teeth, researchers studied children enrolled in Tennessee Head Start during the 1984-1985 academic year to evaluate the retention of pit and fissure sealants on primary molars, 6 to 24 months post-eruption. Using portable dental equipment at several Head Start centers, a team of dentists and dental hygienists placed sealants in 1871 children.<sup>30</sup> One year after application, regional retention rates varied from 74% to 95%, with an overall combined retention rate of 88%. Researchers concluded that sealants properly placed on primary teeth had a retention rate comparable to permanent teeth. They suggested that

application of sealants in Head Start centers provided a positive nonthreatening atmosphere where students did not have to be transported to unfamiliar surroundings.

In the late 1980s, the Washington State Department of Social and Health Services funded a pilot study to determine whether sealants could be effectively incorporated into a school-based dental health program directed at first, second, fifth, and sixth graders.<sup>31</sup> A team of dentists and one dental hygienist placed sealants in 403 teeth. One hundred seventeen children received sealants. The dental hygienist placed sealants in 68 of the children, while dentists placed sealants on the teeth of 49 participants. Six months after the sealants were placed, 85% of the children were available to be examined for sealant retention. Much like the New Mexico study, the majority of the children (98%) had retained the sealants. Nickerson, a dental hygienist and the author of this paper, concluded that sealants could be effectively incorporated into a school-based preventive program.

In Kansas, a study examined the oral health knowledge and practices of 284 students who received caries preventive procedures during a 4-year school program.<sup>32</sup> The purpose of this project (not directly connected to the NPDDP) was to examine the oral health knowledge and practices of sixth graders in Wichita. This study was initiated as a result of health objectives outlined for the nation by the US Department of Health and Human Services (1980), which stated that by 1990, at least 95% of all US schoolchildren and their parents should be able to: (1) identify the principal risk factors related to dental diseases, and (2) be aware of the importance of fluoridation and other measures in controlling these diseases.<sup>33</sup> Participants were divided into 2 groups: (1) those who completed a 4-year regimen as part of the NPDDP, and (2) a control group without NPDDP training. The investigators found no differences in oral health knowledge or practices between those children who had participated in the NPDDP and those who had not. Findings related to oral health knowledge revealed that neither the NPDDP nor the regular Wichita dental education lessons stressed the uses and benefits of fluorides and sealants. Findings related to fluoride revealed that few students who had used fluoride tablets during the 4 years of the NPDDP reported using them at the time of data collection. The researchers, one of whom was a dental hygienist, noted that the continued use of fluoride tablets at home, following the termination of the NPDDP, would have been appropriate since the drinking water in Wichita at the time was not fluoridated.<sup>32</sup>

In 1985, data were collected from a large sample of public schools across the United States to examine the sustainability of fluoride mouthrinse programs (FMRP).<sup>34</sup> Dental hygienists, school administrators, and school nurses were part of the research teams. Researchers found that districts that abandoned the FMRP over time generally did so due to the lack of strong support from advocates, not as a result of weighing the pros and cons. Several variables were associated with adoption of the program. First, when school officials were approached with information about the FMRP program by a "health-related person" versus a "nonhealth professional," the district was more likely to have adopted the FMRP. Second, districts with large proportions of low-income children were slightly more likely to have adopted the FMRP. Lastly, districts lacking strong external support may not have been able to continue the FMRP.

In New York, researchers evaluated the combined use of sealants and fluoride mouthrinsing in children who participated in weekly school-based fluoride rinse program since kindergarten and had sealants applied to their first permanent molars while in the second and third grades.<sup>35</sup> This program, originally started as part of the nationwide NIDR National Caries Program, continued under the auspices of the Department of Children's Dentistry, State University of New York at Stony Brook, and the Bureau of Dental Health of the New York State Department of Health. The treatment group consisted of 95 students who had their 4 first permanent molars sealed and received weekly supervised fluoride mouthrinses. The control group consisted of 131 students who did not have sealants placed but received the mouthrinse regime. After 2 years, examination of 84 of the original 95 sealant/fluoride mouthrinse participants revealed only 3 lesions and 96% remained caries-free. Examination of the available children from the control group (n=51) revealed 24 surfaces were decayed or restored, and 78% of these children were caries-free. Investigators suggested that the combination of fluoride mouthrinses and sealants dramatically reduced caries incidence. Although the service provider was unspecified in this study, a dental hygienist served as the research field coordinator and coauthor.

The economics and effectiveness of school-based oral health programs were studied throughout the 1980s.<sup>10,35-47</sup> The cost-benefit and effectiveness of 4 hypothetical dental preventive interventions were analyzed: (1) community water fluoridation, (2) school-based water fluoridation, (3) weekly school-based fluoride mouthrinses, and (4) school-based

sealant programs.<sup>44</sup> Analyses for labor costs were calculated utilizing a team of dental hygienists and dental assistants to place sealants. Although analyses were performed on imaginary communities, general conclusions were derived from this report. Community water fluoridation provided the greatest benefits, with school-based water fluoridation and mouthrinse programs yielding the next most cost-effective results. In this study, sealant programs yielded negative net-benefit results, although favorable cost-benefit analyses were obtained when dental hygienists were service providers.

Research conducted by Doherty and a team of investigators examined the costs associated with wages and labor productivity in school-based mouthrinsing programs.<sup>45-47</sup> Results revealed that costs varied within such programs because of many factors; however, the selection of paid versus unpaid volunteer labor seemed to play an important role. Implications from these studies provided a framework for community planning and supplied useful information on mouthrinse program costs.

The Massachusetts Department of Public Health (MDPH) has utilized dental sealant programs since 1984.<sup>48</sup> Dental hygienists, acting as assistant project directors and service providers, played an integral role in statewide programs designed to provide sealants to school children. When the MDPH conducted a survey of 9000 school children from 1978-1981 to assess their level of oral health, the results suggested that by the age of 17 these children had a decay rate that was 30% higher than the national average. Recognizing that underutilization of sealants was a public health issue, the "*Save Teeth: Seal Them*" program was designed to increase sealant use in Massachusetts. Researchers recommended that placement of sealants be conducted by dental hygienists, rather than dentists, to ensure cost-effectiveness and success of the project.

School-based prevention programs were extensively studied during the 1980s. Although most programs were deemed a success, some researchers questioned the effectiveness of school-based fluoride preventive programs.<sup>49-50</sup> The decade of the 1980s yielded the greatest amount of literature related to school-based oral health preventive programs and initiatives. While dental Hygienists' involvement was documented more than in the previous decade, it was clear that the unmet oral health needs of the nation's children would worsen unless public health measures were put into place to create alternative delivery models.

## **The 1990s**

Since 1913, the Bureau of Dental Health Services of the New York City Department of Health has provided dental services to public school children. In 1990, the bureau initiated an extensive network of school-based dental clinics. A 6-year analysis of the program built a strong case for the effective utilization of portable delivery modes that in many ways surpassed the effectiveness and capacity of "fixed-state" school programs.<sup>51-52</sup> As an alternative to conventional dental care, the portables were able to deliver "total patient care" in a cost-efficient manner within schools presenting the highest need. To promote the utilization of sealants in New York, the health department implemented several school-based programs to identify high-risk children so sealants could be placed in newly erupted first and second molars. A 1997 evaluation of this program revealed that 1122 sealants were applied by a team of dental hygienists and assistants under the general supervision of a dentist.<sup>53</sup> After 4 years, sealant retention rates ranged from 65% to 82%. The Bureau concluded that the program provided a feasible method for identifying high-risk children who would benefit from sealant placement in a school-based situation.

Utilization of school-based preventive programs continued to contribute to improved oral health, but not without controversy. In 1995, Nowjack-Raymer, a dental hygienist, and her team of researchers dispelled concern over the presence of dental fluorosis in children participating in school-based programs.<sup>54</sup> Reporting for the NIDR, Nowjack-Raymer reiterated the safety of school-based fluoride programs (mouthrinses, tablets, or combinations) in communities with fluoride-deficient water supplies, thus supporting their implementation.<sup>54</sup>

Additionally, in 1996, the Oral Health Program at the CDC established a Fluoride Work Group to review the role and benefits of fluorides. Adair concluded that fluoride mouthrinses are a safe mode of providing caries protection and suggested that school-based programs should be utilized in communities with children who are at high-risk for caries.<sup>55</sup> Horowitz reviewed the role of dietary fluoride supplements, noting that fluoride supplements are highly effective in reducing dental

caries; yet many parents do not administer home-based fluoride and choose to enroll their children in school-based fluoride programs.<sup>56</sup>

Doherty evaluated the resource productivity and returns of school-based mouthrinse programs in the United States.<sup>57</sup> Comparative cost analyses of fluoride mouthrinse programs varied by: (1) program size, (2) method of administration, (3) wage rates, and (4) types of personnel utilized. Data were obtained from 14 federally-supported mouthrinse programs during their second and third years in operation. Implications from the Doherty report concluded that the viability of programs differ depending on the organizational framework, as well as direct and indirect costs. One of the biggest concerns was labor expenditures. Many school-based programs depended on "free labor" or volunteers as a way to reduce costs, yet difficulties in obtaining and coordinating volunteers led to utilization of paid workers, thus increasing program costs.

In the early 1990s, Cohen and Horowitz conducted a national survey to determine the current status of community-based sealant programs in the United States, as well as to identify general program characteristics.<sup>58</sup> Data were gathered through surveys mailed to all state dental directors. Results revealed that 29 states (57%) had active dental sealant programs in the early 1990s, although 8 states had programs that were discontinued within the preceding years. The number of sealant programs in each state ranged from 1 to 25. All but 3 respondents reported that dental hygienists were permitted to place sealants; dental assistants were allowed to place sealants in 15 states. Fifty-seven percent of the states required a dentist to be present when allied dental personnel placed sealants in school-based programs. While the number of states with sealant programs increased from 21 in 1983 to 29 at the time of the survey in 1991, based on the number of programs operating in each state and the number of children served, it was concluded that only a small proportion of children receive the benefits of sealants from community-based programs. One-hundred percent of respondents reported a need for additional community sealant programs in their state.

In an effort to learn more about the diagnostic reliability of different examiners, Katz, conducted a study to evaluate a dental hygienist, dentist, and nondental personnel, in a caries study of 375 children enrolled in Head Start programs in St. Thomas, U.S. Virgin Islands.<sup>59</sup> Because approximately 450 000 children were enrolled in Head Start programs in the United States, at that time, researchers believed that a significant amount of vital information could be obtained. The results of multiple examinations revealed that there was a strong-to-good (0.87 to 0.93) diagnostic correlation between the dentist and dental hygienist, but only a good-to-fair (0.80 to 0.89) agreement between the dentist and nondental personnel.

In 1988, the dental hygiene program director at Youngstown State University and the clinical director of Child and Family Health Services (CFHS) partnering with Area Health Education Centers (AHEC), implemented a pilot study to provide educational and preventive care.<sup>60</sup> This program was a community-based approach to meet the oral health needs of women and children in a low-income rural population. It also provided dental hygiene students with experience treating patients in a nontraditional setting. According to Burger, a dental hygienist and lead author, there are many challenges facing dental hygienists who choose to work in public health settings. In addition to removing barriers to alternative practice settings, the profession struggles to be recognized by other health care professionals for the services they provide.<sup>60</sup> The Columbiana County Dental Health Task Force was established as an integrated community-based approach to help address the lack of access to dental care to economically disadvantaged individuals. The task force, which initially included 2 dental hygienists, 2 dentists, and various service agencies, received funding to hire licensed dental hygienists and dentists to provide educational, preventive, and restorative dental care to help address the community oral health needs.

In a review of preventive dental programs at Louisiana's state schools for the mentally handicapped, lead author, Connick, a dental hygienist, concluded that it was beneficial to have onsite dental clinics at the schools because of lower costs, and that the burden of transporting clients was removed.<sup>61</sup> These schools allowed time for continual oral health assessment of clients, and placed a high priority in identifying poor oral hygiene. Although dental hygiene involvement in the project was unclear, the Dental Health Resource Program (DHRP) office review revealed that the schools had very successful preventive dental programs; however, most facilities were understaffed and could benefit from additional health personnel.

In rural Northern California, several unique community-based models helped to address the access to care problem for individuals with developmental disabilities.<sup>62</sup> A coalition was formed to coordinate resources and community agencies to provide preventive and therapeutic oral care to the population at risk. Many of these individuals have been moved from

institutional settings into community living situations, further compounding the unmet medical and dental needs. For a problem of this magnitude, an alliance was formed with a team of: (1) dental and dental hygiene faculty from the University of the Pacific School of Dentistry (UOP); (2) faculty and students from the Department of Special Education at San Francisco State University; (3) key staff members from local agencies; and (4) local private physicians, dentists, dental hygienists, and dental assistants. A team of dental hygienists and physicians conducted all initial and end of project interviews with parents, caregivers, case managers, dental personnel, and other administrators, to determine barriers, care needs, and future requirements of the program. Dentists and dental hygienists assessed community needs by providing over 300 dental screenings during the first 2 years of the program. The most significant client need was for oral prophylaxis (n = 78), compared to small fillings (n = 20), and extractions (n = 26). By working together through combined efforts of dental school faculty, community officials, and personnel, a model was implemented to address the long-standing problem of access to dental care for persons with developmental disabilities in rural California. This program demonstrated that through a consortium of agencies, in a community-based approach, preventive and therapeutic dental services can be provided to the population in need.

The decade of the 1990s revealed the continuous effort to provide preventive oral health care services to the underserved. Throughout the nation, school-based and school-linked programs were initiated utilizing dental hygienists as key personnel. Yet, a report from the Center for Health and Health Care in Schools concluded that dental decay remained the most prevalent chronic infectious disease among children, and that more than 51 million school hours were lost due to dental-related illnesses.<sup>63</sup> Furthermore, a report in the CDC's weekly publication documented that a school-based program could increase dental sealant utilization among high-risk children, thus helping reduce racial and economic disparities in children.<sup>64</sup>

## Results

A summary of dental Hygienists' involvement in U.S. community school-based oral health programs from 1970 to 1999 is depicted in Table I. Of the 57 articles retrieved, 36 (63%) specifically cited dental Hygienists' involvement as a "service provider," author, or both. For the purpose of this review, "service provider" was defined as educator, administrator, clinician, examiner, or any other unspecified duty performed by a dental hygienist. Of the 36 articles, 27 (75%) cited a "dental hygienist" as a service provider, while 19 (53%) listed a dental hygienist as an author.

**Table I. Dental Hygienist Involvement in U.S. School-Based Articles**

<b>Decade</b>	<b>Total articles retrieved</b>	<b>Articles with RDH as service provider, author, or both</b>	<b>Articles with RDH as service provider only</b>	<b>Articles with RDH as author only</b>
<b>1970 - 1979</b>	7	3	3	1
<b>1980 - 1989</b>	36	26	19	12
<b>1990 - 1999</b>	14	7	5	6
<b>Total</b>	<b>N = 57</b>	<b>36</b>	<b>27</b>	<b>19</b>

## Discussion

Looking back over 3 decades of school-based oral health programs, it is apparent that dental hygienists have been engaged in community initiatives on many levels; moreover, the extent of involvement has grown from the role of educator, examiner, and assistant to that of program administrator, director, researcher, and author. However, as a profession, dental hygiene needs to expand its roles and increase its visibility within the health community. Reasons for the probable under

representation of dental hygienists in the literature remain unclear, but may be due in part to the "silent" partnerships established, or not utilizing professional credentials in publications. On the other hand, dental hygienists have been, and continue to be, involved in school-based oral health programs throughout the nation, and are making substantial contributions to a population at serious risk for oral disease.

Following publication of the Surgeon General's Report and the Healthy People 2010 objectives, the need to remove barriers and establish community partnerships to reach the underserved children of our nation with effective interventions remain key issues.<sup>2,5</sup> The "hidden epidemic" of dental disparities among school children suggests that school-based programs and community partnerships are critical to helping resolve the continuing problem.<sup>65-67</sup> In the face of questions regarding the cost-effectiveness of community school-based oral health programs,<sup>68</sup> current wisdom suggests that even with increasing program costs, the elimination of existing programs addressing the dental needs of the underserved would only discourage new program development, thus widening the "gap" and increasing disparities.

In spite of major improvements over the years, "profound and consequential oral health disparities exist, especially among the poor."<sup>2</sup> Dental hygienists are well positioned to lead the efforts to equalize this disparity and serve unmet community needs. The significant role that dental hygienists play in improving the oral health of the nation has been based on safe and effective measures, which include interventions such as dental sealants and lifestyle behavioral changes.

Research suggests that the best way to reduce dental disparities in children is through school-based programs. Bohannon et al discussed dental sealant use in school and community-based programs, stating, "certainly most dental hygienists possess or can be trained to exercise sufficient diagnostic skills to render the necessary judgments as to which teeth should be sealed."<sup>16</sup> Currently, the number of states that allow dental hygienists to work in school-based programs varies depending on how states define "settings." Thirty-seven states clearly specify that dental hygienists may work in school-based practice settings, 6 states do not put limits on practice settings, and 9 states limit practice settings outside of the dental office to "public" institutions.<sup>69</sup> In states that have authorized unsupervised dental hygiene practice, many hygienists have seized opportunities to provide oral care in nontraditional settings. For dental hygienists residing in states with more practice restrictions, providing services in school-based settings can be more difficult, thus limiting the amount of oral care that is provided.

## **Conclusion**

Over the decades, the literature with respect to dental hygienist's involvement in school-based programs was episodic. However, with the initiatives and goals of the Surgeon General's Report and Healthy People 2010, there is an opportunity for community engagement and research, and a concomitant requirement to produce literature documenting the contributions of the dental hygiene profession.

While dental hygienists were specifically identified as authors on numerous publications, the authors of this review theorize that many other articles involved dental hygienists in the authorship process, yet credentials such as RDH or LDH were omitted from the authors' name. Additionally, articles mentioned "dental auxiliaries" or a "trained dental professional" performed services, yet it was unclear who actually conducted the activity. The authors of this review speculate that the service provider was often a dental hygienist, but no professional recognition occurred.

As the dental hygiene profession moves forward, it needs to expand its scope of practice, become more engaged in community-based oral health care initiatives and policy making, and increase public awareness of the profession. The challenges facing dental hygienists working in public health settings are apparent, yet, if there is a lesson to be learned from history, it is that reaching some of our most vulnerable citizens may be best achieved by collaborating with others to remove existing barriers. This step would allow dental hygienists to work in less restricted practice settings. As dental Hygienists' involvement increases, there is a concomitant need to be more "visible" in the literature and in the health care community. Partnering with other professions, such as medicine, social science, and economics, provides opportunities to expand research activities and increase publications in a variety of peer-reviewed journals. Utilizing professional credentials can increase awareness of the dental hygiene profession, as well as educate and influence policy-makers about

the roles of the dental hygienist. Documenting the ways that dental hygienists have contributed to improving the oral health of America further establishes a place for the dental hygiene profession.

For additional information on practice laws in your state, contact the governmental affairs division at [http://www.adha.org/governmental\\_affairs](http://www.adha.org/governmental_affairs).

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## **Notes**

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## **ADHA's Focus on Advancing the Profession: Minnesota's Dental Hygiene Educators' Response**

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***Purpose.*** *Developing degree-completion programs to enable associate-prepared dental hygienists to complete a baccalaureate degree is essential to help advance the profession. This study determined current associate degree dental hygiene students' interest in degree completion, preferred educational venue, and examined if current interest in course topics supports the ADHA's Focus on Advancing the Profession.*

***Methods.*** *A 55-item survey was designed and distributed to 296 first-year and second-year dental hygiene students enrolled in 8 Minnesota associate degree programs during fall 2004. Seven of the 8 schools participated for a response rate of 69% (N=206). The survey included items to elicit interest in degree completion, preferred educational venue, and interest in course topics. Researchers grouped course topics according to the ADHA focus areas for advancing the profession (research, education, practice & technology, licensure & regulation, and public health).*

***Results.*** *Results of the survey revealed that 66.0% of dental hygiene students are currently interested in completing their baccalaureate degree. The top 2 educational venues for program delivery include evening classes held in off-site locations near their home communities (50.4% very interested) and complete online class format (35.6% very interested). Students were least interested in completing coursework during traditional daytime hours (12.6% very interested). Interest in course topics related to technology (58.3 highly interested) and advanced clinical hand instrumentation (55.7% highly interested) were the strongest, while students were least interested in the design and implementation of research (8.3% highly interested), evaluating scientific literature (7.6% highly interested), and statistics (7.6% highly interested).*

***Conclusion.*** *This study reveals a strong demand for degree-completion programs, with preferred educational venues in nontraditional formats, such as evening classes in off-site locations or online course delivery, to attract the highest number of applicants. Students indicate the highest interest in course topics in the ADHA focus area of practice and technology, with the least interest in research. Development of degree-completion programs should design curriculum in a format that meets the needs of their targeted population, while including course topics that advance the profession as suggested by the ADHA focus areas.*

**Keywords:** ADHA's Focus on Advancing the Profession, baccalaureate dental hygiene, degree completion, online education

## **Introduction**

Since its inception, the profession of dental hygiene has been a preventive oral health care provider, primarily focused as clinical providers, health educators, and community health advocates. Nearly 100 years later, the American Dental Hygienists' Association (ADHA) has called for a review of the direction of dental hygiene with direct implications for educational institutions, in recognition of the nation's demand for increased access to oral health care. Specifically, the ADHA has recommended development of degree completion programs to enable licensed hygienists to pursue their baccalaureate degree and prepare hygienists of the future.

The purpose of this research study was to 1) assess and analyze current associate degree dental hygiene students' interest in baccalaureate degree completion; 2) identify students' interest in educational topics; and 3) identify students' interest in various educational venues to support program development and implementation of degree completion programs in dental hygiene. Additionally, the study will examine how current interest in course topics aligns with areas identified in the ADHA report, *Dental Hygiene: Focus on Advancing the Profession*.

## **Review of the Literature**

Database searches using the key phrases of "degree completion," "distance learning," "distance education," "baccalaureate," "online learning," and "online education," combined with "dental," were completed for this review in the following sources: Academic Search Premier, Health and Wellness Resource Center, Medline, CINAHL, and ERIC. Minimal research has been published to determine the demand for dental hygiene baccalaureate degree completion, the desired educational venue, or the educational topics of interest. Topics addressed within this review include: 1) current status of dental hygiene education; 2) need for baccalaureate degree; 3) demand for degree completion; 4) effectiveness of distance education; and 5) distance education for degree completion.

### ***Current Status of Dental Hygiene Education***

Currently, the entry-level degree in dental hygiene is the associate degree.<sup>1</sup> Dental hygienists are required to graduate from accredited dental hygiene programs. The dental hygiene accreditation standards state that dental hygiene students are to be prepared in general education, biomedical sciences, dental sciences, and dental hygiene sciences, along with responsibilities for assessment, planning, and implementation of preventative and therapeutic services.<sup>2</sup> In 2006, 281 accredited entry-level dental hygiene programs existed, with the majority (84%) awarding an associate of applied science degree (164) or an associate of science degree (73).<sup>1</sup> Only 48 dental hygiene programs offered a bachelor of science degree.<sup>1</sup> Currently, there are 56 dental hygiene degree completion programs in the United States, with 7 programs offering course content 100% online.<sup>3</sup> Master's level education is provided in 11 universities across the nation while a doctoral degree in dental hygiene has not yet been established.<sup>4</sup> To support ADHA's goal of advancing the baccalaureate degree as entry-level in the next 5 years, the number of programs offering baccalaureate degrees and/or access to degree completion programs needs to be increased.

### ***Need for Baccalaureate Degree***

The need for dental hygienists with a baccalaureate degree is demonstrated by the 1) desire to advance the profession, 2) demand for dental hygiene faculty, 3) responsibility to address the oral health needs of the nation, and 4) need for expanded dental hygiene research. In 2005, The American Dental Hygienists' Association (ADHA) report entitled "Dental Hygiene: Focus on Advancing the Profession" provided a framework for dental hygiene education and practice.<sup>5</sup> ADHA's vision in this document includes "implementing the baccalaureate degree as the entry point for dental hygiene practice".<sup>5,6</sup> Educational programs are challenged to develop and support didactic and clinical curriculum focusing on 1) Research, 2) Education, 3) Practice and Technology, 4) Licensure and Regulation, 5) Public Health, and 6) Government, to help prepare graduates as oral health professionals of the future.<sup>5</sup> Requiring a baccalaureate degree as entry-level for dental hygiene provides opportunity to prepare graduates for alternative career opportunities in education, administration, public health, and

research, without overcrowding the curriculum.<sup>5</sup> A survey of 468 dental hygiene graduates from a baccalaureate program in California revealed that 21% of graduates completed a graduate or professional program, with over half of those graduates pursuing master's degrees related to education.<sup>7</sup> Twenty percent of graduates currently or have previously held faculty positions and 61% have leadership positions in community organizations.<sup>7</sup> While unable to compare with other programs, this research supports the concept that graduates of baccalaureate programs do pursue further education and alternative career opportunities in the field of dental hygiene.

As we look at the current number of dental hygiene programs, it becomes apparent that the demand for educators across the nation is strong. Nunn and colleagues found that 68% of dental hygiene faculty will need to be replaced within the next 5 years, primarily due to retirement.<sup>8</sup> The predicted outcome of faculty shortages in dental hygiene will impact the number of graduates, thus impacting the oral health of the United States. Students who graduate with a baccalaureate degree are further prepared for advanced education such as a master or doctoral level degree.

In an effort to meet the dental health needs of underserved populations in the United States, the ADHA has moved forward with a plan to develop a master's degree for a new middle-tiered profession titled the Advanced Dental Hygiene Practitioner (ADHP).<sup>5</sup> The ADHP is designed to increase the scope of practice for dental hygienists to include advanced preventive therapies, diagnosis, treatment such as restorative procedures, and appropriate referrals.<sup>9</sup> Sufficient numbers of baccalaureate prepared dental hygienists are needed as qualified applicants to support implementation of the ADHP curriculum.

The 2001 revised National Dental Hygiene Research Agenda (NDHRA) is the foundation of the dental hygiene profession to establish and guide priorities in research topics in the following areas: 1) Health Services Research, 2) Access to Care/Underserved Populations, and 3) Health Promotion/Disease Prevention.<sup>10</sup> ADHA's research agenda is important as it serves as the framework for achieving the mission of ADHA-to advance the art and science of dental hygiene.<sup>10</sup> A survey of 167 dental hygiene programs revealed that 62% of baccalaureate programs provide a separate course on research, compared to 8% of non-baccalaureate programs.<sup>11</sup> Non-baccalaureate programs are forced to incorporate research within other dental hygiene courses. The 4-year baccalaureate dental hygiene education can provide the foundational knowledge and skills required to meet the NDHRA without overcrowding the curriculum.

### ***Demand for Degree-completion***

A recent survey of 423 dental hygienists from 46 different states, who receive the magazine RDH, identified that hygienists are interested in more information about degree completion programs to help achieve career satisfaction.<sup>12</sup> Development of degree completion programs will be critical if the entry-level degree for dental hygiene is moved to a baccalaureate degree. With associate and certificate programs representing about 84% of all dental hygiene programs, simply closing these schools would severely compromise the ability to meet the oral health needs of the nation. Articulation agreements designed to improve credit transfer between associate/certificate programs and baccalaureate programs have been suggested as one way to promote degree completion.<sup>5,13</sup> However, successful development of degree completion programs should consider what educational venue (face-to-face versus distance) will enable the largest number of dental hygienists to pursue their baccalaureate degree.

### ***Effectiveness of Distance Education***

Effectiveness of distance education has been demonstrated through multiple research studies in dental and dental hygiene education.<sup>14-18</sup> Bearden and colleagues found no statistical differences in course grades and performance on the national board exam for 54 dental hygiene students who self-selected to enroll in either online or face-to-face nutrition courses.<sup>14</sup> Darby compared course grade achievement between on-campus and off-campus interactive television students enrolled in an interdisciplinary research course in the fall of 2000 and found no significant differences.<sup>15</sup> Fleming and associates found no significant difference in post-test scores of 33 first-year dental hygiene students randomly assigned to either the slide/audiotape format or web-based instruction to teach normal intraoral radiographic anatomy.<sup>16</sup> No significant difference

was found in the post-test outcomes of 75 first-year dental students randomly assigned to an interactive CD format, interactive CD plus lecture format, and lecture-only format to teach an introductory radiology course.<sup>17</sup> Gallagher and colleagues compared grades on assignments, student exams, a case study project, final course grades, and content retention between dental hygiene students who self-selected to enroll in a traditional face-to-face course or online course in gerontology.<sup>18</sup> Online students scored significantly higher than traditional students on the second exam, assignments, case study project, and total final points in the course.<sup>18</sup> Similarly, online students scored higher on the content retention questionnaire assessed 6 months after course completion.<sup>18</sup> The literature surveyed provides evidence that distance instructional methods are a viable option for course delivery in dental hygiene.

### ***Distance Education for Degree-completion***

Recognizing distance education as an effective teaching strategy, online course delivery in dental hygiene is increasing. Based on a national survey of 172 dental hygiene programs, Grimes reported, "dental hygiene programs (22%) are beginning to implement programs offered through technology-based distance education methods. Dental hygiene is somewhat behind our colleagues in nursing, as 51% of nursing programs had implemented distance education by 1998."<sup>19</sup> Grimes identifies the major themes supporting technology-based education as 1) increasing student access, 2) maintaining regular employment during advanced education completion, and 3) providing flexibility of curriculum while responding to student demand.<sup>19</sup> Distance education methods, including interactive television (ITV), online course delivery with software such as Desire to Learn™ or Black Board™, a mixed-model of face-to-face and online, or a cohort-model located off-site, can be utilized to provide an alternative educational venue for regionally-bound, licensed dental hygienists who desire to complete their baccalaureate degree.

Distance education venues for degree completion programs are also supported by dental hygienists. A random sample of 383 dental hygienists from the Canadian Dental Association indicated correspondence format, online/Internet format, and evening and weekend classes in their home communities as the preferred educational venues for baccalaureate degree completion.<sup>20</sup> Barriers to completing their baccalaureate degree included a need for flexibility in scheduling and family and work obligations.<sup>20</sup>

The limited number of dental hygiene programs offering baccalaureate degrees combined with the demand for further education emphasizes the need for more research examining interest in degree completion in the United States and desired educational venues. Assessing interest in course topics as determined by potential students combined with examining curriculum focus areas determined by the ADHA can help guide design of degree completion programs.

## **Methods and Materials**

A 55-item questionnaire was developed by the authors, with sections addressing demographics, current interest in degree completion, including desired pace, venue, and topics of educational coursework, for this investigation. Human subject approval was obtained from the Institutional Review Board at Minnesota State University, Mankato, Minn. In addition, informed consent was obtained from all participants.

Questionnaires and instructions were distributed to faculty from each of the 8 associate degree-granting educational institutions at a Minnesota Dental Hygiene Educators' meeting. Faculty members were instructed to deliver the consent form and questionnaire to all first-year and second-year students enrolled in their dental hygiene programs. Completed questionnaires were returned to the investigators in the stamped envelope provided.

The questionnaire data were collected and analyzed by SPSS Version 10.0, with 10.0% of entries rechecked for accurate data entry. Given the nature of the data, descriptive statistical methods were used including percentages and frequencies.

## **Results**

Dental hygiene students from 8 associate degree-granting institutions consisting of Century College, Herzing College, Lake Superior College, Normandale College, Northwest Technical College, St. Cloud Technical College, Rochester Community and Technical College, and Argosy (N=296) were invited to participate in a volunteer baccalaureate degree-completion survey. Seven institutions chose to participate resulting in a final sample of 204 (69.0%) students. Fifty-four percent of participants were in their final year of dental hygiene school, with 46.0 percent in their first year. The majority (75.4%) of students intended to pursue a career in a general private practice, with 14.4% interested in group private practice, 7.7% interested in specialty practices (orthodontics, pediatrics, periodontics), 1.5% in community practice, and 1% interested in education.

### ***Interest in Degree***

Sixty-six percent of students identified they were currently interested in completing a Bachelor of Science degree in dental hygiene. Of those interested, the majority (52.3%) indicated they would begin taking coursework in 1-2 years, while 37.1% indicated they would begin taking coursework in 3-5 years. The remaining students were unsure when they would begin coursework (6.1%), or indicated it would be more than 5 years (4.5%).

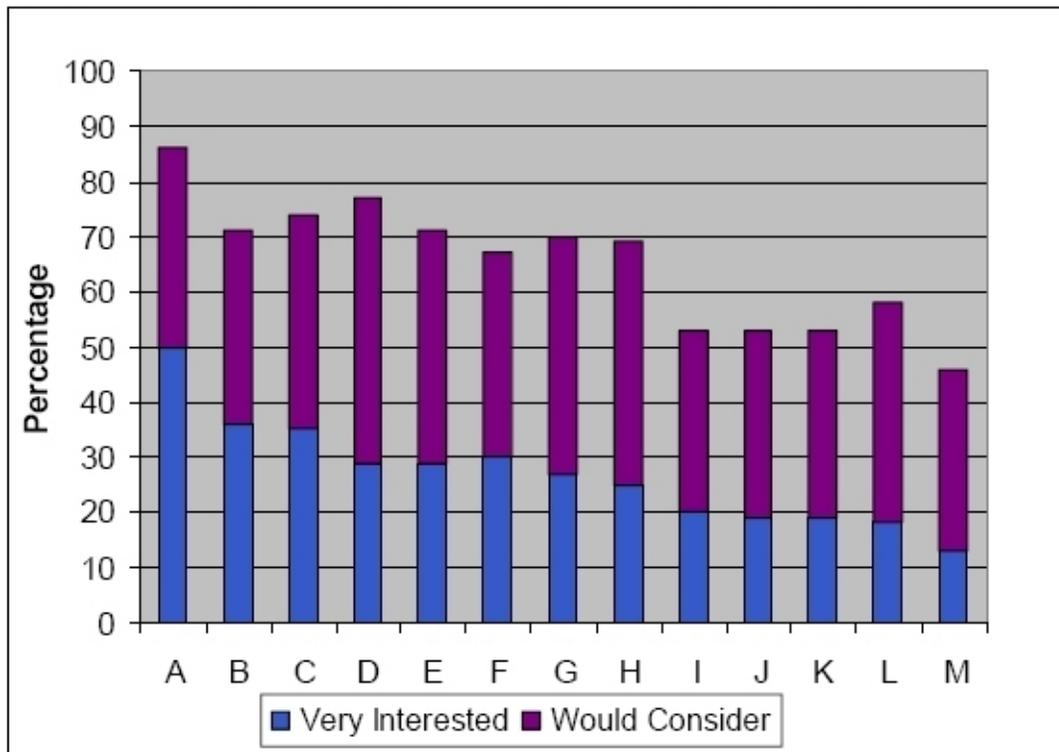
Over half of those interested (57.6%) intended to take 2 classes per semester. Others intended to take 3 to 4 classes per semester (26.5%), or only 1 class per semester (15.9%).

Almost 40% of students were willing to commit as many years as needed to complete their baccalaureate degree at their desired pace. About 32% of those interested were willing to commit 2 years for completion of coursework, with 16% desiring only one year of additional education. The remaining 12% were willing to commit 3-4 years.

## **Educational Venue**

To determine preferred educational venues for degree completion, students who identified an interest in degree completion were asked to indicate their interest (very interested, would consider, no opinion, not interested) in a variety of settings. The complete summary of student interest in educational venues can be found in Table 1. Examining strong interest, 50.4% of students were very interested in evening classes held in off-site locations near their home communities, 35.6% were very interested in online-only coursework, 34.8% were very interested in online coursework with a maximum of 3 face-to-face meetings, and 28.9% were very interested in a mixture of face-to-face and online coursework. Students were least interested in completing coursework during traditional day time hours at Minnesota State University, Mankato, Minn (12.6% very interested).

Table 1. Interest in Educational Settings (Interested students only)



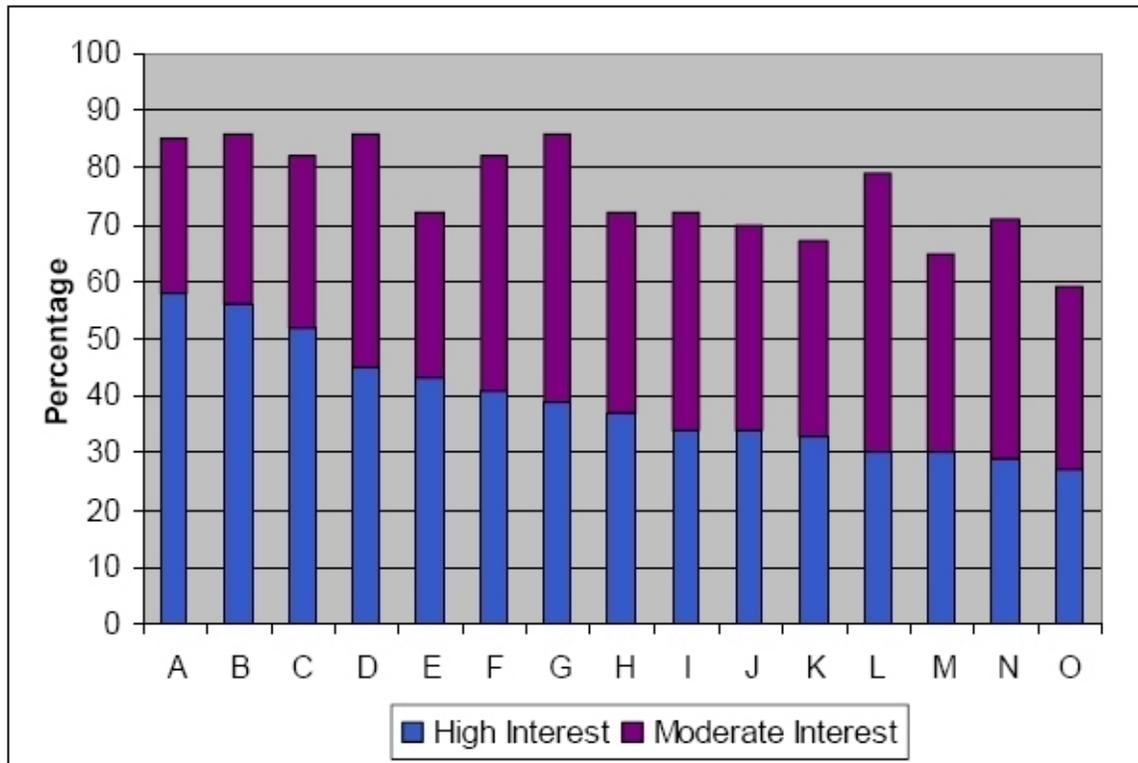
Key	
A	Evening classes in off-site locations
B	100% online classes
C	Online with a maximum of 3 face-to-face meetings
D	Hybrid of online and face-to-face classes
E	Evening classes at Minnesota State University (MSU)
F	Weekend classes in off-site locations
G	Evening classes through Interactive Television (ITV)
H	Monthly classes in off-site locations
I	Weekend classes through ITV
J	Weekend classes at MSU
K	Monthly classes through ITV
L	Monthly classes at MSU
M	Traditional day-time classes at MSU

### Educational Topics

To determine interest in educational topics for degree completion courses, students who identified an interest in degree completion were asked to indicate their interest (high interest, moderate interest, a little interest, no interest) in 29 different topics. The highest percentages of student interest in educational topics were reported in technology (58.3% highly interested), advanced clinical hand instrumentation (55.7% highly interested), restorative functions (51.5% highly interested), and current issues in dental hygiene (45.0% highly interested). Students were least interested in the design and implementation of research (8.3% highly interested), scientific writing (8.3% highly interested), evaluating scientific

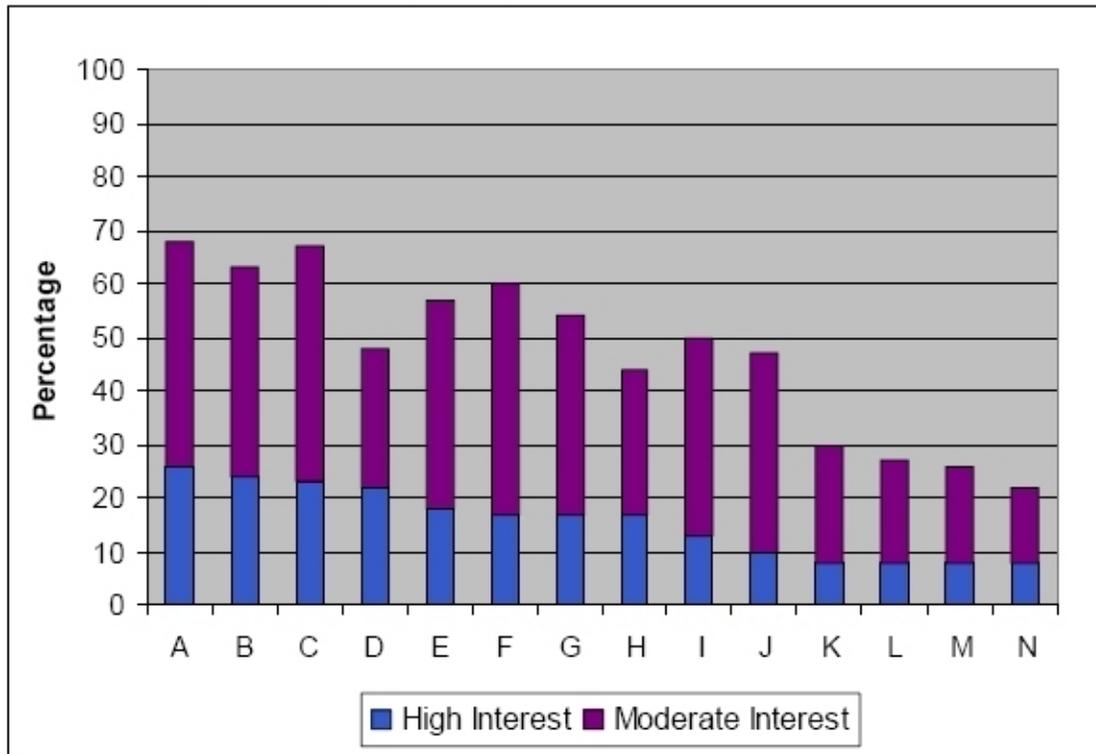
literature (7.6% highly interested), grant writing (7.6% highly interested), and statistics (7.6% highly interested). A complete summary of interest in educational topics can be found in Tables 2 and 3.

*Table 2. Interest in Topics, Top 15*



Key	
A	Advanced Technology
B	Advanced Clinical Instrumentation
C	Restorative Functions
D	Current Issues in Dental Hygiene
E	Study Abroad
F	Assessment of Risk Factors
G	Advanced Periodontal Clinical Skills
H	Assessing Community Health Needs
I	Advanced Radiography Interpretation
J	Clinical Teaching
K	Classroom Teaching
L	Advanced Periodontal Knowledge
M	Planning Community Health Programs
N	Community Practice
O	Teaching Methods

Table 3. Interest in Topics, Bottom 14



Key	
A	Medically Compromised Patients
B	Independent Study
C	Evaluating Oral Health Programs
D	Medical Ethics
E	Gerontology
F	Advanced Pharmacology
G	Business Management
H	Multicultural Issues
I	Oral Health Outcomes
J	Design/Implementation of Research
K	Analyzing Literature
L	Grant Writing
M	Scientific Writing
N	Statistics

## Discussion

This research study explored the demand for baccalaureate degree completion by current 2-year dental hygiene students while measuring interest in curriculum topics supporting the American Dental Hygienists' Association (ADHA) document *Dental Hygiene: Focus on Advancing the Profession* (2005). There is a general belief by dental hygiene educators and ADHA leadership that the profession of dental hygiene is in position to address the lack of access to oral health care in the United States.<sup>6</sup> In addition, the ADHA report, *Dental Hygiene: Focus on Advancing the Profession*, challenges the nation's educators to "revise the dental hygiene educational curriculum to prepare future dental hygienists to deliver quality oral health care to all segments of the U.S. population and to be responsive to an evolving health care delivery system".<sup>5</sup>

Results of this study support the data collected by *RDH* magazine, stating that dental hygienists do have interest in degree completion programs.<sup>12</sup> This investigation revealed strong support for degree completion with 66.0% of participants currently interested in completing their baccalaureate degree. Since participants were current 2-year students enrolled in Minnesota dental hygiene programs, results cannot be generalized to other regions or to previous graduates in dental hygiene. However, this research supports development of degree-completion programs in the Midwest.

Barriers to completing a baccalaureate degree, such as the need for flexibility in scheduling and family and work obligations, were identified in a Canadian research study as.<sup>20</sup> Results from the current study suggest that degree-completion programs need to recognize these barriers and enable students to enroll part time. Similar to the findings of Cobban and Clovis<sup>20</sup>, students in the current study identified evening classes in off-site locations near their residence, 100% online class offerings, and a blend of online and face-to-face courses as the preferred educational venues. In Minnesota, the 8 associate degree programs are located throughout the state, across a span of 250 miles. Developing individual off-site locations near each of the 8 associate programs is not feasible. Studies conclude that distance education is an effective educational methodology and applicable for dental hygiene degree completion programs.<sup>14-18</sup> It is the interpretation of the authors of this study to recommend implementation of online education supporting degree completion students that are regionally bound without close access to a degree completion program.

A strong degree-completion program supports the ADHA's action plan to "implement the baccalaureate degree as the entry point for dental hygiene practice within five years", and should incorporate coursework from each of the six focus areas to develop dental hygienists of the future.<sup>9</sup> The curriculum topics in this study were grouped by the authors and compared to five of ADHA's six focus areas to advance the profession. The survey did not include any specific items directly related to government. Some of the survey items such as *Current Issues in Dental Hygiene and Restorative Functions* could have been placed in multiple categories, but only one category was selected for purposes of this discussion. Survey items with the percentage of students who indicated a high interest in the specified topic are organized within each focus area in Table 4.

**Table 4. Interest in Educational Topics within ADHA's Focus Areas**

Focus Area:	Survey Item:	High interest %:
Research	Design/implementation of Research	8.3%
	Scientific Writing	8.3%
	Evaluating Scientific Literature	7.6%
	Grant Writing	7.6%
	Statistics	7.6%
Education	Teaching Methods	27.3%
	Faculty Responsibilities and Issues	22.7%
	Clinical DHYG Practicum	34.1%
	Classroom DHYG Practicum	33.3%
Practice & Technology	Adv. Periodontal Clinical Skills	39.1%
	Adv. Periodontal Knowledge	30.1%
	Assessing Patient Risk Factors	41.4%
	Adv. Clinical Hand Instrumentation	55.7%
	Technology	58.3%
	Adv. Radiographic Interpretation	34.1%
	Adv. Pharmacology	17.6%
Restorative Functions	51.5%	
Licensure & Regulation	Medical Ethics	18.2%
	Business Management	16.7%
	Current Issues in DHYG	45.0%
Public health	Assess Need for Comm. Hlth Programs	36.8%
	Design & Imple. Comm. Hlth Programs	30.1%
	Evaluate Comm. Hlth Programs	23.3%
	Medically Compromised Patients	25.8%
	Gerontology	16.8%
	Community Practice	28.8%
	Health Outcomes	9.9%
	Multicultural Issues	13.0%

Students indicated the highest interest in individual topics related to technology, advanced clinical instruction/skills, restorative functions, and current issues in dental hygiene. When grouped within each focus area, students demonstrated the highest interest in topics related to Practice & Technology (17.6%-58.3%) and aspects of Licensure and Regulation (16.7%-45.0%). Moderate interest was also demonstrated in the areas of Education (22.7%-34.1%) and Public Health (9.9%-36.8%).

Of significant concern is the lack of student interest in design and implementation of research, scientific writing, evaluating scientific literature, grant writing, and statistics. Developing a body of dental hygiene research to advance the profession is contingent on developing research skills and interest in graduates. A recent national survey identified that 62% of baccalaureate programs and 8% of non-baccalaureate programs provide a separate course on research. Despite the lack of

interest identified in this study, it is critical that degree-completion programs incorporate a research course and evidence-based decision making into course offerings. The ADHA's National Dental Hygiene Research Agenda is dependent on baccalaureate and degree-completion programs providing ample opportunities for graduates to develop and implement research skills.

A limitation of this study is that the sample included current first-year and second-year dental hygiene students located in Minnesota. Future studies should utilize a larger stratified random sample to include both current students and dental hygiene graduates from multiple regions and age groups. Descriptions of interest in each of ADHA's Focus Areas were limited by the survey items. Future studies may want to expand on the number of items utilized to describe interest in each of ADHA's 6 focus areas. Reasons for and barriers to completing a baccalaureate degree after licensure were not identified in this study, and may provide further guidance to development of user-friendly degree-completion programs. Additionally, future studies may want to compare the identified reasons for baccalaureate degree completion with ADHA's goals for the future of the profession.

## **Conclusion**

Increased numbers of dental hygienists with baccalaureate degrees are necessary to support ADHA's plan to advance the profession, address the future dental hygiene faculty shortage, and expand the body of dental hygiene research. With associate and certificate programs representing about 84% of all dental hygiene programs, the development of user-friendly degree-completion programs is essential to enable licensed dental hygienists to complete their baccalaureate degree.

This Minnesota study found that 66.0% of current associate degree students were interested in completing a Bachelor of Science degree in dental hygiene. The majority of students in this study desired a part-time pace, and were willing to dedicate as many years as needed to complete their degree at that desired pace. According to strong interest, the top 3 desired educational venues included 1) evening classes held in off-site locations near their home communities, 2) complete online coursework, and 3) online coursework with a maximum of 3 face-to-face meetings. Moderate to strong interest was identified by students in educational topics that support ADHA's focus areas of 1) Practice and Technology, 2) Licensure and Regulation, 3) Education, and 4) Public Health. Despite the lack of interest in topics related to research identified in this study, it is critical that degree-completion programs incorporate a research course and evidence-based decision making into their programs to support ADHA's National Dental Hygiene Research Agenda. It is recommended that degree-completion programs design curriculum in a format that meets the needs of their targeted population while including course topics that support the ADHA's report, *Dental Hygiene: Focus on Advancing the Profession*, and the priorities established by the ADHA's National Dental Hygiene Research Agenda.

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## **Notes**

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