

# Editorial

## It's all about curiosity and collaboration!

Rebecca S. Wilder, RDH, MS; Susanne Sunell, RDH, EdD

In June 2009, dental hygienists from across the United States, Canada and Europe came together to explore their questions and discuss how we could all work together to expand our knowledge about dental hygiene research. From June 15 to 17, 150 dental hygienists traveled to Washington, D.C. to talk about the future of our profession, the newest oral care technologies, the latest evidence linking oral health to systemic health, access to oral healthcare and many more topics. It was all about curiosity and collaboration!

Our common curiosity spurred us to explore a wide range of issues, as is evident from the work found in the research proceedings highlighted in this issue of the *Journal of Dental Hygiene*. The proceedings reflect the collaboration of 2 national organizations as well as collaborations among researchers. This issue of the *JDH* provides an overview of this collaborative research conference; however, the influence of the conference was greater than the sum of its various presentations. The conference provided diverse opportunities to make connections with others. Participants explored ways they could collaborate to further investigations and to explore areas of mutual interest in a more comprehensive way. It was all



Rebecca S. Wilder, RDH, MS  
Editor in Chief, *Journal of Dental Hygiene*  
American Dental Hygienists' Association



Susanne Sunell, RDH, EdD  
Scientific Editor, *Canadian Journal of Dental Hygiene*  
Canadian Dental Hygienists Association

about sharing and expanding the horizons of our research to support the oral health of our societies. It was about building collaborations to more effectively use scarce resources in the best interests of the public.

Through this edition of the *Journal*, we would like to extend these connections to our members, the dental hygienists of North America, who have an equal sense of curiosity and a desire to collaborate. Our curiosity is a characteristic that brings us together regardless of the work setting – it underpins the relationship between research and practice. The questions we are exploring arise from you, the dental hygienists working with clients – be they individuals, families, groups or communities. The work of researchers is to take the questions that you identify and shape them into realistic and relevant research questions that can be explored in a systematic way. This is the foundation of our collabora-

tion. You stimulate the questions and we attempt to find ways to provide you with insights that will support client safety and better oral health outcomes.

We are now extending out to you, our members, an opportunity to foster additional collaborations. We hope that your curiosity will stimulate your interest in reading this is-

sue of the *Journal of Dental Hygiene* and that it will initiate further communication with researchers so that we can work collaboratively to meet the oral health needs of people throughout the world. Working together we can achieve so much more!

Sincerely,

Rebecca S. Wilder RDH, MS  
Editor in Chief, *Journal of Dental Hygiene*  
American Dental Hygienists' Association

Susanne Sunell, RDH, EdD  
Scientific Editor, *Canadian Journal of Dental Hygiene*  
Canadian Dental Hygienists Association

# Guest Editorial

## Conference Overview and Acknowledgment

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

The North American Dental Hygiene Research Conference was held on June 15–17, 2009, in Bethesda, Md. The 3-day conference provided an opportunity for dental hygiene researchers throughout the U.S., Canada and Europe to convene at one of the world's leading research institutions to explore commonalities in their research interests, learn from each other about new and ongoing research programs and foster future collaborations. It is our hope that discussion and interest generated at the conference provided the networking support and intellectual stimulation needed to systematically and purposefully move our collective research agendas forward. To this end, the purpose of the conference was to:

- Foster collaboration through establishing a network of dental hygiene researchers and sharing research investigations
- Increase the knowledge and skills for submitting grant proposals that address national research priorities
- Increase and diversify the number of individuals engaged in oral health research
- Examine existing models of health care delivery addressing specific target groups and settings, e.g., elderly/nursing homes, children/schools
- Explore strategies to improve



Jane L. Forrest,  
RDH, EdD  
Conference Co-Chair



Ann Eshenaur Spolarich,  
RDH, PhD  
Conference Co-Chair

data acquisition and analysis. In order to achieve these objectives, a program devoted to a wide range of topics was created. The conference brought together leading researchers from the laboratory who showed us how new technologies will revolutionize practice, as well as practitioners who are researching problems encountered every day by clinicians, so that we can all improve the type and quality of care we provide our clients. The link between oral and systemic health was discussed, along with strategies for engaging dental hygienists in research to further elucidate these relationships in medically complex populations. Conference participants were also able to learn how to translate knowledge obtained from research into clinical practice, adopting an evidence-based approach to clinical decision-making and to learn strategies to communicate more effectively with one another, other health professionals and the public. Finally, an opportunity was provided to share our own original

research with one another and various federal agencies and private industry, so that we can all learn to build better relationships and to maximize the use of limited resources for positive gain.

This conference required a year of planning, and we must acknowledge the contributions and support that we have received

from many individuals and organizations along the way. First, we thank the Canadian and American Dental Hygienists Associations for partnering with the National Center for Dental Hygiene Research to invite dental hygienists from across the continent to participate in this event. Conference attendees represented 5 countries, including 33 states in the U.S., 5 Canadian provinces, Great Britain, Italy and Sweden. These included 25 graduate dental hygiene students and graduate program directors, 83 full and part-time faculty from universities, dental schools and community colleges, 8 dental hygienists from dental school research centers and private research companies, 14 full-time dental hygiene clinical practitioners, 7 public health/hospital dental hygienists, 11 government directors/project officers, 14 hygienists, dentists and physicians representing various industries, 6 professional association representatives, 4 journal editors and 4 entrepreneurs.

We thank the members of our Steering Committee, MaryAnn Cugini, RDH, MHP; Cindy Gadbury–Amyot, RDH, EdD; JoAnn Gurenlian, RDH, PhD; Salme Lavigne, RDH, MS; Judy Lux, MSW; McKenzie Smith, MPH, MEd and Rebecca Wilder, RDH, MS for volunteering their time and talents, and for moderating each of the sessions during the meeting.

We extend our appreciation

and thanks to the National Institute of Dental and Craniofacial Research, National Institutes of Health (NIH) for hosting our participants on-site and for the opportunity to come together to learn and to visit the NIH campus. We gratefully acknowledge the educational grants used to support the attendance of our graduate dental hygiene program directors and our graduate dental hygiene

students, and the research shared by many organizations to further our knowledge and understanding of their oral health products and services. Most importantly, we extend our deepest and most heartfelt gratitude for the educational grant support provided by the Procter & Gamble Company and Colgate Oral Pharmaceuticals, which made this conference a reality.

## NIDCR's 2009–2013 Strategic Plan

*Isabel Garcia, DDS, MPH  
Deputy Director, National  
Institute of Dental and  
Craniofacial Research  
National Institutes of Health.*

The National Institute of Dental and Craniofacial Research (NIDCR) remains committed to improving the oral, dental and craniofacial health of our nation. NIDCR pursues its mission through research, research training and the dissemination of health information to the public and health care professionals. NIDCR has played a leadership role in establishing prevention as a cornerstone of American oral health since its inception in 1948. Past investments have positioned the NIDCR to categorize complex dental, oral and craniofacial diseases and conditions that afflict millions of Americans. A comprehensive research agenda encompassing prevention, early detection and management of these diseases defines our current and future investments.

In consultation with National Institutes of Health (NIH) leadership, the NIDCR engages in long and short-term program planning to identify NIDCR priorities. These efforts develop and use information from several sources and consult a broad range of key stakeholders. The NIDCR also obtains input through a range of conferences and workshops that review emerging scientific opportunities, identify public health concerns and provide state-of-the-science assessments. As a component of the NIH, the NIDCR conducts its planning and priority setting within a larger context that considers input from the Congress and the Administration, the Department of Health and Human Services, the NIH and external peer review.

The 2009–2013 NIDCR stra-

tegic planning process gathered public and stakeholder input about prospective activities, areas of research emphasis, future research approaches, needs and opportunities. The NIDCR obtained this input in several ways, through:

- An open–forum listening session augmented by informal conversations at the American Association for Dental Research meeting in Dallas on April 2, 2008
- An open–forum listening session held in conjunction with the NIDCR Patient Advocates Forum on the NIH campus on April 21, 2008
- Web–based responses from 140 individuals and organizations to 6 strategic planning questions posted on the NIDCR Web site between May and July, 2008
- Two open–forum listening sessions augmented by informal conversations at the International Association for Dental Research meeting in Toronto on July 2–3, 2008
- A series of NIDCR staff meetings to obtain input on NIDCR goals and priorities
- Presentations during National Advisory Dental Research Council meetings
- A feedback session held on Feb. 9, 2009 with stakeholders representing federal agencies, professional dental organizations, dental specialties, voluntary organizations and industry
- Public comment obtained through Web posting of the draft plan during February 2009

The 2009–2013 NIDCR Strategic Plan provides a guide for funding decisions and defines areas that will be closely monitored for key developments and innovations that can be applied to oral, dental and craniofacial health. The goals and objectives presented throughout the plan strike a careful balance between basic and applied research, address workforce issues and confront the vexing

problem of health disparities. The goals and objectives within the plan do not encompass the entire range of NIDCR supported research that collectively contributes to our overall mission, but they do capture the areas that offer the most significant scientific promise in the near term.

The 2009–2013 NIDCR Strategic Plan is built on 4 key goals: widening our scope of inquiry, strengthening the research pipeline, fostering novel clinical research avenues and eliminating oral health disparities.

### Widening the Scope of Inquiry

The tools of modern science show us that diseases have no disciplinary boundaries. Our best chance for understanding complex diseases such as cleft lip and cleft palate, ectodermal dysplasias, dental caries, chronic pain and oral cancer is to embrace the newest technologies and advances, as well as opening our doors to expertise from different fields. Thus, the plan's first strategic goal asserts that it is critical we bring the best science to bear on problems in oral, dental and craniofacial health through multi- and interdisciplinary research. This investment requires a healthy marriage between creative individual investigator-driven research and team science approaches.

### Strengthening the Research Pipeline

The second strategic goal focuses on the need to work hard to draw curious minds to oral health research. It is our responsibility to inspire and support the next generation of scientists from a diverse array of backgrounds and biomedical and behavioral disciplines. The future of oral health depends on training the scientists of tomorrow and giving them opportunities to make discoveries.

### Fostering Clinical Research Avenues

Today, we are on the verge of

many opportunities to develop tailored, preemptive oral health care. More targeted facile diagnostic tests, new drugs and biologics, practice-based research venues and culturally sensitive behavioral interventions will provide novel clinical avenues to improve oral, dental and craniofacial health. Promoting innovative clinical research, the plan's third strategic goal, requires not only resources but also a new mindset to embrace and apply new approaches to solving old problems.

### **Eliminating Oral Health Disparities**

The most challenging issue we face as health professionals, educators and scientists is the stubborn reality that health disparities continue to exist in our country. We must improve our understanding of what causes inequality at individual, community and social levels. This knowledge will inform the development of practical and culturally appropriate interventions. Thus, the fourth strategic goal is to apply rigorous, multidisciplinary

research approaches to eliminate disparities in oral, dental and craniofacial health by improving health in diverse populations.

In charting a course for the next 5 years, NIDCR will be guided by the strategic plan while always considering emerging opportunities, successes and failures on an ongoing basis to inform our planning and program activities. We are ever mindful that the ultimate goal of our scientific efforts is to improve people's lives.

## The Canadian Institutes of Health Research (CIHR) and its Institute of Musculoskeletal Health and Arthritis (IMHA)

Jane E. Aubin, PhD

*Scientific Director, Institute of Musculoskeletal Health and Arthritis/Canadian Institutes of Health Research/Professor, Department of Molecular Genetics  
Faculty of Medicine, University of Toronto*

### Canadian Institutes of Health Research (CIHR) Overview

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency responsible for funding health research in the country, and reports to Parliament through the Minister of Health. CIHR has been operational since the year 2000 and currently holds a budget of C\$928.6 million for 2008–2009. CIHR's mandate is to "excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system." CIHR's mission is to transform health research in Canada by funding more research on targeted priority areas, such as population health and health services research, by building research capacity in under-developed areas, training the next generation of health researchers and focusing on knowledge translation, so that the results of research are transformed into policies, practices, procedures, products and services.

CIHR consists of 13 virtual institutes, a structure that is unique in the world. One of these is the

Institute of Musculoskeletal Health and Arthritis (see below). Each institute supports a broad spectrum of research in its topic areas and, in consultation with stakeholders, sets priorities for research in those areas. These institutes bring together all partners in the research process: the people who fund research, those who carry it out and those who use its results, to share ideas and focus on what Canadians need: good health and the means to prevent disease and fight it when it happens.

Through the research it funds, the CIHR helps to:

- Reduce the adverse impact of disease and illness on Canadians, increasing life expectancy, improving quality of life and contributing to a healthy and productive workforce
- Respond quickly and effectively to health crises, such as outbreaks of infectious diseases, by rapidly mobilizing researchers as evidenced during the SARS outbreak
- Contain the high and rising cost of delivering health care by identifying innovative and cost-effective ways of providing health services
- Deliver concrete research evidence to help individual provinces make critical, evidence-based decisions about reforms to their health care systems, reforms that will save money and improve services
- Provide evidence-based decisions about reforms to their health care systems
- Sustain and enrich industry with a rich pipeline of new discoveries
- Ensure the ethical conduct of research by providing leadership on complex challenges, such as the growing burden of obesity and mental health in the workplace, and by launching initiatives in collaboration with partners both in Canada and internationally that are designed

to have a real and tangible impact on these problems

In 2007–08, the CIHR had:

- Expenditures of C\$974.1M, supporting nearly 12,000 health researchers and trainees at 280 universities, teaching hospitals and other health research institutions in every province of Canada
  - Awarded 816 new or renewal grants with an average value of C\$119,000 selected by peer review from applications to the Open Operating Grants program
  - 311 partnership agreements with 247 partners
  - Benefited from 2,400 peer reviewers, each donating an average 15 days work to assess research proposals (equaling 36,000 days of donated work)
  - Held 24 Café Scientifiques, bringing researchers together with the public to exchange new information on the outcomes of health research
  - Reached 21,842 students through its Synapse youth engagement program
- Over its lifetime, the CIHR has:
- Established more than 830 partnership agreements with over 400 organizations, including the National Institutes of Health (NIH)
  - Leveraged more than C\$716.2M in additional funding for CIHR-led health research
  - Established international linkages with researchers from more than 50 countries, including the U.S.

### Institute of Musculoskeletal Health and Arthritis (IMHA) Overview

IMHA's vision is to sustain health and enhance quality of life by eradicating the pain, suffering and disability caused by arthritis, musculoskeletal, oral and skin conditions. To achieve its vision, IMHA supports excellent research

to enhance active living, mobility and movement and oral health, and addresses the causes, prevention, screening, diagnosis, treatment, support systems and palliation for a wide range of conditions related to bones, joints, muscles, connective tissue, skin and teeth. After an extensive consultation process, IMHA launched its second strategic plan in 2008, in which it re-stated its focus on 3 Strategic Research Priorities.

### **Physical Activity, Mobility and Health**

Research under this theme will create a better understanding of the relationships among physical activity, mobility and MSK health at every level, including the positive effects of motions and forces on the cellular behavior of joint tissues and the well being of individuals. The psychosocial aspects of exercise, activity and sports on populations are also relevant.

### **Tissue Injury, Repair and**

### **Replacement**

This theme supports innovative research into the cause and prevention of the physical, psychological, psychosocial and economic impacts of acute and chronic injury and prostheses. Potential research areas include novel drug or cell delivery models and approaches, application of tissue-engineered biomaterials as conduits or shunts in tissue regeneration and the ethical consequences of regenerative medicine based on tissue engineering strategies.

### **Pain, Disability and Chronic Disease**

The primary focus of this theme is to better understand the genetic and environmental causes, optimal treatment and elimination of pain and disability in all IMHA disease areas. A second area of significance is the need to understand the relationship between chronic diseases and conditions within IMHA's mandate (e.g., skin and bone diseases and diseases that compromise oral

health). The impact of chronic musculoskeletal, oral and skin diseases on general health and well-being is also of utmost importance.

Since their inception, CIHR and IMHA have supported oral health research in topics across all of IMHA's strategic priorities and related areas, spanning health services and policy, biomedical, clinical and public and population health research. Capacity in oral health research is being increased by ongoing support through grants, training awards and the Strategic Training in Health Research program. In addition, IMHA continues to support a large number of conferences and workshops, including ones sponsored by the Canadian Dental Hygienists Association, to enhance opportunities for IMHA stakeholders to meet together with partners to identify research gaps, prioritize research questions to address them and set national agendas in health research and knowledge translation.

## Update on Healthy People 2020

*Dolores M. Malvitz, RDH, DrPH  
Public Health Consultant,  
American Dental Hygienists'  
Association*

For 30 years, the U.S. government has published a set of health objectives for the nation, now known as *Healthy People*. This collaborative effort has been grounded in the notion that establishing objectives and providing benchmarks to monitor progress over time can motivate, guide and focus action within public health agencies (federal, state, local), as well as by their private-sector partners. Initiated in 1979, after the *Surgeon General's Report on Health Promotion and Disease Prevention* called attention to social and behavioral determinants of health, the exercise has continued each decade. While the goal of improving health for all Americans remained unchanged, the 3 publications (1979 to 1990; 1990 to 2000; 2000 to 2010) differed in specific goals, content and processes used to establish objectives.

From 1990 to 2010, *Healthy People* approximately doubled in size – from 226 to 467 objectives and 15 to 28 priority (or focus) areas. When sub-objectives for demographic groups are counted, the overall number of objectives reaches 823. Databases used to track objectives have expanded correspondingly, e.g., the 17 oral health objectives for 2010 rely on 5 major surveillance systems and periodic data collection efforts by 5 organizations. Given limited resources, the Office of Disease Prevention and Health Promotion (ODPHP, the unit within the Department of Health and Human Services that oversees *Healthy People*) began planning in 2006 for the 2020 cycle of objectives by contracting with the National Opinion Research Center (NORC) to as-

sess the framework and process for *Healthy People*.

The NORC Report, submitted in January 2007, recommended several major changes:

- Narrow the scope by reducing the number of topic areas and objectives
- Organize objectives by health risks and determinants, rather than diseases, to focus attention on the root causes of poor health
- Target the public health community as *Healthy People's* primary audience
- Articulate a clear vision for the initiative, thus creating a united effort to achieve common goals
- Develop dissemination strategies to engage partners

During the spring and summer of 2008, 6 regional hearings and web-based solicitations sought comments on the NORC proposals.

In February 2008 (preceding that comment period), an ad hoc work group on oral health met for the first time. Convened by the Association of State and Territorial Dental Directors, it was comprised of 15 representatives from professional and advocacy organizations in oral health, as well as an equal number of persons from the oral health units of federal agencies responsible for establishing and monitoring oral health objectives within *Healthy People*. The group's task was to ensure submission of testimony addressing the oral health community's concerns. A second meeting of the group occurred a year later (March 2009) to recommend which 2010 objectives should be retained, modified or deleted for 2020, and which new objectives should be added. Some 27 separate objectives were considered. While consensus of the work group was to serve as the basis for memoranda that oral health leads within federal agencies submitted to the ODPHP, the process did not include sharing these memoranda with meeting attend-

ees.

Late in 2008, the Secretary's Advisory Committee on National Health Promotion and Disease Prevention Objectives (comprised of 13 experts with diverse expertise on varied aspects of public health) released the vision, mission and goals for *Healthy People 2020* (HP2020). As promised, the vision is crisp and memorable – “A society in which all people live long, healthy lives.” The mission lists 5 things HP2020 should accomplish:

- Identify nationwide health improvement priorities
- Increase public awareness and understanding of the determinants of health, disease and disability and the opportunities for progress
- Provide measurable objectives and goals that can be used at the national, state and local levels
- Engage multiple sectors to take actions to strengthen policies and improve practices that are driven by the best available evidence and knowledge
- Identify critical research and data collection needs

The overarching goals established for HP2020 are to:

- Eliminate preventable disease, disability, injury and premature death
- Achieve health equity, eliminate disparities and improve the health of all groups
- Create social and physical environments that promote good health for all
- Promote healthy development and healthy behaviors across every stage of life

An action model, depicting how these goals might be achieved, has been posted on the *Healthy People* Web site (Figure 1).

Over the next year, the schedule for release of documents and comment by stakeholders will be tight, thus the *Healthy People* Web site (<http://www.healthypeople.gov/HP2020>) should be visited fre-

quently for updated information. The ODPHP has said that the remaining framework for HP2020 (e.g., focus areas, criteria for inclusion of objectives, target-setting methods for individual objectives) will be posted by June 2009 and followed by a 60-day comment period. Draft objectives will become available in autumn 2009, again with public comment invited. While the ODPHP indicated that release of the final 2020 document should occur early in 2010, it also admitted this schedule is ambitious for completing clearance, particularly given a new HHS Secretary.

Some certainties exist. *Healthy People* will focus on an ecological approach to health promotion. Its objectives will be organized by interventions, determinants and outcomes. No printed version will be released — it will be available online, as a searchable, multilevel and interactive database that helps stakeholders access metrics and guidance about effective interventions, as well as identify priorities.

Dental hygiene researchers should be interested in the broad

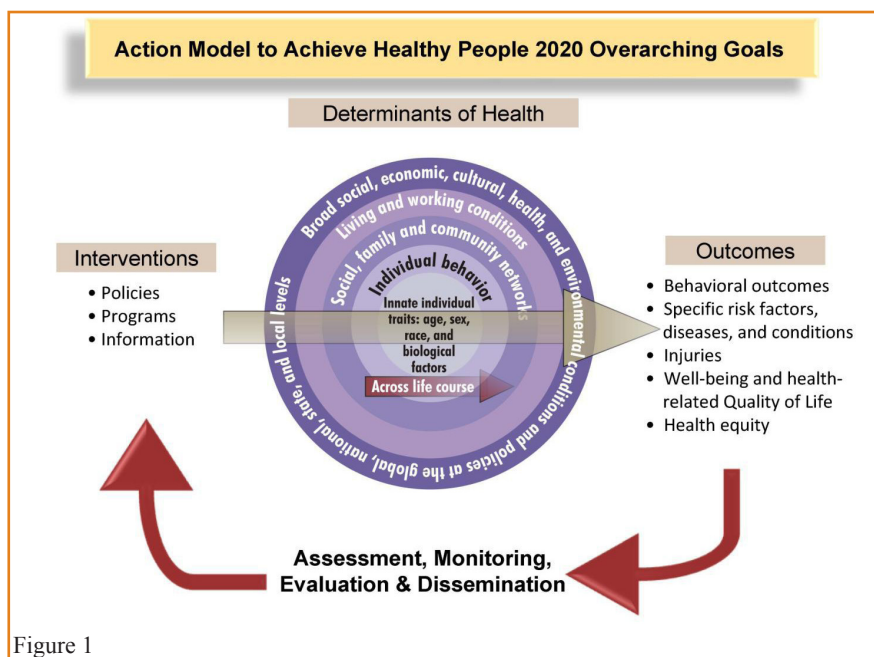


Figure 1

array of *Healthy People* objectives, because they serve as the foundation for health efforts by the federal government (e.g., health policies, allocation of funding for public health interventions and research). State and local health agencies also use *Healthy People* to choose priorities for their limited resources.

Well-chosen research questions, selected through true collaboration with public health professionals and congruent with the National Dental Hygiene Research Agenda, could make critical contributions to improving the effectiveness and efficiency of all programs with oral health content.

# The American Dental Hygienists' Association National Dental Hygiene Research Agenda

Jane L. Forrest, RDH, EdD  
University of Southern California, School of Dentistry

## Introduction

The aims of this paper are to highlight the American Dental Hygienists' Association (ADHA) National Dental Hygiene Research Agenda (NDHRA) as a strategic guide for conducting oral health research, examine the status of the existing body of dental hygiene research and identify mutual areas of interest and research priorities shared among different organizations.

## The ADHA NDHRA as a Strategic Guide for Conducting Oral Health Research

Reaching a consensus on a research agenda is a prerequisite for a profession to advance its research efforts. Using a systematic approach to updating the agenda on an ongoing basis allows it to remain viable and responsive to changing needs – it serves as our “roadmap.” The ADHA NDHRA was first conceptualized in 1993 as a working model for guiding research efforts to purposefully expand the profession's body of knowledge, encourage collaborative research and to guide education and practice.<sup>1</sup> Consensus on 5 broad categories containing 37 specific research topics was reached in 1995 using the Delphi technique.<sup>2</sup> In 2000, participants at the fourth ADHA National Dental Hygiene Research Conference confirmed that the agenda was still relevant. Health services research, access to care/underserved populations and health promotion/disease prevention were identified as priorities.<sup>3</sup>

Table 1. Research that Supports Dental Hygiene Clinical Practice<sup>5</sup>

MEDLINE Indexed Research that Supports Clinical Dental Hygiene Practice	Primary Journals Containing Systematic Reviews
Between 1990 – 2005:	•British Dental Journal•Caries Research
112 meta-analyses in 40 journals and Cochrane Library	•Community Dentistry & Oral Epidemiology
•50% located in 7 journals and Cochrane Library	•Journal of the American Dental Association
•50% located in 33 other journals	•Journal of Clinical Dentistry
1707 RCTs	•Journal of Clinical Periodontology
•70% located in 32 journals	•Journal of Public Health Dentistry
•30% located in 174 journals	•Cochrane Database Library

In 2006, the second Delphi study was conducted to re-examine the categories and topics to determine whether these priorities reflected current global health care issues as well as issues that impact the profession. After 3 rounds of mailings, the original 5 agenda categories were updated and a consensus was reached on 42 topics.<sup>4</sup> However, findings on the knowledge and use of the former NDHRA indicated that work is needed to better promote, coordinate and integrate its use by dental hygienists. In order to do so, several significant issues must be addressed by the ADHA, educators and other dental hygiene organizations, including:

- Making a commitment to using the agenda to guide research and funding so that limited resources are used most effectively
- Socializing students to the research process so that scientific inquiry is valued and becomes the norm for problem solving
- Creating a system to monitor the progress and outcomes of our research, training and dissemination activities
- Evaluating the merit of the research to better support clinical decision-making

## Examine the status of the existing body of dental hygiene research

The body of research evidence that supports clinical dental hygiene practice cuts across several disciplines. Most of this research is not found within the dental hygiene body of literature. For example, studies on prevention and therapy related to caries, periodontal diseases and oral cancer have been conducted by investigators, the majority of whom are not dental hygienists and do not publish in dental hygiene journals. The most relevant systematic reviews/meta-analyses are found in 7 journals and the Cochrane Collaboration Library (Table 1).<sup>5</sup> However, these only represent 50% of the studies, while the remaining 50% are found in 33 other journals. When looking at randomized controlled trials, the location of high level evidence is even more widely distributed among 200 journals.

Identifying research conducted by dental hygienists is more difficult due to the lack of a monitoring system. In an attempt to identify who is doing what, poster abstracts presented at the ADHA Annual Session in 2007 and 2008 and at this conference were examined to see under which research agenda category the studies could be classified. Overall, there appears to be a gap between those areas identified as priorities (e.g., Health Services Research, Health Promotion) and the

area receiving the most attention, Professional Education and Development (Table 2).

### Identify mutual areas of interest and research priorities that are shared among other research initiatives

An extensive review of health-related literature and major governmental and foundation reports were conducted in structuring the Delphi study so that there are many areas of shared concern. These include: evidence-based practice, where the focus is on effectiveness and outcomes of care and translating research findings into practice, health promotion/disease prevention, so that new knowledge from health communications is being used to promote healthy behaviors and improve health literacy and improving access to care by reducing health disparities, eliminating barriers and designing better systems of delivery. In addition, there is a shared interest in enhancing the research infrastructure through expanding the research workforce and training opportunities.

In summary, the most important aspects of having a national research agenda are its utilization as a strategic guide to keep us focused on established priorities and its support for building a strong research infra-

**Table 2. NDHRA Categories and Research Poster Abstract Categorization**

Meeting	Agenda Category					Total
	Health Promotion/ Disease Prevention	Prof Education & Development	Clinical DH Care	Health Services Research	Occupational Health/ Safety	
ADHA (2007/08)	7	31	15	1	0	54
NADHRC (2009)	11	9	14	4	0	38
Total	18	40	29	5	0	92

structure and body of knowledge. In addition, it aligns dental hygiene with other major health professional organizations and contributes to the credibility of the profession by being able to share our goals with the broader scientific community.

### References

1. ADHA 1993–94 Council on Research. The ADHA National Research Agenda: White Paper by the ADHA 1993–94 Council on Research. *J Dent Hyg.* 1994;68(1):26–29.
2. Forrest JL, Lyons K, Bross TM, Gitlin LN, Kraemer L. Reaching consensus on the National Dental Hygiene Research Agenda: A Delphi study. *J Dent Hyg.* 1995;69(6):261–269.
3. Gadbury–Amyot CC, Doherty F, Stach DJ, Wyche CJ, Connolly I, Wilder R. Prioritization of the National Dental Hygiene Research Agenda. *J Dent Hyg.* 2002;76(2):157–166.
4. Forrest JL, Spolarich AE. A Delphi study to update the American Dental Hygienists' Association National Dental Hygiene Research Agenda. *J Dent Hyg.* 2009;83(1):18–32.
5. Forrest JL, Miller SA. A Bibliometric Analysis of the Scientific Literature on MEDLINE Related to Clinical Dental Hygiene Practice. 2005;not published.

## Canadian Dental Hygienists Association: Creation and Capacity Building in the 21st Century

*Salme E. Lavigne, RDH, BA, MSDH*

*Professor & Director, School of Dental Hygiene, University of Manitoba*

Canada is a nation committed to the provision of high quality, affordable and accessible health care. Dental hygienists as independent, self-regulated primary health care providers contribute to the health and well-being of Canadians. The Canadian Dental Hygienists Association (CDHA), as the “collective voice and vision of dental hygienists in Canada advancing the profession, supporting the members and contributing to the oral health and general well-being of the public,” recognizes the need for a strong research base to support the profession.

We invite Canadian researchers to apply for funding through the Canadian Institutes of Health Research (CIHR), the leading health research agency in Canada, and the Canadian Foundation for Dental Hygiene Research and Education (CFDHRE).

To provide a foundation for dental hygiene research, CDHA developed a research agenda in 2003<sup>1</sup> and created a supplemental research document in 2008.<sup>2</sup> CDHA developed these documents within the context of the many disparities and gaps in the delivery of oral health services in Canada, documented by the Federal, Provincial and Territorial Dental Directors, the Canadian Association of Public Health Dentistry and the CDHA. With the specific purpose of identifying research endeavors that would ultimately enhance the oral health outcomes for

individuals and the public, CDHA used the 4 pillars of the CIHR as the framework for our research agenda. These 4 pillars represent a shift away from traditional biomedical models of research towards a focus on population health, health services and clinical research.

The 4 pillars and some examples of corresponding research:

### Biomedical Research

- Immunology – periodontology, oral cancer and dental caries
- Periodontal – systemic health connections
- Genetic conditions and oral health
- Nutrition and oral conditions

### Clinical Research

- Oral diseases risk assessment
- Ergonomics and patient care
- Antimicrobials and anticariogenic agents effectiveness
- Outcomes evaluations

### Health Services Research

- Clinical decision-making
- Cost-effectiveness/benefit analysis of dental hygiene services
- Financing services
- Service delivery mechanisms
- Oral care and quality of life

### Social, Cultural, Environmental and Population Health

- Oral disease distribution patterns
- Social and economic impact of oral disease on populations
- Equity and service provision
- Culturally and linguistically relevant services

CDHA reviewed the Research Agenda in 2008 and added 13 key themes for the 21<sup>st</sup> century to improve the oral health and well-being of Canadians. The 13 themes are based on the new national framework for oral health developed by the Federal, Provincial and Territorial Dental Directors in their 2005 Canadian Oral Health Strategy (COHS) document to col-

lectively meet national challenges in oral health.<sup>3</sup> The COHS is consistent with the World Health Organization's definition of good health, which emphasizes that good health is not merely the absence of disease or infirmity, it is also a reflection of the social and mental well-being of people in a community.

These 13 themes and 4 pillars provide some very broad guidelines for research. Dental hygiene research in Canada is young and developing and we did not want to place unnecessary limits that may hamper the growth of this evolving research community.

CDHA is guided by these principles for research:

- Ethical issues underpin all areas, and ethical conduct is the first consideration
- Acceptable evidence from research includes both qualitative and quantitative approaches
- Interprofessional and intersectoral partnerships are preferred
- Cultural and linguistic sensitivities are requisite
- Participatory research is essential for the empowerment of individuals and communities
- Vulnerable populations should be considered as a cross cutting theme wherever possible

CDHA groups research recommendations within 4 main priorities:

### Increase research capacity

- Build a foundation of research culture in dental hygiene education
- Expand opportunities for dental hygiene researchers
- Create a home for Canadian dental hygiene research
- Expand the CDHA role in fostering research

### Improve knowledge translation

- Identify, utilize and enhance communication strategies for research
- Create a knowledge transfer

designate

- Provide consumer decision-support aids

### **Enhance research activity through collaboration and partnerships**

- Advocate for new collaborations to address research priorities in oral health
- Align with research and funding institutions

### **Obtain a clearer picture of the state of current dental hygiene research and researchers**

- Conduct a survey of dental hygiene researchers to determine the breadth of research topics
- Conduct a survey to determine the educational path taken by dental hygiene researchers

We are making swift and crucial progress in implementing these recommendations. We have developed a database of dental hygiene researchers that connects researchers and inspires non-researchers. This database will soon be open to international researchers, to in-

crease the synergy of these connections. Two important collaborative relationships were developed. An affiliate partnership with the Canadian Cochrane Network and Centre enabled us to deliver systematic review workshops — the hallmark of knowledge translation activities. The Canadian Foundation for Dental Hygiene Research and Education collaborated with CIHR's Institute of Musculoskeletal Health and Arthritis to develop the inaugural Masters Award in Dental Hygiene. This giant step forward for dental hygiene research celebrates the unique perspective dental hygienists apply to oral health research.

Oral health research conducted by dental hygienists in collaboration with key partners will contribute significantly to the overall health and well-being of the Canadian public. Research findings will guide the practice of dental hygiene by increasing the evidence base for the delivery of high quality, effective and efficient oral health care and will support the modernization

of Canada's approach to health and health care and contribute to the improvement of access to oral health care services for the unserved and underserved populations. The CDHA will continue to lead dental hygiene in Canada in promotion and support of research with the ultimate goal of improving the oral health of Canadians.

### **References**

1. The Canadian Dental Hygienists Association. Dental Hygiene Research Agenda. CDHA. 2003.
2. The Canadian Dental Hygienists Association. Dental hygiene at a crossroads: knowledge creation and capacity building in the 21st century: A report on research in the field of dental hygiene in Canada. *CDHA Draft publication*. 2008.
3. FPTDD. A Canadian oral health strategy. Federal, provincial, territorial dental director's working group. Ottawa, 2005.

## Increasing Adoption of New Innovations and Effective Practice Recommendations

*Jan E. Clarkson, BDS, PhD  
Director, Effective Dental Practice Program DHS&RU and  
Director, Scottish Dental Practice Based Research Network,  
Director Scottish Dental Clinical Effectiveness Program;  
Coordinating Editor, Cochrane Oral Health Group*

The adoption of new innovations and practice recommendations can be a slow and haphazard process. There is a well documented lag between the publication of evidence and its implementation in clinical practice. In Scotland, we are using a multifaceted approach to this issue.

### The Effective Dental Practice Program

One approach is to develop a program of research specifically dedicated to investigating the translation of knowledge into evidence-based dental practice within primary dental care services as well as dental education. The Effective Dental Practice (EDP) Program now includes a range of such studies funded by the Medical Research Council, the Chief Scientists Office, the National Institute for Health Research Health Technology Assessment, the Economic and Social Research Council and the Scottish Government.

For example, the ERUPT trial examined the effect of 2 different implementation strategies to increase the adoption of effective practice recommendations in Scotland – a specific fee for service and a general education course. One-hundred and forty-nine general dental practice GDPs returned data on 2,833 children who had treatment records showing at least 1 erupted second

molar. The trial demonstrated that a fee for a preventive fissure sealant would increase the number of children receiving such care by 10%. The results of this trial informed and influenced the Scottish Executive policy decision to change the fee for item of service for this particular treatment.

### Scottish Dental Practice Based Research Network

Another approach is to encourage dentists, trainers and academics involved in dental education and dental research in Scotland to join the Scottish Dental Practice Based Research Network (SDPBRN). The aim of the SDPBRN is to encourage, facilitate and conduct high quality research specific to the primary care setting, and to disseminate information relevant to the provision of evidence-based primary dental care. The network maintains a register of current research and research ideas, along with current contact details of members in order to facilitate research collaborations. The SDPBRN has supported the collaboration of the National Health Service Education for Scotland, the Dental Health Services and Research Unit and dental deaneries in England, Wales and Northern Ireland. This enabled the conducting of a series of practice-based randomized controlled trials, surveys and cohort studies.

### The Cochrane Oral Health Group

Another approach is to contribute to the Cochrane Oral Health Group (OHG). This is part of the Cochrane Collaboration, an international, non-profit and independent organization dedicated to making up-to-date, reliable and accurate information about the effects of health care readily available worldwide. High quality systematic reviews of current available best evidence is of particular importance in dentistry, where many dentists work in rela-

tive isolation with little hope of critically evaluating the thousands of journal articles published each year or of verifying the claims of those advocating novel interventions or materials. This has resulted in a number of problems. Interventions are being adopted despite evidence against their use, costly interventions are being adopted at the expense of cheaper, equally effective ones, interventions are not adopted despite evidence for net clinical benefit and interventions are adopted in the absence of quality evidence.

The OHG comprises an international network of health care professionals, researchers and consumers. The work of the OHG is carried out by over 617 members from 40 different countries around the world. Members contribute in many different ways: preparing systematic reviews, peer reviewing, manually searching journals, translating articles and offering consumer input. Activities are coordinated by its Editorial Base, located within the School of Dentistry, University of Manchester, United Kingdom. To date, the OHG has published 90 systematic reviews and 73 protocols. Its performance has ranked it third out of the 24 United Kingdom National Health Service funded groups.

### Apply Psychological Models to Understand and Facilitate Professional Behavior Change

Since adopting new evidence into practice often requires clinicians to change their behavior, another approach we are taking is to use psychological models to understand and investigate factors associated with implementing evidence-based dental practice. These models explain behavior in terms of predictive beliefs which can be influenced, as well as methods for measuring and influencing them. In effect, they provide a means of focusing the design of a knowledge translation intervention and include an expla-

nation of how it will work. Psychological models have informed the design of interventions, increased our understanding of our research results, as well as the likelihood of our intervention success. For example, most knowledge translation interventions are focused on the “why” and the “what” of evidence-based practice. Using psychological models and methods has allowed us to accumulate evidence suggesting that dentists also need to plan in more detail about when and how they can implement evidence-based behaviors.

### **Translation Research in a Dental Setting**

The final avenue is using a multidisciplinary team of experts to help synthesize the evidence from trans-

lation research programs with the practical realities of health care and clinical settings as understood by different perspectives. The Translation Research in a Dental Setting (TRiaDS) collaboration includes academics, dentists and doctors from primary and secondary care, psychologists, economists, statisticians, trialists and policy makers. The overall aim is to develop an evidence-based framework for choosing and designing knowledge implementation interventions with the greatest likelihood of success, whether these interventions take place at the initial development and presentation of the evidence, guideline design, the level of the organization or the level of the individual clinician or patient. The TRiaDS framework will be based

on the results of a program of high quality randomized controlled trials (RCTs) on the translating of dental guidance into practice. The first RCT, comparing 2 strategies for the implementation into practice of Scottish Dental Clinical Effectiveness Program (SDCEP) decontamination guidance (*Cleaning Dental Instruments*) is already underway. It is expected that the development of a coherent theoretical framework for understanding patient, professional and organizational behavior change will also have applications outside dentistry. SDCEP was initiated to provide guidance in areas of uncertainty for dental health care practitioners in Scotland and to date have worked in 7 priority areas.

## Historical Overview of Models of Practice Based Research; NIDCR DPBRN Grant Initiative

Donald J. DeNucci, DDS, MS  
Program Director, Practice-based Research Networks  
NIDCR, NIH

Dental practice-based research is research conducted in clinical practices by practitioners and their staffs that is designed to answer questions dental professionals face during routine care of patients. The origins of practice-based research can be traced back to small groups of European medical practitioners who began sharing information pertinent to patient care and clinical outcomes. The early precursors to today's practice-based research networks (PBRNs) were the European sentinel networks of the 1970s. This sentinel model soon took hold in the U.S. as the Ambulatory Sentinel Practice Network (ASPN) followed closely by the establishment of the Pediatric Research in Office Settings (PROS) in 1984.<sup>1</sup> Currently, there are over 120 primary care PBRNs known to be active in the U.S., which include about 20,000 practices of pediatrics, family medicine and general internal medicine located in all 50 states.<sup>2</sup>

In 2005, the National Institute of Dental and Craniofacial Research (NIDCR) funded 3 large dental PBRNs for a period of 7 years at a cost \$75 million, the largest single project in the history of the NIDCR. These dental PBRNs are composed of academic hubs and coordinating centers that leverage the research strengths of these institutions with

the real work environment of clinical practice. The primary purpose of these grants is to provide an infrastructure to conduct multiple clinical trials and prospective observational studies that answer questions facing general dental practitioners in the routine care of their patients. The PBRN infrastructure is also designed to provide a flexible and adaptable electronic communications network/platform that ensures a common means for connectivity, data sharing and communication within the PBRN and with other medical and dental PBRNs currently in existence or that may be created in the future. There are presently over 500 practices involved in this project in more than 20 states and Scandinavia.

Practice-based research networks can generate important and timely information to guide the delivery of health care and improve patient outcomes. Many of the unique questions faced by dental health practitioners on a daily basis are most appropriately addressed in dental practice settings in the context of the oral health care delivery system. Indeed, the recent American Dental Association Future of Dentistry Report specifically recommended that national clinical research networks be established, which link treatment approaches and outcomes in private practice settings.<sup>3</sup> By connecting practitioners with experienced clinical investigators, PBRNs can enhance the clinical research agenda of the NIDCR and produce findings that are immediately relevant to practitioners and their patients. PBRNs support a variety of clinical studies with clear and easily defined outcome measures, and they typically draw on the experience and insight of practicing clinicians

to help identify and frame research questions. Because research is conducted in the real-world environment of dental practice, results are more likely to be readily accepted and adopted by practitioners and translated into daily practice. Moreover, because PBRNs use the existing personnel and infrastructure of established dental practices, certain types of clinical studies can be conducted in a cost-effective manner.

Although dental PBRNs were initially established to engage general dental practitioners in the research process, membership has now been expanded to include dental specialists and other key members of the dental team, including dental hygienists. In addition to roles as research coordinators and clinical research associates, dental hygienists are certain to have the opportunity to develop studies of interest to the dental hygiene community and to serve as principal investigators on these projects.

## References

1. Green LA, Hickner J. 2007. A short history of practice-based research networks: From concept to essential research laboratories. *J Am Board Fam Med*. 2007 19(1): 1–10
2. Agency for Healthcare Research and Quality. Primary Care Practice-based Research Networks [Internet]. Cited May 5, 2009. Available from: <http://www.ahrq.gov/about/highlit07b.htm>.
3. ADA. Future of Dentistry Report. Dental and Craniofacial Research, 149 [Internet]. Available from: [http://www.ada.org/prof/resources/topics/futuredent/future\\_chap07\\_08.pdf](http://www.ada.org/prof/resources/topics/futuredent/future_chap07_08.pdf).

## **An Update from the PEARL Network and Serving as a Practice Research Coordinator for the PEARL Network**

*Ronald G. Craig, DMD, PhD  
Associate Professor,  
Department of Basic Sciences  
and Craniofacial Biology  
Department of Periodontology  
and Implant Dentistry,  
New York University College of  
Dentistry, Director PEARL  
Information Dissemination Core  
Joanne Johnson, RDH  
Oral Health Center,  
Westborough Massachusetts*

The Practitioners Engaged in Applied Research and Learning (PEARL) is a dental practice-based research network (PBRN) comprised mainly of general dental practitioners who conduct clinical research within the setting of their private practices. The PEARL Network is 1 of 3 national dental PBRNs supported by a grant from the National Institute of Dental and Craniofacial Research (NIDCR). A distinctive feature of the studies conducted within dental PBRNs is the direct impact of study results on the daily clinical practice of dentistry. Each of the 3 national dental PBRNs has evolved its own unique organizational structure. The PEARL Network is supported by the NIDCR, which provides financial support, The EMMES Corporation of Rockville, Md., which functions as the data coordination and analy-

sis center and the New York University College of Dentistry, which provides central administrative support. From within the PEARL administrative center, 5 pharmaceutical industry standard clinical research coordinators directly interface with member practices to assist with study initiation, assurance of data quality, compliance with Good Clinical Practice and the protection of human subjects, as well as answer any questions or problems that arise during the conductance of PEARL Network studies. At present, the PEARL Network consists of 188 dental practitioners from 21 states largely located within the northeastern U.S.

Practitioner-investigators of the PEARL Network suggest ideas for research that arise during the course of providing dental care that are ranked for priority by the Network membership. Research ideas given the highest priority are developed into formal research protocols by the PEARL administrative center, with assistance in study design and data analysis by the EMMES Corporation. At present, the PEARL Network has completed or is conducting 8 studies that range from surveys of practice procedures to effectiveness studies to randomized clinical trials. Present studies include: the treatment of deep carious lesions, post-operative hypersensitivity after placement of resin-bonded composite restorations, risk assessment for osteonecrosis of the jaw, outcomes of endodontic therapy, use and effectiveness of analgesics in dental practice and the treatment of hypersensitive non-carious cervical lesions. Within the next 3 years additional studies are

planned that include: assessment of the criteria used in general practice for periodontal diagnosis, treatment and maintenance recall, oral cancer screening diagnostics, a new caries classification system and its use in non-surgical treatment of reversible carious lesions, outcomes of implant therapy, outcomes of all-ceramic crowns and outcomes of periodontal therapy. The PEARL Network is also extending its studies to include medical PBRNs, and will conduct studies in collaboration with the other 2 national PBRNs on the impact of PBRN research findings on clinical practice, treatment of temporomandibular joint dysfunction and oral cancer detection.

Opportunities for dental hygienists to participate in the PEARL Network include becoming a Practice Research Coordinator (PRC) for a PEARL Network practitioner-investigator practice. PRCs in many PEARL practices function as the liaison between the practice, the PEARL administrative center and the EMMES Corporation. PRCs help recruit appropriate patients into PEARL research protocols, help train staff in conducting research studies, help in the collection and recording of data and participate in data quality assurance procedures. Additional, unique opportunities for dental hygienists to participate in the PEARL Network may arise depending upon the results of the periodontal diagnosis, treatment and maintenance and recall study and periodontal outcomes studies. Additional information on the PEARL Network and opportunities for participation may be found on the PEARL Network public Web site, [www.pearlnetwork.org](http://www.pearlnetwork.org).

## An Update from “The Dental DPBRN”

Gregg H. Gilbert, DDS, MBA  
The DPBRN Collaborative  
Group

The Dental Practice–Based Research Network (DPBRN) was developed in response to a 2004 initiative from the National Institute of Dental and Craniofacial Research (NIDCR).<sup>1</sup> The mission of DPBRN is “To improve oral health by conducting dental practice–based research and by serving dental professionals through education and collegiality.” It is committed to maximizing the practicality of conducting research in daily clinical practice across geographically dispersed regions, so its structure is designed to focus some activities at the regional level (e.g., close interactions with practitioner–investigators) and other activities that can be done on behalf of the entire network centrally (e.g., study development).<sup>1,2</sup>

The DPBRN central administrative base is at the University of Alabama at Birmingham, comprising the Office of the Network Chair and the Coordinating Center. DPBRN is unique in that it encompasses 4 regions in the U.S. and 1 in Scandinavia. For 2 DPBRN regions, collaborations were established with 2 organizations: HealthPartners (HP) of Minneapolis, Minn. and Kaiser Permanente Northwest/Permanente Dental Associates (PDA) of the greater metropolitan Portland, Ore. area. HP is a prepaid, multi–specialty group that provides comprehensive health care. PDA is a multi–specialty dental group that contracts with Kaiser Permanente Northwest (KPNW) to provide dental services for KPNW prepaid comprehensive health plan members. The 5 DPBRN regions are:

1. The Alabama/Mississippi region, which almost entirely comprises persons in private practice, although a few practices are in public health settings
2. The Florida/Georgia region, which also comprises almost entirely persons in private practice, although a few practices are in public health settings
3. The Minnesota region, which comprises providers employed by HealthPartners and providers in private practice in Minnesota
4. The Permanente Dental Associates region (PDA), which comprises entirely practitioner–investigators in Oregon and Washington in the PDA organization, in cooperation with the Kaiser Permanente Northwest Research Foundation’s Center for Health Research
5. The Scandinavian region, which comprises dentists and dental hygienists in Denmark, Norway and Sweden, about one–half are in private practice and one–half are in a public health setting

The Executive Committee is the main decision–making body of the network and is structured to make DPBRN a practitioner–driven network. It makes decisions on operational issues, considers appropriateness and suggests changes in study procedures, reviews the network’s progress and prioritizes research topics, among other duties. The committee meets approximately 6 times each year, with most meetings held by videoconference. By design, majority voting authority resides with its 6 practitioner–investigator representatives. In addition to 1 practitioner–investigator from each of DPBRN’s 5 regions, there is a member–at–large representative for the combined Alabama/Mississippi and Florida/Georgia regions. To be eligible to serve as a practitioner–investigator representative, a DPBRN practitioner must meet the following criteria: be a licensed

practitioner, be a general dentist or dental hygienist who sees patients in a general practice setting, has participated in at least 1 DPBRN clinical study, has access to e–mail, is able to receive attachments via e–mail and is willing to communicate via e–mail on a regular basis and is able to participate in the regularly–scheduled meetings. One vote is also given to each of 3 non–practitioner–investigators (Network Chair, Principal Investigator of the Coordinating Center, NIDCR representative).

Both dentists and dental hygienists can be DPBRN practitioner–investigator members. To become a member of DPBRN, practitioners must complete a 101–item enrollment questionnaire. The Enrollment Questionnaire is publicly available at <http://www.DPBRN.org> under the [Enrollment/Join](#) tab. DPBRN has 20 approved studies as of June 2009. Stratified by phase, the titles of these studies are:

### Data collection completed

- Dental tobacco control randomized clinical trial
- Practice–based root canal treatment effectiveness
- Assessment of caries diagnosis and caries treatment
- CONDOR case–control study of osteonecrosis of the jaws
- Retrospective cohort study of osteonecrosis of the jaws
- Reasons for placing the first restoration on permanent tooth surfaces

### In data collection phase

- Reasons for replacement or repair of dental restorations
- Patient satisfaction with dental restorations
- Longitudinal study of dental restorations placed on previously un–restored surfaces
- Prevalence of questionable occlusal caries lesions
- Development of a patient–based provider intervention for early

caries management

- Blood sugar testing in dental practice

**Approved by the Protocol Review Committee, but not in data collection phase yet**

- Longitudinal study of questionable occlusal caries lesions
- Longitudinal study of repaired or replaced dental restorations
- Hygienists' internet tobacco cessation randomized clinical trial
- Perioperative pain and root canal therapy
- Persistent pain and root canal therapy
- Assessing the impact of participation in practice-based research on clinical practice and patient care
- Incidence of post-operative infection after oral osseous surgery
- CONDOR Temporomandibular Joint Disease Study

Experiences in DPBRN demonstrate that dentists and dental hygienists from a broad array of practice settings and geographic regions will readily contribute research ideas and participate in practice-based studies. Benefits to participating in DPBRN have comprised a broad range (Table 1). As practitioner-investigators become knowledgeable of the benefits to their practices and patients, and see others being successful with their PBRN participation, they become motivated to engage in the excitement of discovery and the camaraderie from interacting with fellow practitioner-investigators.

PBRNs are based on the understanding that the experience, insight and practical wisdom of daily clinical practitioners and their patients are powerful means to advance the health of the population and address challenges encountered in daily clinical practice. The dental care sector can play an active role in these advancements, showing that knowledge transfer not only

**Table 1. Benefits of participating in DPBRN as communicated by DPBRN practitioner-investigators**

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• Distinguishes the practice from other practices, acting as a practice promoter or practice builder</li><li>• Enhances communication with patients by showing that the practitioner-investigator cares about the scientific basis of daily clinical practice</li><li>• Provides a focus for clinical excellence by devoting increased short-term attention to 1 particular area of clinical practice at a time</li><li>• Projects can improve the quality of dental care by contributing to the scientific basis for the dental procedures that are their focus</li><li>• Receive Continuing Education credit for attendance at DPBRN annual meetings and participating in training and certification activities for specific DPBRN studies</li><li>• Practitioner-investigators decide what studies are done and what treatment is done – not third parties</li><li>• Receive financial remuneration for the time spent doing research</li></ul> | <ul style="list-style-type: none"><li>• Increases the practice's visibility and stature among dental patients</li><li>• Expands the vision for patient care by including a formalized research and quality improvement component</li><li>• Can improve the logistics of daily clinical operations, serve as a team builder for practice staff and engage the entire staff in the excitement of discovery and quality improvement</li><li>• Provides venues for collegial interactions and exchange of ideas with fellow practitioner-investigators – become part of a community of learning and camaraderie</li><li>• Allows practitioner-investigators to see what is effective in their practices in comparison to other practices – using results that are presented anonymously</li><li>• Potential to present at local, state, national and international dental meetings and research conferences</li><li>• Receive certificates suitable for framing and display in the office</li></ul> |
|--|---|

happens in the research-to-practice direction, but also in the practice-to-research direction.

### Acknowledgments

This investigation was supported by NIH grants DE-16746 and DE-16747. An Internet site devoted to details about DPBRN is located at [www.DPBRN.org](http://www.DPBRN.org). Persons who comprise the DPBRN Collaborative Group are listed at <http://www.DPBRN.org/users/publications>. Opinions and assertions contained herein are those of the authors and are not to be construed as necessarily representing the views of the respective organizations or the National Institutes of Health.

### References

1. Gilbert GH, Williams OD, Rindal DB, Pihlstrom DJ, Benjamin PL, Wallace MC, DPBRN Collaborative Group.

The creation and development of The Dental Practice-Based Research Network. *J Am Dent Assoc.* 2008;139(1):74-81.

2. Makhija SK, Gilbert GH, Rindal DB, Benjamin P, Richman JS, Pihlstrom DJ for the DPBRN Collaborative Group. Dentists in practice-based research networks have much in common with dentists at large: evidence from "The Dental PBRN," *Gen Dent.* 2009; in press.

## **An Update from Northwest PRECEDENT (Practice- based REsearch Collaborative in Evidence-based DENTistry)**

*Marilynn Rothen, BS, RDH  
Lead Coordinator, Northwest  
PRECEDENT  
University of Washington School  
of Dentistry*

Northwest Practice-based REsearch Collaborative in Evidence-based DENTistry (PRECEDENT), 1 of 2 dental practice-based research networks (PBRNs) funded and established in 2005 by the National Institute of Dental and Craniofacial Research (NIDCR), draws member-dentists from Washington, Oregon, Idaho, Montana and Utah. Faculty and staff at the University of Washington and Oregon Health and Science University Schools of Dentistry have oversight and management responsibilities for the network, while data management is performed by Seattle Based Axio Research. Presently, there are 159 fully trained member-dentists in the 5-state region. The training required for active participation in network studies involves a 4 hour DVD course on principles of clinical research, an online course in the Responsible Conduct of Research for human subjects' protection and documentation of an understanding of HIPAA as it applies to research. Northwest PRECEDENT also includes a sub-network of 57 orthodontists and the "Friends of Northwest PRECEDENT," dentists outside of the network states who participate in surveys and are kept up-to-date on PRECEDENT activities.

The first study conducted in the network, Study 001, Oral Disease Markers Survey, achieved 2 prima-

ry aims. The first, to initiate dentists to the practice of research through a minimal risk study, introduced required staff training, random selection of patients, the patient consent process, data collection protocols, online data entry and quality control measures. Secondly, the study design gathered data about the disease patterns of patients attending the practices of Northwest PRECEDENT dentists. This provides valuable background information for planning future studies.

Beyond Study 001, ideas for study development are generated and/or evaluated by the member-dentists. The validity of caries risk assessment techniques emerged as a primary concern for network-dentists. Study 002, Salivary Markers in Caries Risk Assessment, examines the respective contributions of environmental data and salivary characteristics to caries risk by following a cohort of patients over 2 years. A future corollary to Study 002 will assess genetic markers for caries in collaboration with ongoing work at the University of Pittsburgh.

While the reliability of the salivary tests was being assessed prior to implementation, PRECEDENT rolled out Studies 003 and 004. Study 003, Case Control Study of Osteonecrosis of the Jaw, was a collaborative effort across the 3 PBRNs. Study 004, Computer Assisted Relaxation Learning, tests a desensitization protocol for needle phobias.

Study 005, Assessing the Outcomes of Cracked Teeth, will be launched this summer. Just as the cause, diagnosis and treatment of cracked teeth often presents a dilemma to the practitioner, the hypothesis and protocol development for this practice-based study presented challenges. The result is an observational study using a cracked tooth registry. A significant hurdle is to establish a method to calibrate participating dentists in assessment

of cracks when it is not feasible to bring all examiners together for training.

The first large randomized clinical trial developed in the PRECEDENT network, Study 006, Comparing Mineral Trioxide Aggregate (MTA) and Calcium Hydroxide as Direct Pulp Capping Agents, has been launched. Dentists are randomized to use of either MTA or Calcium Hydroxide for all pulp capped teeth in their practices with vitality assessed at 2 years. This study introduces PRECEDENT dentists to routine adverse event reporting and study monitoring by a Data and Safety Monitoring Board.

Linked studies 007 and 008 confront the challenge of dentin hypersensitivity. Study 007 surveys members and Friends of PRECEDENT regarding their assessment methods for dentin hypersensitivity and treatment preferences. The cross-sectional design of Study 008 will ascertain the prevalence of dentin hypersensitivity in network practices.

The extraction of third molars is not without risk. Study 009 recruits a cohort of 16 to 22 year olds who have never had a third molar extracted and follows them for 2 years. Data gathered includes dentists' assessment and rationale for recommendations regarding third molars, patients' compliance with those recommendations and outcomes for both compliant and non-compliant patients.

Study 010 surveys dentists from the PBRNs on the impact of their participation and the translation of evidence to clinical practice and patient care. One of the ultimate goals of the dental PBRN is to improve the translation of research findings to clinical practice. Historically, this translation from academia to medical and dental practice has spanned as much as 20 years.

The orthodontic sub-network's first study entails a survey regarding use of Temporary Anchorage

Devices (TADs) and gathers information on outcomes by those who use TADs.

Six studies have received concept approval by the members of PRECEDENT's executive committee and NIDCR. A faculty member at either Oregon Health and Science University or University of Washington takes the lead on research design and full protocol development. Once a study protocol has received approval from the network's Protocol Review Committee, the work of operationalizing the study begins with the development of study materials (manual of procedures, data collection forms, etc.) and training procedures for the offices.

Most studies are rolled out to practices in waves with a regional

coordinator making an initial training call. Three of the 4 regional coordinators are dental hygienists, as the background and experience of hygienists make them ideal coordinators. They assist office staff in completing all necessary training and calibration to initiate the study. An in-office visit follows with the enrollment of the first couple of patients to ascertain compliance with staff training, human subjects' protection and study procedures. Quality assurance measures continue with review of data entered online, regular office contact and random site visits at study completion for data verification. In some PRECEDENT practices, dental hygienists gather study data and/or function as in-office coordinators. Finally,

study results are presented at well-attended PRECEDENT annual meetings, research conferences and as manuscripts submitted to various journals.

The oversight and management by University of Washington and Oregon Health and Science University of this network involves a large and diverse team of faculty and staff researchers, including several hygienists. The work of developing and operationalizing studies is truly a collaborative effort, crossing disciplines, institutions and networks. It is, however, the enthusiasm of the member-dentists and their staff and their willingness to learn and implement disciplined research methodology that generates new evidence for the practice of dentistry.

## How Can Dental Hygiene Interface with Dental Practice–Based Research Networks?

*Ann Eshenaur Spolarich, RDH, PhD*

*Clinical Associate Professor and Associate Director, National Center for Dental Hygiene Research, USC School of Dentistry;*

*Adjunct Associate Professor, Arizona School of Dentistry and Oral Health*

During Plenary Session II, we gained important insights about the history and status of Practice–Based Research Networks (PBRNs), including the Scottish Dental PBRN and the 3 National Institute of Dental and Craniofacial Research (NIDCR) funded PBRNs. I have the honor and privilege to serve as a member of the NIDCR PBRN Monitoring Committee (MC) representing the American Dental Hygienists' Association (ADHA). The MC is comprised of representatives from NIDCR, professional organizations, specific content experts and a public advocacy member. The MC meets twice annually to conduct a review of the progress of the PBRNs, and to provide feedback to PBRN program directors and to NIDCR. In addition to these responsibilities, I represent the interests of organized dental hygiene to NIDCR and report back to ADHA.

Established networks provide the infrastructure needed to conduct research that can strengthen clinical decision making and improve the delivery of patient care. Dental hygienist researchers have many opportunities to interface with existing PBRNs. When planning collaborative projects, the following 4 considerations should be taken into account:

1. Utilization and sustainability of

resources

2. Potential topics for study
3. Translation of study results
4. Establishing key relationships

As with any research grant, the funds will eventually run out, causing investigator focus to shift towards project sustainability. NIDCR has made a \$75 million dollar investment into this 7 year project, and now in its fifth fiscal year, both the funding agency and the networks must carefully evaluate plans for the future. There are many positive outcomes that have been achieved by this project, including well-established training and certification programs for clinician investigators, institutional review board (IRB) and other procedures for protocol review, liaisons with hundreds of private dental offices and community centers across wide geographic distances and diverse population groups and sophisticated bioinformatic systems to analyze data. At this time, no one dental hygiene organization has the same degree of financial, manpower, technical, statistical nor expert resources to recreate these same outcomes, nor should an attempt be made when these resources have already been successfully put into place. To maintain this level of progress, the networks should first seek collaborative relationships with other interested professional groups to maximize the utilization of limited resources for mutual gain, and seek additional opportunities for funding to sustain their existing programs.

Established networks could logically question what dental hygienist investigators will bring to future collaborations. First, dental hygienist investigators should obtain their own funding to conduct collaborative studies within the networks. Arguably, the majority of existing network studies is of greater interest to, and applies more directly to, the practice of dentistry, which is appropriate given the objectives of the grant. This is not to suggest that

the networks do not currently support studies relevant to dental hygiene interests, but it is unrealistic to expect them to obtain monies for all future projects. Dental hygienists need to seek funding opportunities from a variety of sources, including federal agencies. Second, the dental hygiene research community and can provide guidance and direction to clinicians interested in forming these collaborations, and offer additional training opportunities for grant writing and mentoring. Third, organizations will need to rethink their own priorities to help to underwrite related costs. New funding programs need to be created through our foundations and centers for research for targeted support of these objectives. Undoubtedly, obtaining funding will continue to be the greatest challenge.

Many established dental hygienist investigators can bring leadership, programmatic and statistical expertise to the networks as support. Clinician hygienists already demonstrate an eagerness to receive training as principle investigators, and are already working in practices and community centers enrolled in the networks. Many dental hygienists are working with unique populations in specialized care settings that would allow them to study clinical problems in smaller, often under-represented groups.

Research interests will invariably differ among investigators, and the network infrastructure provides an opportunity to conduct studies of broader interest. Network settings will allow us to:

- Learn about “best practices” for providing services and improving outcomes
- Examine clinician practice behavior
- Analyze outcomes based upon the sequence of care
- Identify effective methods for promoting behavioral change
- Develop patient registries that reflect demographic and dis-

ease descriptors by practice setting and SES

- Review dental, insurance and electronic records for disease patterns and trends
- Test and validate the utility of screening tools and devices

Network practices are not suitable for studying workforce issues such as supervision or regulatory issues that are politically-driven, nor under the current federal auspices should they be used for commercial product testing or development.

Dental hygiene professionals act as important advocates by translating the knowledge gained from practice-based research into our professional activities. We must remember that our clinicians do not always attend many of the scientific meetings where new study findings are presented. It is necessary to invite network representatives to our local

study clubs and to state, regional and national meetings to meet with clinicians. Dental hygienists who are already working within these networks should be encouraged to attend and participate in these events. We must inform and invite the networks to submit abstracts to scientific sessions at dental hygiene meetings, and use our meetings and professional publications for dissemination of findings.

Translating research into the hands of practitioners takes an enormous amount of work, and the Practice Impact Group of the NIDCR-funded project is identifying factors that may allow for faster implementation of study findings into practice. Interim results are often viewed cautiously, especially by our academic institutions, so it is important to include our faculty in discussions about progress within

networks. Eventually, findings from practice-based research will be included in our curriculum. Several of the network leaders have already developed courses and teaching materials for use in dental schools. Perhaps a relationship can be established with our dental hygiene faculty to develop similar materials and information exchange.

Even with sound, emerging evidence, clinicians do not always accept new findings, and there will be many opportunities to study the factors that limit or encourage changes in practice. Engaging clinicians in the conduct of studies that support change may be an effective strategy for enhancing the perceived value of adopting new behavior. Undoubtedly, clinicians are an important driving-force behind research that improves practice.

## Stem Cells and Dentistry

*Jeremy J. Mao, DDS, PhD  
Professor, College of Dental  
Medicine, Columbia University*

Dental hygienists have an unprecedented responsibility to educate patients regarding stem cells and dental and oral regeneration. Stem cells are master cells that generate tissues and organs. In the oral cavity, stem cells generate all the structures involved in dental hygiene therapy, including enamel, dentin, cementum, gingival epithelium and periodontal ligament. Stem cells and related technologies will transform dentistry at a magnitude far greater than amalgam and dental implants once did, because stem cells, capable of generating tissues in native development, have the ability to regenerate tissues following trauma or disease. Imagine what the practice of dentistry will be like if the periodontium, including cementum, alveolar bone and periodontal ligament, can readily regenerate. This is no longer science fiction – biomolecules are being used to regenerate the periodontium in patients.

Stem cells are typically quiescent cells that reside in virtually every tissue and organ in the body. They are activated to participate in tissue turnover and homeostasis during aging, upon injury or in disease and play a central role in wound healing. Both the periodontal ligament and alveolar bone harbor stem cells. These periodontal and alveolar stem cells have the capacity to differentiate into bone and other cells, and participate in the healing of periodontal defects. Importantly, stem cells reside in the pulp of both deciduous and permanent teeth. Dental pulp stem cells are being explored for the regeneration of not only dental/oral structures, but for structures distant from the orofacial region. Dental stem cells may play

important roles in future medical regenerative therapies.<sup>1</sup>

What can a dental hygienist do to educate patients on the coming revolution of stem cells and dental/oral regeneration? Patients will increasingly ask whether their extracted teeth and other dental tissues should be stored for stem cell “banking.” Cryopreservation of stem cells has been a medical practice long before the discovery of dental stem cells. Following years of cryopreservation, a percentage of the stored stem cells retain their initial capacity.

Dental pulp stem cells are isolated by opening the pulp chamber and root canal of the extracted or exfoliated tooth to liberate cells out of the extracellular matrix. The isolated cells are then stored under ultra-low temperature to induce the arrest of cellular activities. While it should be the patient’s own decision as to whether to “bank” their dental stem cells, dentists and dental hygienists have the newly added responsibility of educating their patients about the advantages and disadvantages of cell storage. On the plus side, the patient’s own cells are stored for potential regenerative therapies for use that will likely not be limited to the regeneration of dental and oral structures. Autologous cells should not cause immune rejection or extrinsic pathogen transmission, risks that may occur with tissues from a different donor.

Others argue against storing dental stem cells, as there are no approved therapies at this time that utilize these cells. Conversely, proponents feel that it is only a matter of time before therapies will become available, justifying the need for storing these cells now. Those who promote the storage of dental stem cells further point out that more stem cells or stem cells of potentially higher potency are more likely to be present at a younger age, which supports the collection of dental stem cells from the pulp of deciduous teeth and from ex-

tracted premolars and third molars in children and adolescent patients. An analogy to what should be an amicable and dispassionate debate of cryopreservation of dental stem cells is perhaps the half glass of water: those who see it as half empty will probably opt not to store dental stem cells, whereas those who see it as half full probably would. Both parties are correct. The bottom line is that it should be the patient’s decision whether to store dental stem cells, and dental professionals can assist their patients with understanding dental stem cells and the research regarding dental/oral/tissue regeneration. Dental professionals can gain important background information and new knowledge about the progress of dental stem cell research by staying current with published literature. Continuing education articles written for dental professionals about dental stem cells and dental/oral regeneration are also available.<sup>2</sup>

What can dental hygienists do as active participants, rather than bystanders, in the transformation of dentistry by stem cells and related technologies? The answer is simple – engage in research. A profession that fails to advance itself by new knowledge is not a profession that lasts. What will dental hygiene care be like for regenerated tissues and teeth? Dental hygiene evolved into a profession during a time when dental defects, including caries, gingivitis and periodontal disease, were repaired by scaling, root planing and restorations with amalgam and composites. What will be the new competency requirements for dental hygiene students and practicing dental hygienists in the era of dental stem cells and transformed dentistry when regeneration increasingly replaces repair? Answers to these questions can only be discovered in research. Abraham Lincoln once said, “The best way to predict the future is to create it.” So, get involved.

## References

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1. Mao JJ. Stem cells and the future of dental care. *N Y State Dent J*. 2008;74(2):20–24.
2. Mao JJ. Stem cells: sources, therapies and the dental profession. The Academy of Dental Therapeutics and Stomatology, Tulsa, OK; Pennwell [Internet]. Cited June 8, 2009. Available from: <http://www.ineedce.com/course/review.x?url=1486%2fPDF%2fStemCells.pdf&scid=13797>.

## A Saliva-based Prognostic Test for Dental Caries Susceptibility

*Paul C. Denny, PhD, Professor of Diagnostic Sciences, School of Dentistry, University of Southern California, and CTO, Proactive Oral Solutions, Inc.*

Saliva has become the medium of choice for a variety of diagnostic tests that formerly employed blood or urine.<sup>1</sup> Current tests range from a simple measurement of alcohol to a complex, multi-analyte test for oral cancer. With solutions to stabilize DNA present in saliva, global genomics is possible with little more than “spit” and a postage stamp.

Among tests under development is a class that is not precisely diagnostic, but rather prognostic. We present here a prognostic test for caries susceptibility with the aim to provide scientifically based, individualized guidelines for preventing dental caries before they start. The remarkable decrease in the average number of caries in the U.S. over the last half century can be largely attributed to improvements in dental hygiene and nutrition. However, the complete eradication of caries by these methods is unlikely because inherent susceptibility remains that is due to host factors. The impact of these factors is very significant. Approximately 15% of all children under the age of 10 present with caries in their 6 year molars, despite living with benefits of regular oral health care. Approximately 30% remain caries free between the ages of 16 and 19 years-old (<http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5403a1.htm>).<sup>2</sup> If we knew in advance the degree to which each child is susceptible, procedures and treatments are available that realistically could prevent more than 90% of those remaining caries.

The caries susceptibility test,

which we call the CARE test, is based on the types of oligosaccharides (sugar chains) attached to proteins in saliva. These oligosaccharides are analogous to, and representative of, one's blood types.

Oligosaccharide chains play important roles throughout the body for maintaining good health. However, they also appear to be the primary mechanism for attachment of pathogens to the host, often resulting in infection.<sup>3</sup> Different pathogens have different oligosaccharide requirements for attachment. Thus, an individual may be particularly susceptible to one pathogen whose preferred oligosaccharide is among that person's blood types, but not to another pathogen because of the absence of that preferred oligosaccharide.

The tooth pellicle is a coating of select salivary proteins with their attendant oligosaccharides. The primary function of these oligosaccharides is to provide lubrication to the tooth surface, thereby preventing excessive wear. If the pellicle is composed of oligosaccharides favored by oral cariogenic bacteria for attachment, it will likely lead to increased risk. Equally important is a caries prevention mechanism in saliva. The effectiveness of this system is also dictated by inherently produced oligosaccharides, which are attached to MUC7 mucin and other proteins called agglutinins. If these oligosaccharides are capable of binding with the cariogenic bacteria, they form protein-bacteria aggregates while still in the fluid phase of the saliva. Once aggregated, bacteria are prevented from attaching to the pellicle. If an individual does not make the types of oligosaccharides that promote this aggregation, caries susceptibility is further enhanced. The dental caries susceptibility test is based on the ratio of oligosaccharides that contribute to the 2 processes.

The CARE test typically uses whole, resting saliva (collected by

drooling) and measures the specific oligosaccharides on small dots of dried saliva. The amount of each type of oligosaccharide is fed into a mathematical algorithm that was developed from the caries histories (DFT) from young adults. The test, when applied to the saliva of children, projects what the individual caries patterns in permanent teeth would be as young adults, if preventive measures are not employed. While the test can yield an estimate of the total number of caries that can be expected as the child matures, the algorithm has been modified to provide insight to the groups of teeth most susceptible.<sup>4</sup> This prognostication has the advantage of targeting specific tooth groups for preventive treatments on an individual basis.

The test stratifies children into 4 levels of susceptibility:

- Level 1 – no caries as a young adult
- Level 2 – caries on no more than 2 teeth
- Level 3 – 3 or more molars with caries
- Level 4 – 3 or more molars and/or premolars with caries

Levels 3 and 4 directly lead to targeted preventive strategies, such as which teeth should receive sealant applications. The 1 or 2 caries that are associated with level 2 typically do not appear until after age 14. Thus, we suggest these children are given special monitoring intended to identify the very early lesions when preventive measures are still effective. Overall, though the test output is limited to 4 levels and results in some preventive over treatment, this is not excessive and appears to be cost effective even in the short term.

As we look toward bringing the prognostic test to general usage while satisfying regulatory agencies, a new set of concerns must be addressed. Chief among these are to validate the prognostic value of the test in children and to calibrate the

test algorithm for all geographic locations it will be used. These goals are being pursued in a partnership between designers of the test and 1 or more dental insurers. This partnership provides the opportunity to focus on that portion of the population which will benefit most directly from the test, as well as the ability to pre-select individuals with a history of dental coverage. The latter is important because the caries restoration history can be reconstructed from claims records as a function of the age of the individual. This allows for validation of the prognostic value of the test by a so-called “ret-

rospective prospective” study. Here, children at various ages are tested for their susceptibility level, which is then combined with their caries restorations to provide the historical record associated with each susceptibility level. These records, in the aggregate between 6 and 23 years old, will provide the benchmarks for prognostic validation at specific ages in future studies, as might be expected for approval by the FDA.

## References

1. Tabak LA. A revolution in biomedical assessment: the development of saliva di-

agnostics. *J Dent Educ.* 2001;65(12):1335–1339.

2. MMWR Surveillance Summaries, August 26, 2005/54(03):1–44.
3. Sharon N. Carbohydrate–lectin interactions in infectious disease. *Adv Exp Med Biol.* 1996;408:1–8.
4. Denny PC, Denny PA, Takashima, J, Si Y, Navazesh M, Galligan JM. Saliva Test: A novel saliva test for caries risk assessment. *Calif Dent Assoc J.* 2006;34(4):287–294.

## Diagnostic Devices for Detecting Oral Cancer

*JoAnn R. Gurenlian, RDH, PhD  
President, Gurenlian &  
Associates, Visiting Doctoral  
Faculty, Capella University*

In the U.S., it is estimated that 34,000 Americans will be diagnosed with oral and pharyngeal cancer this year, causing over 8,000 deaths. Worldwide, oral cancer is the sixth most common malignancy, with more than 400,000 new cases diagnosed each year. Oral cancer is more prevalent than cervical cancer and Hodgkin's lymphoma. One American dies every hour from oral and pharyngeal cancers.<sup>1</sup> Unfortunately, diagnosis of oral cancer is established twice as often at a later stage, resulting in poor prognosis. In these situations, the overall 5-year survival rate is less than 50%.

Oral squamous cell carcinoma accounts for over 90% of oral cancers. Lesions often present as leukoplakia, erythroplakia or erythro-leukoplakia. Risk factors for oral cancer include tobacco, alcohol consumption, infections (including human papilloma virus), mucosal diseases, exposure to ultraviolet light, ionizing radiation, arsenic or industrial chemicals, chronic irritation and immunosuppression. Other cofactors include chronic periodontal disease, poor oral hygiene, ill-fitting dentures, sharp teeth and edentulism.<sup>2</sup> Surprisingly, an estimated 25% of oral cancer victims do not fit the traditional profile of older users of tobacco and alcohol as they have no risk factors.

Early detection of oral cancer can be accomplished through a variety of approaches. The conventional oral examination (COE) is the main approach used by dentists and dental hygienists to identify oral abnormalities. Once identified, a scalpel biopsy and histologic examination of the lesion can be performed to

determine the definitive diagnosis. However, it is difficult to visually diagnose premalignant and malignant pathoses. As well, not all clinicians routinely perform a COE.

To improve opportunities for diagnosing oral lesions, adjunctive diagnostic techniques have been developed and marketed among the dental community. These devices include toluidine blue (TB) staining, light-based detection systems, narrow emission fluorescence and brush biopsy.

TB has been used for over 40 years to detect mucosal abnormalities. TB is a metachromatic vital dye that tends to bind preferentially to tissues undergoing rapid cell division to sites of DNA change associated with oral premalignant and malignant lesions. It has been useful for demarcating the extent of a lesion prior to surgical removal. An overall sensitivity of 93.5% and specificity of 73.3% had been previously reported.<sup>3</sup> However, a recent meta-analysis reported a wide range of variation with respect to sensitivity and specificity.<sup>4</sup> In addition, no randomized clinical trials have been conducted to assess TB.

Light-based detection systems use chemiluminescent light to enhance visualization techniques. A pre-rinse of 1% acetic acid solution is used, followed by examining the oral cavity with a blue-white light source. Three systems are currently on the market including ViziLite Plus with TBlue (Zila Pharmaceuticals), Microlux DL (AdDent) and Orascope DK (Orascope, a Kerr Corporation). The ViziLite system combines a blue-white light energy source with TB staining. The Microlux DL system uses a blue-white light-emitting diode and a diffused fiber-optic light guide. The Orascope DK system is a 3-in-1, battery-operated, hand-held LED instrument that has an oral lesion screening instrument attachment. These light-based detection systems can enhance visualization of

oral white lesions, but they cannot distinguish between oral malignancy, premalignant lesions, benign keratosis and other mucosal inflammatory lesions. No published studies were found for the Microlux DL or Orascope DK systems. Several studies of the ViziLite Plus with TB demonstrated improvement in specificity, reduction of the false positive rate by 55.26% and increasing the negative predictive value to 100%.<sup>4</sup>

Narrow emission fluorescence involves exposure of the mucosa to the blue light spectra using the VELscope® device (LED Dental). Tissue undergoing neoplastic change, such as dysplasia and invasive carcinoma, will demonstrate a loss of fluorescence. This system has been promoted as useful in assessing lesion margins enhancing surgical management. A summary of 2 studies evaluating VELscope indicated both sensitivity and specificity were high. However, these studies were of known lesions confirmed by biopsy. This system was not studied in relation to use as an adjunct for detection of new lesions.<sup>4</sup>

Recently, a new multispectral fluorescence device has been introduced, the Identafi™ 3000 (Trimira™). This system uses 3 distinct color wavelengths to distinguish lesion morphology purportedly reducing false positives. However, no published studies were found on this system.

Brush cytopathology using the OralCDx Brush Test system (Oral CDx Laboratories) involves the microscopic study of cell samples. A specialized brush that collects transepithelial cells are smeared onto a glass slide and sent to a laboratory for staining and analysis. A computer-based imaging system ranks the cells on the basis of degree of abnormal morphology followed by a cytopathologist who interprets the results. Reported accuracy, sensitivity and specificity results vary. Use of this test has been recommended for assessment of lesions the clini-

cian might not investigate further.

Although the opportunity exists to utilize adjuncts in detecting precancerous and cancerous lesions, there appears to be a lack of definitive evidence to imply that any of these systems improve the sensitivity or specificity of oral cancer screening beyond COE alone.<sup>5</sup> Ultimately, the scalpel biopsy and histologic examination remain the gold standard for achieving definitive diagnosis. Nevertheless, early detection of oral squamous cell carcinoma will only occur if dental professionals are looking for it.

## References

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1. Oral Cancer Foundation. Oral Cancer Facts [Internet]. Cited May 8, 2009. Available from: <http://www.oralcancerfoundation.org/facts>. Accessed 5/8/09.
2. Bsoul SA, Huber MA, Ter-ezhalmy GT. Squamous cell carcinoma of the oral tissues: A comprehensive review for oral healthcare providers. *J Contemp Dent Pract*. 2005;6(4):1–16.
3. Rosenberg D, Cretin S. Use of meta-analysis to evaluate tolonium chloride in oral cancer screening. *Oral Surg Oral Med Oral Pathol*. 1989;67(5):621–627.
4. Patton LL, Epstein JB, Kerr AR. Adjunctive techniques for oral cancer examination and lesion diagnosis: A systematic review of the literature. *J Am Dent Assoc*. 2008;139(7):896–905.
5. Lingen MW, Kalmar JR, Kar-rison T, Speight PM. Critical evaluation of diagnostic aids for the detection of oral cancer. *Oral Oncol*. 2008;44(1):10–22.

## Clinician–Patient Communication to Enhance Health Outcomes

*Michele Nanchoff–Glatt, PhD  
Institute for Health care  
Communication*

Clinician–patient communication underlies successful health care. Until recently, health professional training paid little attention to the development of communication skills. Too often, clinicians have had to rely on whatever innate communication talents they possessed. However, we now know that effective clinician–patient communication must be learned as both an art and a science. Communication skills and techniques can be mastered. Research has demonstrated that increasing communication skills improves diagnostic accuracy, increases involvement of the patient in decision making and increases the likelihood of adherence to therapeutic regimens. Additional benefits are an increase in patient and clinician satisfaction and

a reduced likelihood of exposure to malpractice litigation.

The average clinician may perform as many as 160,000 patient interviews during a health care career. However, techniques are frequently not used that can improve diagnostic accuracy, involve the patient in decision making and increase the likelihood of adherence to the desired regimen. Clinicians may not have learned these techniques during their training. Some of the techniques may have been developed since the clinician was trained. The challenge is to introduce the techniques to clinicians and develop their skills in using the techniques in a brief period of time.

The program presented at this conference introduces a conceptual model that makes the utilization of communication skills within the normal practice setting effective and possible. This fast paced interactive program is designed to provide participants with opportunities to practice skills and techniques, not simply hear about them. A model of complete clinical care is presented that consists of 2 roles for the clinician: the biomedical and the hu-

man communication roles. Specific communication skills include opening the interview, engaging the patient as a person, empathizing with the patient, educating the patient, enlisting the patient as a partner in their care where decision making is shared and closing of the interview.

By the end of the program participants will:

- Have greater awareness of a clinician's roles regarding the importance of clinician–patient communication as an essential aspect of health care
- Have greater awareness that complete clinical care consists not just of “find it and fix it” but of 4 communication skills: engage, empathize, educate and enlist.
- Be able to demonstrate the skills and utilize feedback from a peer
- Commit to trying out 1 or 2 procedures that the participant currently does not use for a period of 5 weeks and then evaluate the outcomes associated with these approaches

## Providing Oral Health Care Across Cultures

*Louanne Keenan RDH, BA,  
MEd, PhD*

*Director, Office of Education  
Faculty of Medicine and  
Dentistry, University of Alberta,  
Edmonton*

When a brigade of dental professionals arrives in a foreign country to provide volunteer services, they must integrate oral health strategies that go beyond clinical services. The goal of a dental mission is to involve the community leaders in designing the right programs and services to meet the unique needs within their culture. Many consultations with community leaders and health providers are required to adapt the oral care to the unique challenges within each remote community. Interpreters have to be recruited and taught the basic dental terminology, to ensure that the patients' safety is not compromised. The people who arrive at the temporary dental clinics may be in a compromised state: exhausted from walking hours or days, hungry due to poor nutrition, afraid of the strangers and of the pain that may accompany dental procedures, illiterate and unable to communicate and may have more unexplainable barriers to accepting free dental care.

Health care practitioners (HCPs) graduate with entry level competency at multiple roles: clinician, health promoter, educator, administrator and researcher. They learn about the barriers to optimal health: language/communication barriers, social challenges, power imbalances, marginalization and discrimination.<sup>1</sup> Working in foreign countries improves our ability to accept and adapt to the cultural context of our clients (individual, family and community). By witnessing the huge diversity of healing and wellness practices (traditional and non-tradi-

tional), we heighten our awareness of the cultural barriers that patients face. In the pursuit of knowledge about cultural sensitivity, we refine our attitudes about cultural awareness and enhance our cultural competency skills. Ultimately, we must integrate our patients' definitions of what "safe service" means to them.<sup>2</sup>

We need to ensure the cultural safety of our patients by embracing their differences.<sup>2</sup> By providing a standardized level of care, we minimize the challenges faced by minority populations. Health practitioners must think beyond prescribed dental treatments as the only determinant of the clinical encounter. The patient is marginalized by the loss of their traditional relationships within their culture. HCPs can encourage patients, family members and communities to share (using their personal descriptions of their experience of illness and treatment) the power distance between HCPs and patients, the concept of time in relation to the flexibility of appointment times and social gender roles. When health care providers engage with patients in this way, it can present opportunities to become more patient-centered and improve cultural safety.

Dental hygienists take on multiple roles as they move along the continuum of becoming culturally competent.<sup>3</sup> As health promoters, dental hygienists should determine why there is inequity to accessing oral health care and information for people from different cultures. Yee and Sheilham stated that "In developing countries, nearly 90% of the population is unable to receive standardized caries treatment."<sup>4</sup> By incorporating listening, valuing and culturally sensitive understanding, the dental hygienist as educator will be more likely to apply culturally appropriate teaching and learning strategies in their attempts to demonstrate authentic, supportive and inclusive behavior. As change agents, dental hygienists can take

a leadership role in acknowledging the possible need to change their own emotional responses before they can advocate for patients from other cultures, and suggest the best use of resources to promote and support patients' rights and well-being.

As clinical therapists, dental hygienists must deliver oral health information and preventive strategies alongside therapeutic procedures, and also take into account a patient's right to communicate in their native language. This could reduce delays in care, non-adherence to therapy and medical errors from lack of comprehension.<sup>5</sup> Dental hygienists can acquire information about different cultures in a respectful and transparent manner by engaging communities as partners in the role of researcher. Finally, as administrators, dental hygienists can become partners with developing communities to ensure the cultural safety of the community. By participating respectfully in the decision-making process, and exchanging potential strategies, the community will increase their capacity to deliver oral health care to their people.

By establishing a safe place to share knowledge, beliefs and attitudes, HCPs will improve their understanding of the cultural implications of providing appropriate health care. In the process of becoming culturally competent, we recognize the importance of respecting differences, but we must not reduce cultures into shared, homogenous groups. To stop this categorization of people, we need to humble ourselves and become critically aware that we are all cultural beings. The multi-level nature of cultural safety involves everyone – we all carry historical and political experiences that shape our perceptions, attitudes, beliefs and behaviors. Working in relationship with our patients, their families and their communities, makes us all richer for the multicultural experience.

## References

1. Flores G, Tomany-Korman SC. The Language spoken at home and disparities in medical and dental health, access to care, and use of services in US children [Internet]. Cited April 17, 2009. Available from <http://www.ncbi.nlm.nih.gov/pubmed/18519474> (registration required for access).
2. Indigenous Physicians Association of Canada and the Association of Faculties of Medicine of Canada. First Nations, Inuit, Metis health core competencies [Internet]. Available from [http://www.ipacamic.org/docs/IPAC\\_AFMC\\_Core\\_Competencies\\_Eng\\_Final.pdf](http://www.ipacamic.org/docs/IPAC_AFMC_Core_Competencies_Eng_Final.pdf).
3. The Canadian Dental Hygienists Association. Dental Hygiene: Definition, Scope and Practice Standards [Internet]. Cited May 7, 2009. Available from [http://www.cdha.ca/pdf/Definition-Scope\\_public.pdf](http://www.cdha.ca/pdf/Definition-Scope_public.pdf).
4. Yee R, Sheiham A. The burden of restorative dental treatment for children in Third World countries. *Int Dent J*. 2002;52(1):1–9.
5. Taylor SL, Lurie N. The role of culturally competent communication in reducing ethnic and racial healthcare disparities. *Am J Manag Care*. 2004;10:SP1–4.

## The Role of Health Literacy in Reducing Health Disparities

Alice M. Horowitz, RDH, PhD  
School of Public Health,  
University of Maryland

The first assessment of health literacy among American adults was recently released by the U.S. Department of Education. The study found that nearly 80 million adults are not able to find or understand relatively simple health related information. The most vulnerable were adults who had not completed high school, were 65 years of age or older, were living in poverty and are a racial/ethnic minority.<sup>1</sup>

Low health literacy is a problem and improvements are a likely pathway to decreasing health disparities.<sup>2</sup> This is especially relevant for chronic diseases such as oral diseases which require continual self and professional care. Studies in medicine have shown that patients with low health literacy are more likely to use hospital emergency services, have less knowledge of disease management and of health-promoting behaviors, report poorer health status and are less likely to use preventive services. In addition, diabetics with low literacy are less likely to control their blood sugar.

The majority of the “causes of causes” of chronic diseases are life-style behaviors. For example, having a poor diet, lacking physical activity and using tobacco are major causes of heart disease, cancers, diabetes and cerebrovascular disease. These and other lifestyle behaviors also contribute to oral diseases such as dental caries and periodontal diseases, which can be prevented or controlled.

Both health care providers and health care systems would benefit from having patients know and understand their health challenges and their cooperation with self care to

increase healthy outcomes and minimize health care costs. Further, in a multicultural society, health care providers and health care systems need to provide culturally and linguistically competent health care.<sup>1</sup>

Oral health literacy has been defined as “the degree to which individuals have the capacity to obtain, process and understand basic oral health information and services needed to make appropriate health decisions.”<sup>3</sup> Oral health literacy is much more than having reading and numeracy skills. American adults who access dental care reports get most of their dental information from dentists. Yet surveys have shown that little to nothing is taught to dental students about communicating with patients. In addition, we do not know whether their communication is effective and whether their patients understand what they need to know and do for their oral health and that of their children.

Despite advances in oral disease prevention the prevalence of untreated oral diseases is disproportionately high among lower socioeconomic populations.<sup>1</sup> A significant barrier to improved oral health may be poor oral health literacy. Low health literacy likely exacerbates other barriers to improved health such as cost of care, access to care, complexity of health care systems and lack of insurance coverage. Too many individuals do not understand the importance of oral health in connection with general health. Many do not understand what they can do for self care, their role in benefiting from and promoting community programs or how to pose questions to ask their health providers.

If a mom does not understand that she needs to clean her infant’s mouth and why it is important, she is not likely to do so. If parents do not understand that the uses of fluoride toothpaste and community water fluoridation are primary methods to prevent caries, how can they make appropriate decisions to

protect themselves and their children against this disease? Finally, if a parent has no health information-finding skills, they are inescapably handicapped.

We know how to prevent dental decay, but this information is not readily available to all populations and not necessarily in a manner that can be understood and applied. Access to correct information about fluoride and why we need it and access to the preventive regimens (fluoride toothpaste) could decrease the need for dental treatment services. This is especially relevant for individuals who are disadvantaged.

Imagine the difference if a patient is able to understand and apply what a provider has told her about how to care for her own oral health and that of her children. Imagine if this provider is knowledgeable about how to communicate at the mother’s level of understanding and address cultural differences. Imagine the improvements we may see in the nation’s oral health if we train dental providers how to communicate with all types of patients, including the underserved and elderly. Just imagine.

### Strategies for Progress

Oral health literacy is recognized as a necessary element of all efforts to improve oral health and to reduce disparities. Relatively little oral health research has been conducted compared with general health literacy. Thus, the research opportunities are limited only by our imagination. Oral health literacy research is needed in connection with the public at large, dental providers and policy makers. A few examples of needed research include determining:

- How best to teach communication skills among dental and dental hygiene students
- The degree of effectiveness of counseling provided by dental providers
- The best approaches to teaching

care givers how to prevent caries in their own mouths and that of their infants and children

- What lower SES women know about and do regarding caries prevention so appropriate interventions can be designed
- The impact of community health workers/navigators in the prevention of Early Childhood Caries
- How to integrate oral health literacy into adult education programs
- The impact of oral health educational materials written in

plain language on understanding self-care practices

- What policy makers know and understand about oral disease prevention

These efforts and others can help engage community groups in oral health literacy efforts. Each of us must encourage funding agencies to support research and demonstration programs in oral health literacy.

## References

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1. White S. Assessing the nation's health literacy. *AMA Foundation*. 2008.

2. Institute of Medicine of the National Academies. Health literacy: A prescription to end confusion. *National Academies Press*. Washington DC, 2004.
3. U. S. Department of Health and Human Services. Healthy People 2010 2nd ed. Washington, DC: U.S. *Government Printing Office*, 2000.

## Periodontitis and Premature Death: A Longitudinal, Prospective Clinical Trial

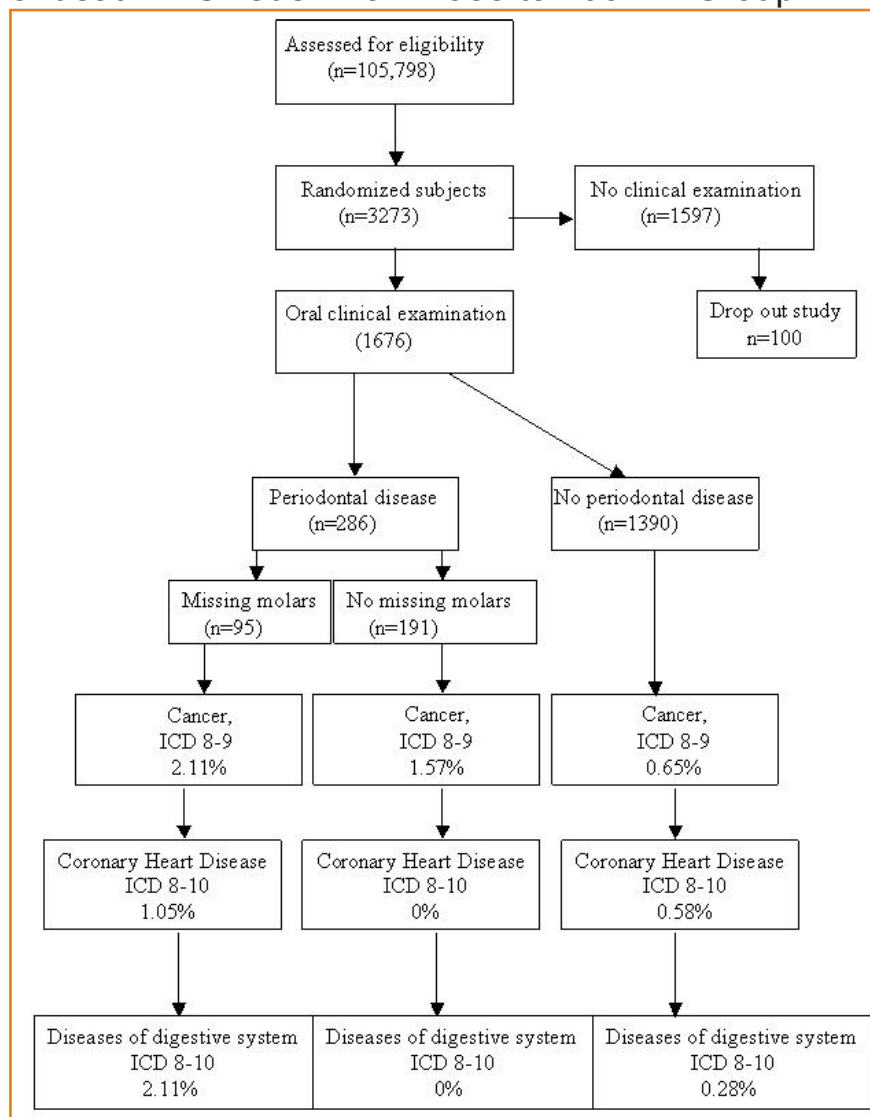
*Birgitta Söder, PhD, RDH  
Professor Dr., Karolinska  
Institutet, Huddinge, Sweden*

Periodontal disease is initiated by a biofilm of bacteria on the teeth that trigger an immune-inflammatory response in the adjacent host tissues. It is estimated that 15% to 35% of the adult population in industrialized countries suffers from this multi-factorial illness. In individuals with constitutional proinflammatory traits, the reaction to bacteria may lead to an excessive host response, resulting in general inflammatory reaction. To investigate the relation between periodontitis and general diseases, longitudinal studies spanning several years are recommended to ensure that the time period in which periodontitis develops is taken into account.<sup>1</sup>

In longitudinal studies, individuals are followed over time with monitoring of risk factors or health outcomes. Outcomes such as mortality and incidence of cancer have been related to employment status, and other variables measured. Most longitudinal studies examine associations between exposure to known or suspected causes of disease and subsequent morbidity or mortality. In the simplest design, a sample or cohort of subjects exposed to a risk factor is identified along with a sample of unexposed controls. The 2 groups are then followed up prospectively, and the incidence of disease in each is measured. By comparing the incidence rates, attributable and relative risks can be estimated.

A problem with the cohort method when applied to the study of chronic diseases is that large numbers of people must be followed up

Table 1: Proportions (%) of the 3 most frequent causes of death in Sweden from 1985 to 2001 in Group A



for long periods before sufficient cases accrue to give statistically meaningful results. The difficulty is further increased with low grade, silent and long lasting diseases, such as periodontal disease. There is a long induction period between first exposure to a hazard and the eventual manifestation of disease.

Randomized controlled trials are a superior methodology in the hierarchy of evidence, because they limit the potential for bias by randomly assigning patients for prospective clinical trials. This minimizes the chance that the incidence of confounding variables will differ between the groups.

The advantage of prospective cohort study data is the longitudinal observation of the individual through time and the collection of data at regular intervals. However, cohort studies are expensive to conduct, are sensitive to attrition and take a long follow-up time to generate useful data. Nevertheless, the results that are obtained from long-term cohort studies are of substantially superior quality to retrospective/cross-sectional studies, and cohort studies are considered the gold standard in observational epidemiology.

The baseline cohort for the present longitudinal study was selected

in 1985 using the registry file of all inhabitants (n=105,798) of Stockholm County born on the twentieth of any month between 1945 and 1954. Randomized from the file were 3,273 individuals aged 30 to 40 years. In total, 1,676 individuals, 838 women and 838 men, underwent a detailed oral clinical examination.<sup>2</sup> The presence of systemic diseases in the study group were 2,001 compared with data in the following registers from the Swedish National Board of Health and Welfare: the Cancer register, the Hospital register, the Heart Infarct register and the register for Causes of death.

Our hypothesis was that the presence of gingivitis and periodontitis in young adults increases the risk for future life-threatening diseases. Our aim was to evaluate the role of periodontitis in premature death in a prospective study.

The subjects were divided into clinically examined (group A) and dropout (group B). In addition, all age-matched subjects in Stockholm County constituted group Sc and all age-matched subjects in all of Sweden constituted group S. In January 1985, group Sc comprised 105,798 individuals and Group S 1,254,238 individuals.

The present study addresses the issue of periodontal disease as a risk marker for mortality by evaluating the relationship between periodon-

titis and premature death 16 years after the diagnosis of periodontitis. Our results confirm the hypothesis that periodontitis in young adults with any missing molars is a risk marker for premature death (Figure 1).<sup>3</sup> The prematurely deceased women in the study were expected to live 36.1 years longer and the deceased men 31.6 years longer. The individuals who died were probably infected with periodontitis many years before the baseline registrations. However, the result in present study showed periodontitis as a risk marker for premature death.

Earlier studies have suggested that the reason for mortality could be the combined effect of periodontal diseases, calculus and dental plaque or the severity of caries, periodontitis, periapical lesions and pericoronitis.<sup>4</sup> We have previously shown in a 17-year prospective study that molars were the teeth most affected in subjects with periodontitis.<sup>5</sup>

These results have been confirmed in the present investigation. The missing molars in these young individuals signal a long history of chronic inflammatory and microbial burden of periodontitis, but may also reflect an underlying weakness of the host defense system. A very high bacterial load on tooth surfaces and in gingival pockets over a prolonged period may be responsible for the diseases, subsequently causing death. Therefore, reducing the

bacterial burden of affected individuals and identifying the bacteria responsible for the diseases causing death in these subjects are critical.

Our findings have public health consequences and may create a basis for prophylactic measures that, in view of the prevalence and outcome of periodontal diseases and the costs it incurs to society, are well warranted.

## References

1. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. *Lancet* 2005;366(9499):1809–20.
2. Söder PO, Jin LJ, Söder B, Wikner S. Periodontal status in an urban adult population in Sweden. *Community Dent Oral Epidemiol.* 1994;22(2):106–111.
3. Söder B, Jin LJ, Klinge B, Söder PÖ. Periodontitis and premature death A 16-year longitudinal study in a Swedish urban population. *J Periodont Res.* 2007;42(4):361–366.
4. DeStefano F, Anda RF, Kahn HS, Williamson DF, Russell CM. Dental disease and risk for coronary heart disease and mortality. *BMJ.* 1993;306(6879):688–691.
5. Söder P-Ö., Söder B., Nowak J., Jogestrand T. Early carotid Atherosclerosis in Subjects with Periodontal Diseases. *Stroke.* 2005;36(6):1195–1200.

## Periodontal Disease and Association with Diabetes Mellitus and Diabetes: Clinical Implications

*Robert J. Genco, DDS, PhD  
State University of New York at Buffalo*

Microorganisms in dental biofilms cause periodontal disease. For example, the healthy, normal flora is comprised mainly of Gram-positive and Gram-negative cocci, and it shifts to flora associated with gingivitis (which is mainly Gram-positive and Gram-negative cocci), other Gram-negative forms and Actinomyces. In periodontitis, there is emergence of a more pathogenic flora which is comprised of organisms such as Porphyromonas gingivalis, Tannerella forsythensis, Treponema denticola and also species of Campylobacteria, Fusobacterium, Prevotella and Peptostreptococci. These pathogens occur in a biofilm which begins at the gingival margin and extends into the gingival sulcus and periodontal pocket. Biofilm organisms have multiple virulence factors such as lipopolysaccharide (LPS), which trigger inflammation and factors which suppress host protection. This inflammation acts locally to induce soft tissue destruction as well as bone resorption. The local inflammation also leads to a chronic level of systemic inflammation characterized by elevated plasma levels of inflammatory mediators such as TNF- $\alpha$ , IL-6 and acute phase proteins such C-reactive protein.

In the last 2 decades, investigators have been assessing the role of risk factors for chronic periodontitis. The goal was to determine factors important in increased susceptibility or decreased resistance to periodontal disease to provide a basis for risk factor intervention and to better understand the patho-

genic mechanisms by which dental biofilms cause periodontal tissue destruction. In a study population of 1,247 individuals aged 25 to 74 years old from Erie County, New York, we found that of several hundred factors assessed only a few were important risk factors. These include infection with *P. gingivalis* and *T. forsythensis*, diabetes, smoking, male gender, chronic stress and inadequate coping and older age. In a U.S. population-based study (NHANES III) of 12,367 non-diabetic individuals, it was found that there was an association of periodontal disease with body mass index (BMI). Approximately a 40% to 50% increase in the risk for periodontal disease was found in those with obesity. The mechanism likely to account for this association comes from studies which show that adipose tissue produces pro-inflammatory mediators which lead to systemic inflammation. This systemic hyper-inflammatory state likely sets the stage for greater periodontal destruction. Also, the GI flora changes with a high fat diet, leading to increased LPS-containing organisms, increased GI permeability and resulting endotoxemia, which results in a hyper-inflammatory state exaggerating the response to periodontal infection.

Possibilities for intervention with risk factors in the management of periodontal disease include diabetes control, smoking cessation and weight management/calorie restriction. These have or will become a mainstay in management of periodontal disease. They are often accomplished by all members of the treatment team including an essential role for dental hygienists.

The relationship between diabetes and periodontal disease is a two-way relationship. That is, not only does diabetes predispose to greater periodontal destruction, but periodontal disease leads to poorer glycemic control over time. This likely results, in part, from the in-

creased level of systemic inflammation evidenced by periodontitis, which enhances insulin resistance, leading to poor glycemic control. Periodontal therapy can stabilize or restore glycemic control as shown by several studies in which HbA<sub>1c</sub> levels are reduced after periodontal therapy. This is an important finding since periodontal disease is associated not only with poor glycemic control but with the increase in diabetic complications resulting from poor glycemic control. In a recent study by Saremi et al., it was shown that in Type 2 diabetics who suffer from periodontal disease, the death rate from cardiovascular disease and diabetic nephropathy increased markedly.<sup>1</sup>

There may also be an effect on periodontal and initiation of the diabetic state. A recent study shows that individuals free of diabetes mellitus at baseline tend to have greater development of Type 2 diabetes if they have periodontal disease. That is, periodontal disease may be related to the increased risk, not only of worsening glycemic control and more severe diabetic complications, but increased risk of development of Type 2 diabetes. The effect of periodontal disease on diabetes has only recently been revealed, and more research is needed before we fully understand this relationship. This information, in turn, will provide direction for management of periodontal disease in an effort not only to save the dentition, but also to reduce its systemic effects.

The dental team can act as an important point of contact of the patient for early diagnosis and management of dental-related systemic disease, such as screening for undiagnosed diabetes and possibly pre-diabetes. In 2007, it was estimated that 24 million people in the U.S. have diabetes and 24% of those are undiagnosed, which means there were about 5.8 million undiagnosed diabetics in the U.S. Since approximately 70% of Americans have vis-

ited a dentist in 2007, we propose that screening for diabetes mellitus in the dental office can be an effective initial step our profession can take to help mitigate the devastating effects of diabetes. The following measures are recommended:

- Administration of the “Diabetes Risk Test” (American Diabetes Association Brochure H598903)
- Administration of a home test

kit for plasma glucose and A<sub>1c</sub>. If plasma glucose is over 110 mg/dl, and/or hemoglobin A<sub>1c</sub> level is over 6%, refer to physician for diagnosis

You would expect that per 1,000 adult dental patients, approximately 120 would have diabetes and about 40 would be undiagnosed. In addition to other good management procedures for diabetics undergoing dental procedures, this screening

service may be of great value to the population.

## References

1. Saremi A, Nelson RG, Tulloch-Reid M, Hanson RL, Sievers ML, Taylor GW, Shlossman M, Bennett PH, Genco R, Knowler WC. Periodontal disease and mortality in type 2 diabetes. *Diabetes Care*. 2005;28(1):27–32.

## Translating Evidence of Oral–Systemic Relationships into Models of Interprofessional Collaboration

*Casey Hein, RDH, MBA  
Director for Interprofessional  
Oral–Systemic Curriculum  
Development;  
Assistant Clinical Professor in  
the Department of Periodontics  
Faculty of Dentistry, University of  
Manitoba*

For several decades there has been consistent pressure from various economic and political forces that continue to erode the boundaries of the profession of dental hygiene. Perhaps one of the most important things that must now be addressed is the revitalization of the profession, and security of its future. In addition to these critical concerns lies an unprecedented opportunity to reposition dental hygiene as a fundamental component to interprofessional health care teams. If the dental hygiene profession is committed to securing its future within the healing arts at this level of significance, the development and execution of a robust and vigorous research agenda is no longer an option – it must be done. The question becomes what area of research provides the greatest opportunity for advancement of the dental hygiene profession?

There are many areas of research that will allow for insightful discovery within our present realm of traditional dental hygiene practice. However, there are a number of paradigm shifts that cannot be overlooked in pursuit of a vibrant and secured future for dental hygiene. Taken in their totality, these paradigm shifts point out the obvious – that the greatest opportunity we have to create a compelling research agenda is in demonstrating improvement in

measurable patient outcomes and health care cost savings by targeting periodontal–systemic diseases and conditions in underserved populations with co–morbidities associated with inflammatory driven, high impact diseases. The Centers for Medicare and Medicaid Services (CMS) has called for greater coordination of care for “highest impact conditions,” many of which (e.g., heart disease, diabetes, rheumatoid arthritis, cancer, renal disease) are associated with systemic inflammation, potentially exacerbated by untreated periodontal disease, in an underserved population.<sup>1</sup> It is to this interest that we must align our research agenda.

In setting up success for the development of such a robust research agenda, there are several questions which must be addressed:

- Will the provision of periodontal treatment rendered by dental hygienists who are specialized in treating patients with multi–factorial risk reduce co–morbidities in high risk populations?
- Of the high risk populations with multi–factorial co–morbidities, which populations provides the greatest opportunity to demonstrate a treatment effect of specialized dental hygiene care?
- What outcomes of interest, both intermediate outcomes and long–term outcomes, as defined by CMS,<sup>1</sup> of periodontal intervention should be studied?
- What other disciplines should dental hygienists include in interprofessional collaboration to both cross screen and refer patients at risk for co–morbid conditions associated with periodontal disease and engage in collaborative case management?

In order to ready the profession of dental hygiene to participate in this level of coordinated, interprofessional care, it is critical that the

current paradigm of dental hygiene care be expanded to include primary health assessment, intervention and the leadership of interprofessional teams in prevention and management of multi–factorial diseases related to the oral cavity (Figure 1). Within this expanded scope of practice falls an exponential number of opportunities for dental hygienists to perform primordial prevention (interventions before risk factors are acquired and health promotion), primary prevention (screen for undiagnosed systemic disease in asymptomatic patients and symptomatic patients with undiagnosed diseases) and integration of the “Common Risk Factor” approach into interprofessional continuums of care.<sup>2</sup>

Given the strength of evidence to support the role of periodontal disease in increasing the cumulative inflammatory burden implicated in many chronic disease states (e.g., heart disease, diabetes), health care providers from all disciplines must have an accurate and reliable means by which to identify patients who are at risk for a number of systemic diseases and conditions which are underpinned by inflammation. Development of a risk assessment tool that quantifies cumulative inflammatory burden will provide an evidence–based means by which to triage care among a team of providers from various disciplines, allowing for more aggressive treatment and interprofessional monitoring of patient outcomes. The dental hygiene profession is well positioned to take the lead in developing and testing this type of novel risk assessment tool.

Another area of investigation that provides an opportunity for dental hygienists to demonstrate a leadership role in interprofessional health care is to explore the social–ecological model of sustaining change in health behavior.<sup>3</sup> By piloting innovative population–level interventions that target high risk populations, we may demonstrate successful models

of change or prevention of health damaging behaviors that influence the integrity of the oral cavity and impact overall health.

For the dental hygiene profession to distinguish its role on an interprofessional health care team within a continuum of care for high risk populations, we must provide evidence (applicable to both federal funding and private insurers) of the economic benefits that accrue as the result of the provision of periodontal treatment rendered by dental hygienists in high risk populations, including the following:

- Demonstrate that expenditures made for prevention and wellness promotion (related to modifiable risk factors for periodontal disease) will translate into cost savings in the not-so-distant future. The dream case for demonstrating return on investment for prevention and wellness is tobacco-cessation services<sup>4</sup>
- Provide evidence that periodontal disease might increase the medical care costs for a number of high impact diseases and conditions<sup>5</sup>
- Provide evidence that intervention of periodontal disease will translate into cost savings on medical coverage of patients at high risk<sup>5</sup>

Intervention trials which have investigated the effects of periodontal treatment on diabetes, cardiovascular disease and pre-term birth (among other inflammatory driven disease states) have yielded inconclusive results. However, it is important to point out that the particular interventions prescribed in these studies may not be the specific therapies necessary to produce a treatment effect.

There are a number of ideas for strategic positioning that support this vision for a robust and rigorous research agenda for dental hygiene. It is important to acknowledge that, although the heuristic proposed in this presentation represents an ex-

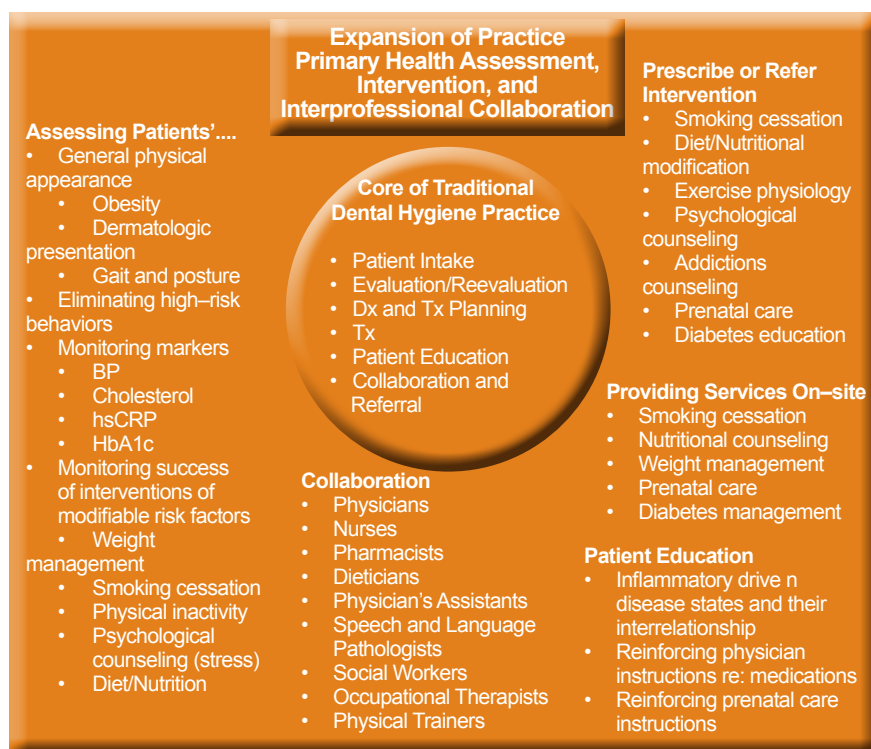


Figure 1

tremely aggressive research agenda, it does offer the most promising future for the profession of dental hygiene. Finally, if the profession does not decisively move beyond its sole focus on the oral cavity to extend its scope into the provision of primary health practices, other disciplines are well positioned to assume this important role. Is a specialized track of training necessary to prepare dental hygienists to treat patients with multi-factorial co-morbidities within high risk populations? This is an issue which must be addressed. Nonetheless, primary health care assessment fits squarely within dental hygienists' contemporary scope of practice, and an essential component of interprofessional collaboration.

## References

1. Centers for Medicare & Medicaid Services. Roadmap for Quality Measurement in the Traditional Medicare Fee-for-Service Program [Internet]. Cited April 15, 2009. Available from: <http://www.cms.hhs.gov/Quali->

[tyInitiativesGenInfo/downloads/QualityMeasurementRoadmap\\_OEA1-16\\_508.pdf](http://www.cms.hhs.gov/Quali-tyInitiativesGenInfo/downloads/QualityMeasurementRoadmap_OEA1-16_508.pdf).

2. Sheiham A, Watt RG. The common risk factor approach: a rational basis for prompting oral health. *Community Dent Oral Epidemiol* 2000; 28(6):399-406.
3. Orleans CT. Promoting the maintenance of health behavior change: Recommendations for the next generation of research and practice. *Health Psychol*. 2000;19(1)(Suppl.):76-83.
4. Albert DA, Papapanou P, Conicella ML, et al. The effect of periodontal treatment on medical costs. Abstract presented at ADEA/AADR Meeting. March 8, 2006
5. Albert DA, Sadowsky D, Conicella ML, et al. An examination of periodontal treatment and per member per month medical costs in an insured population. *BMC Health Serv Res*. 2006; 6:103-109.

## Developing Research Plans and Outcome Measures for Oral-Systemic Project Assessments

*Karen B. Williams RDH, PhD  
Professor, Director University of  
Missouri Kansas City, School of  
Dentistry  
Clinical Research Center*

Several designs have utility for research aimed at assessing oral-systemic relationships. While experimental designs are the accepted standard for assessing effectiveness of interventions, many research questions on the oral-systemic link are not amenable to experimental designs. Observational designs are necessary for evaluating relationships between oral risk factors and serious systemic diseases such as cardiovascular disease, cancer, stroke and diabetes in a human population. Experimental studies on systemic diseases can be achieved using animal models, but results from these models may not generalize to human outcomes.

Observational designs are increasingly used to explore the natural history of dental/oral diseases, and evaluate risk factors that impact systemic disease patterns and oral health outcomes. The concept of group comparison between naturally occurring groups (in contrast to manipulated/created groups as is typical in experimental studies) is at the heart of planning observational studies. Observational research employs 3 general designs: prospective follow-up, retrospective case-control and cross-sectional designs. Each method has advantages and disadvantages but all have weaknesses with respect to demonstrating causality. In order for causality to be established between a risk factor (e.g., periodontal disease) and a systemic outcome, 5 tenets must be satisfied:

- Relationship must be biologically plausible
- Exposure to the suspected cause/risk factor must precede development of the outcome. Moreover, the period of exposure must be sufficient to logically affect the outcome
- Concomitant variation between causal/risk factor and outcome must be demonstrated (e.g., more or less exposure, higher or lower risk of outcome)
- Other possible explanations for the outcome must be ruled out
- Findings must be replicated in multiple samples and multiple studies

While observational studies generally have 1 or more of these tenets unsatisfied, they are still important in establishing scientific evidence for or against possible relationships.

### Designs

Cross-sectional studies are commonly used to describe health outcomes using a descriptive approach. A cross-sectional study typically compares the frequency and distribution of the target disease or health outcome across subgroups of the population. For example, a dental hygiene researcher is interested in examining the problem of early childhood caries (ECC) in children under the age of 5 years. Believing that ECC may be related to children's history of asthma as well as mother's educational background, the researcher collects information from mothers and children attending a pediatric clinic on the mothers' highest level of education, the children's history of having or not having asthma and examines each child for presence or absence of ECC. Comparisons are then made between children with and without asthma and across educational strata. Cross-sectional data on frequency of children falling in each strata are shown in Table 1.

An empirical view of the data suggests there may be relationships of interest to examine further. The data suggest that the child's asthma history and mother's education may be related to having ECC. However, without considering other potential confounders (dietary habits, oral hygiene behaviors, access to fluoride, parent knowledge/attitudes and socioeconomic factors) the researcher may fail to fully explore the multi-factorial nature of ECC and make invalid conclusions about relationships.

Cross-sectional studies are advantageous as they are often cost effective, easy to accomplish in a defined period of time and have no problem with subjects dropping out. Disadvantages include response and/or participation bias and self-report bias. However, the greatest disadvantage is that, because data is collected at a single point in time (prevalence), it is not possible to determine whether exposure to the suspected risk precedes development of the outcome.

Two additional designs that produce results with higher levels of evidence are useful to consider when planning oral-systemic research. The prospective follow-up design begins with the selection of a cohort of individuals free of disease (the outcome) who are then followed over time. During that time they are observed on potential risk factors and followed until they develop or fail to develop the outcome of interest. At completion of the study, those who do and do not develop the disease are compared with respect to their exposure to specific risk factors. This strategy compared naturally formed groups (those with disease and without disease) to determine if they were differentially exposed to levels of risk for the outcome. While this strategy offers real advantages to examining potential cause and effect linkages, it can be costly, time consuming and often impractical since cohorts may

need to be followed longitudinally (sometimes for decades) to get a true picture of cause–effect associations. The second and more commonly used retrospective case–control strategy starts with the outcome of interest (comparable groups, one of which has the disease and one of which does not have the outcome) and examines the degree to which the groups differ with respect to previous exposure to factors which might be related to the disease.

### Application of Designs

To illustrate these different designs, a prospective study would take a cohort of adults who are free of lung disease and who are similar with respect to age, environmental location and socioeconomic status, and follow them over a course of 20 years to examine which develop lung cancer. During the 20 years they are examined periodically to determine their exposure to potential risk factors such as smoking status and exposure to asbestos or other carcinogens. The prospective design is considered the gold standard for observational studies because they can demonstrate that exposure to the risk factor precedes development of disease outcome.

In contrast, a retrospective case–control study would compare a group of individuals with lung cancer to a group without lung cancer to determine if the groups differ with respect to exposure to a specific factor, such as smoking or asbestos retrospectively. An inherent problem with the case–control retrospective design is the difficulty in accounting for all possible confounding variables. In spite of numerous case–control studies showing a strong association between tobacco use and lung cancer, the retrospective nature of the evidence prevents legal experts from definitively stating “smoking causes lung cancer.” In essence, the argument is “What other factors (variables) not accounted for in the design of the

Table 1

Mothers Education	No Asthma		Asthma		Total Kids
	No ECC	ECC	No ECC	ECC	
Less than 8th grade	236	84	156	62	462
9th through 12 grade	357	54	388	94	893
High school diploma only,	191	15	202	17	425
High school diploma plus some college.	83	2	74	6	165

study may have an association with the development of lung cancer?” Retrospective studies have the distinct advantage of being relatively inexpensive and time efficient compared to prospective studies. In addition, they are efficient when the outcome of interest is relatively uncommon in the population.

### Project Development and Outcome Measures

Conceptualizing a research question related to oral–systemic relationships is a necessary first step in the research planning process. The hygienist must clearly define what variables and nature of relationships will comprise the focus of the investigation. For instance, if the research question is to describe the relative frequency of particular health outcomes in a specific group or subgroups in a population, then the research design will be quite different than if the researcher wishes to explore what intrinsic or extrinsic factors (or combination thereof) influence severity or likely outcomes of disease in a target population. Irrespective of the observational design selected, the researcher must take into account that there are potentially several confounding variables that will need to be addressed. Thus, one must consider methodologically how best to either exclude these or plan for statistical control when necessary.

A central tenet in the oral–systemic link is the multi–factorial nature of disease. As a result, researchers need to consider the po-

tential multi–factorial nature of their specific question prior to identifying outcome measures and important covariates. Covariates are those factors that may be related to the outcome measure of interest but may not be the primary predictor variables of interest.

An example may provide clarity. Let’s assume a researcher is interested in determining if inflammatory burden from periodontal disease is related to Alzheimer’s disease. One would first need to identify other sources of inflammatory burden that might also be common in the target population (rheumatoid arthritis, inflammatory bowel disease, genetic conditions, etc) and either rule out research subjects with those potential confounders or include these subjects, but obtain measures for statistical control in the analysis. Adequate planning in advance and fully understanding the multi–factorial nature of any given outcome is crucial to obtain meaningful results.

Lastly, selecting and operationalizing the appropriate predictor and outcome variables must be well thought out if the researcher desires meaningful results. The outcome variable is that variable thought to change as a result of influence of a potential risk factor or exposure. Using the previous example (periodontal disease as a risk factor for Alzheimer’s), one would have to seriously consider how best to operationalize periodontal disease. The researcher could simply dichotomize periodontal disease (Case

Type II or less versus Case Type III or greater) or operationalize it using a severity rating based on number of periodontal probing depths >5 mm. Either would be valid, but results obtained might differ considerably. Similarly, with operationalizing Alzheimer's disease, one might opt to use the Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria, a self-report of dementia, a

previous diagnosis of Alzheimer's or results from the Mini Mental State Exam (MMSE). Selection and operationalizing the outcome has implications for the "do-ability" of the project with respect to obtaining a sample and validity of findings.

Surrogate outcomes are frequently used as well. For instance, while the most valid measure of periodontal disease progression is tooth loss,

researchers often use change in attachment level as a surrogate measure because it is more proximally available as a measure. Irrespective, selection of predictor and outcome variables with a view towards clear operational definitions should be a primary consideration in the planning process.

## **The Business of Dental Hygiene – A Practice Experience in Nursing Homes**

*Doreen K. Naughton, RDH, BSDH*

*Dental Hygiene Health Services,  
Owner and Clinician  
University of Washington,  
Department of Dental Public  
Health Sciences, School of  
Dentistry, Affiliate Instructor*

Twenty-five years ago, few people had heard of the Internet. The same was true for the business of dental hygiene. Few had ever considered the business of dental hygiene as a career opportunity. Now it is exciting to see the changes that have occurred with the business of dental hygiene.

According to the American Dental Hygienists' Association, 29 states permit direct access to care provided by dental hygienists.<sup>1</sup> "Direct access means that the dental hygienist can initiate treatment based on his or her assessment and patient needs without the specific authorization of a dentist, treat the patient without the presence of a dentist and can maintain a provider-patient relationship."<sup>1</sup> The total number of dental hygienists providing direct access services is unknown. In those states with required permit application, 476 dental hygienists are identified by the ADHA as providing direct access to care.<sup>1</sup> In states without a permit process, self reported information is the only source of practitioner information.

Based on self-report, available literature and issuance of state permits, it is known that dental hygienists provide care in a variety of limited access settings such as public, community and Indian health clinics, schools, group homes that serve disabled children, adults and elderly patients. Others practice in nursing

homes and assisted living facilities, home health agencies and private homes, senior centers, jails and juvenile detention centers, hospitals and senior centers.

The type of services provided varies based on state practice acts. Some permit the full scope of dental hygiene practice including dental hygiene diagnosis (Colorado, California). Other states have restricted, for example, the use of injectable local anesthesia, nitrous oxide-oxygen sedation, root planing and radiographs. Supervision requirements vary from no supervision and collaborative practice arrangements to off-site supervision agreements.<sup>2</sup>

Direct access providers are employed by agencies and living facilities, have independent contract arrangements or own practices as sole proprietors, form corporations or established not-for-profit corporations. Their service delivery models are unique to the needs of the dental hygienists and the patients they serve.

Dental hygienists receive reimbursement from a variety of sources. Fifteen state Medicaid programs allow direct reimbursement to dental hygienists. Many private dental insurance programs now provide direct reimbursement to dental hygienists or to members. The exact number has not been identified. However, there were none in 1989.

The State of Washington has allowed direct access dental hygiene care since 1984. At that time there was little evidence to support the idea that a business in dental hygiene could become a successful venture. The need for preventive dental hygiene care, however, was evidence by the increasing demand from the dental consumer, especially from those with limited access to care.

After passage of the legislation, I started to explore the possibilities of providing care to elderly and disabled patients in nursing homes. I consulted with an attorney, an accountant, dentists and dental hy-

gienists from Colorado, California and Washington. Their information was very helpful and their encouragement provided hope for success.

Although not a requirement of the practice act, I elected to complete my bachelor of science in dental hygiene degree. This enhanced my ability to provide care to persons with special needs and to create a business in dental hygiene.

In January 1989, I purchased an existing dental hygiene practice. Dental Hygiene Health Services was established as a sole proprietorship. My immediate goals were to provide quality, cost-effective care for special needs patients and develop a successful dental hygiene business.

In the past 20 years, Dental Hygiene Health Services has provided care to over 4,000 patients in a total of 11 facilities in the Greater Seattle area. On average, 400 patients receive dental hygiene care each year.

Currently, 2 nursing facilities have fully equipped dental clinics. Other sites have dental chairs, lights and/or operator chairs. I transport a portable compressor, ultrasonic, instruments and disposable supplies. Each facility assigns a coordinator/dental assistant to manage the delivery of care. All patients are referred to dentists in the local community or at facilities.

Clinic is scheduled 10 to 12 days and office time 4 to 6 days each month. Payment for services is received from private pay, private insurance, Medicaid and facility sources.

The clinical delivery of dental hygiene care is only one side of a successful dental hygiene business. Practice management is critical for success. There are numerous tasks to manage, such as scheduling, billing, insurance claims, collections, inventory, product and equipment research and marketing.

Communications regarding care must be maintained on 4 levels for every patient:

- The facility, legal guardian

- Primary health provider
- Other health care providers
- The patient, based on their ability to participate in the decision for care

The task of communication and record keeping is managed with computer generated forms, reports and an accounting program. Computerized report features a series of drop-down selections and the ability to clone entire reports for modification which minimizes the need to create complete new reports for every patient encounter. Upgrades for computer reports and a dental hygiene practice management software system are in the development stage.

After 20 years of providing direct

access dental hygiene care, I have met my start-up goals of providing quality, cost-effective care and I have a financially successful practice that has allowed me to continue providing dental hygiene care to my many special patients. To quote authors Robert Hisrich and Michael Peters, I agree that "Running a successful business is not only a financial risk – it is an emotional risk as well. I get a lot of satisfaction from having dared it – done it – and been successful."<sup>3</sup>

## References

1. The American Dental Hygienists' Association, Governmental Affairs Division. Direct access

to care from dental hygienists – list of states (pdf) [Internet]. Cited February 2009. Available from: [http://www.adha.org/governmental\\_affairs/downloads/direct\\_access.pdf](http://www.adha.org/governmental_affairs/downloads/direct_access.pdf).

2. The American Dental Hygienists' Association, Governmental Affairs Division. Dental hygiene practice act overview – list of states (pdf) [Internet]. Cited August 2008. Available from: [http://www.adha.org/governmental\\_affairs/downloads/fifty-one.pdf](http://www.adha.org/governmental_affairs/downloads/fifty-one.pdf).
3. Hisrich RD, Peters MP. On your own: how to start, develop, and manage a new business. *Business One Irwin*. 1992

## Dental Hygienist Prescribers in Alberta

Stacy Mackie, RDH, BS  
Dental Hygienist Prescriber,  
CRDHA Pharmacy Course  
Administrator

In Canada, the regulation of health professions is province-specific. While labor mobility of health professions is a national concern, it is up to each provincial government to determine the legislation and scopes of practice for each profession. In Alberta, the profession of dental hygiene has been self-regulating since 1990. The College of Registered Dental Hygienists (CRDHA) is the regulatory body for dental hygienists in the province of Alberta, and is responsible for licensing (registering) dental hygienists and issuing practice permits.

The new *Dental Hygienists Profession Regulation*, effective Oct. 31, 2006 is part of Alberta's *Health Professions Act* (HPA). The general intent of the HPA was to remove barriers to care and allow health professions to practice to the full extent of their competencies.

Under Alberta's HPA, the process for regulatory changes for professions is well defined. Each step must be followed, allowing other stakeholders (e.g., other health professions, educational institutions) to have input at differing phases of regulation development or revision.

During development of the new regulations for the dental hygiene profession, the CRDHA requested removal of previous regulatory requirements for general supervision. Removal of the supervision clause would increase access to dental hygiene care in a variety of settings and geographical locations.

However, the challenge was ensuring that dental hygienists could provide the full spectrum of dental hygiene services to clients in non-traditional practice settings.

Thus, it was determined that dental hygienists would need the authority to prescribe the drugs routinely used in dental hygiene practice. This subset of drugs was listed in the *Dental Hygienists Profession Regulation* (Table 1).

A strategic, well organized educational process occurred to ensure government and other stakeholders (e.g., the regulatory bodies for physicians, pharmacists and dentists) that dental hygiene education in Alberta adequately prepared dental hygienists to safely make all the decisions around prescribing these drugs for the purposes of providing dental hygiene services.

Once the ability to prescribe was established in the Regulation, CRDHA, in collaboration with other stakeholders, determined the procedures that dental hygienists must complete to be authorized to prescribe the drugs listed in the Regulation.

The Prescriber's Identification (ID) Program for Alberta dental hygienists was developed by CRDHA to ensure that there is a minimum, consistent level of competence, ensuring that dental hygienist prescribers can safely and effectively prescribe. The program includes the following steps:

- Self-paced, self-study course with modular curriculum, mandatory assignments and a final comprehensive examination
- Once successfully completed, the dental hygienist is eligible to apply for a prescriber's ID number through CRDHA
- CRDHA issues a prescriber's ID number and informs the Alberta College of Pharmacists (ACP)

It is important to note that obtaining a prescriber's ID number is not required to be eligible to practice dental hygiene in Alberta, nor does the type of practice setting dictate who is eligible to become a dental hygienist prescriber. The opportunity to become a dental hygienist

prescriber is open to all registered dental hygienists in the province. Given the geographic challenges in improving access to oral health care throughout the province, dental hygienists who practice independently, provide mobile or home-based client care and those practicing in remote geographic areas are more likely to be interested in obtaining a prescriber's ID number.

The 6 month, self-paced, self-study course requires successful completion of multiple written assignments to earn eligibility to sit for a comprehensive final examination. Live, online support sessions are offered to participants bimonthly.

The final examination contains a range of 80 to 90 questions, including free-standing and case-based multiple choice items. The items assess knowledge, application and critical thinking skills on 52 competencies from the Alberta-specific dental hygiene competency profile.

Questions in the test item bank were written by an expert panel. All questions were pilot tested and reviewed by a select group of experts. Questions are delivered randomly from the question bank but must meet the examination blueprint criteria for testing of cognitive ability levels, competency groupings and course learning objectives. Item analysis is performed on each completed examination and remains ongoing as part of program evaluation. The exam is offered in 2 formats, electronic or paper based, at testing centers located throughout the province, with a required passing grade of 80%.

An extensive research plan to study and evaluate the outcomes of this program was conceptualized during the early stages of program development. An independent research consultant created the evaluation tools used to measure over 70 variables, using quantitative analyses. A statistician from the University of Alberta serves as a consultant to the project.

Demographic data on each participant is gathered at enrollment, including year of registration, educational program attended, number of years in practice and type of practice setting. Other data gathered includes standard testing outcomes, such as time required to successful course completion, participation in online support sessions and number of attempts and scores attained on assignments and the examination.

Prescribers will be invited to participate in a long-term study that will evaluate their prescribing behavior and the impact that prescribing authority has on their client populations, as well as on their related general and professional communities. We anticipate that prescribing behavior will vary by type of setting and geographic location. Surveys will be used to assess prescribing behavior, defined by number, frequency and types of drugs prescribed, plus the circumstances that dictate the need for these services, such as emergency intervention and management, pal-

**Table 1**

*Dental Hygienists Profession Regulation:* Section 13 (d) to prescribe the following Schedule 1 drugs within the meaning of Schedule 7.1 to the Government Organization Act for the purpose of treating oral health conditions, providing prophylaxis and treating emergencies:

- i Antibiotics
- ii Antifungal agents
- iii Anti-infective agents
- iv Antiviral agents
- v Bronchodilators
- vi Epinephrine
- vii Fluoride
- viii Pilocarpine
- ix Topical corticosteroids

liative or therapeutic indications and prevention of oral disease. Interdisciplinary collaborative behavior, compliance with legislation and decision-making will also be assessed. Participants will self-assess their skills, confidence and practice behavior based upon what they were taught in the program. We look forward to sharing this important data with the global dental hygiene com-

munity in future publications.

The first intake of 40 students started in July 2008. The second intake of 35 students started in March 2009. Several participants have obtained their prescriber's ID number and are currently eligible to issue prescriptions in Alberta. Figure 1 illustrates the geographical locations of the course participants.

## Affiliated Practice Dental Hygiene

*Michelle Gross–Panico, RDH, MA  
Arizona School of Dentistry & Oral  
Health, A.T. Still University*

Improving the oral health status of the U.S. population is a significant challenge to policy makers, health officials, dental educators and dental care providers. One way to expand preventive dental services to underserved populations is by allowing dental hygienists to provide preventive services with less restrictive supervision in underserved communities.

In 2004, the Arizona legislation approved HB 2194 as law, which created a new opportunity for children to access preventive dental services offered by a dental hygienist without the direct supervision or prior examination of a licensed dentist. This law allows dentists and dental hygienists to work in collaboration to expand services through a non-traditional model called an Affiliated Practice Relationship.

There is a variety of possible Affiliated Practice model structures that include the use of portable, mobile or fixed dental equipment. Each of the Affiliated Practice dental clinics in Arizona has a different structure and unique partners, such as hospitals, elementary schools, community health centers, county health departments, Indian Health Services, dental schools and dental hygiene schools. There are more potential possibilities of collaboration and partnerships with state and county government agencies, nonprofit organizations, private practice dental or pediatricians and community clinics.

An Affiliated Practice dental clinic at San Marcos Elementary in Chandler, Ariz., licensed as CHW East Valley Children's Dental Clinic, provides free preventive dental services to low income, minority

and under/uninsured children. The clinic uses Dentrux dental software and a Microsoft Access database to collect and analyze oral health data. Data from the following patient assessments are collected:

- New decay
- No new decay
- Plaque score percent
- Caries risk level
- AAP Case Type
- White spot lesions
- Untreated decay
- Treated decay
- Early childhood caries
- Sealants present
- Treatment urgency

Assessing these conditions over time will allow dental clinics to assess their Affiliated Practice model's impact on improving oral health outcomes.

The strategy that the CHW East Valley Children's Dental Clinic utilizes to measure the efficacy of the Affiliated Practice clinic is collection and analysis of the patient's zip code, race, first visit to a dental care provider, number of patients seen, dollar value of services provided and dollar amount of grant funds secured. In addition, process evaluation of clinic services is continuous and supported with the use of parent/guardian satisfaction surveys and throughput evaluations. Measuring these indicators allows the Affiliated Practice dental hygienists to ensure that the model is effective at serving the target population, keeping costs low, receiving a return on investment and delivering quality care efficiently.

Cost effectiveness of the Affiliated Practice model is measured through analysis of the cost benefits of providing preventive services and the cost benefits of utilizing a non-traditional practice model. Providing preventive oral health care decreases the incidence of oral disease and saves money for Medicaid/insurers, the health care system and society. Affiliated Practice dental clinics are more cost-effective

compared to traditional models of dental practices due to lower overhead costs. There are decreased overhead costs in an Affiliated Practice dental clinic because payment of a dentist's salary is eliminated. Since dental services are limited to prevention, a smaller staff is needed, fewer instruments and equipment are required and malpractice insurance fees are lower. Awarded grant funds, reimbursement as a Medicaid provider for the Arizona Health Care Cost Containment System (AHCCCS) and partnerships with non-profit and community organizations that contribute resources allow Affiliated Practice dental hygienists to offer preventive services in areas of the greatest need and maintain low fees.

Affiliated Practice dental hygienists have discovered weaknesses of the model. Perhaps the most challenging weaknesses are the difficulties of financial sustainability and restriction on patient age. Affiliated Practice dental clinics rely on grants and reimbursement from Medicaid through only one plan of the AHCCCS. This limited payer mix does not allow many options for generation of revenue and financial sustainability. The restriction on Affiliated Practice dental hygienists to provide services for only underserved children age 0 to 18 years old is also very limiting. Arizona has a large population of underserved adults and seniors that would also benefit from the services of Affiliated Practice dental hygienists. Legislative efforts are currently being made to lift this patient age restriction on Affiliated Practice. These weaknesses are actively being addressed by the Affiliated Practice dental hygienists, Arizona Dental Hygiene Association and Arizona Department of Health Services.

The strengths of Affiliated Practice are many. The cost benefits of preventive oral health care to hospitals, emergency rooms, health care systems, insurance companies,

elementary schools and society are significant. Also, the cost effectiveness of the Affiliated Practice model has been demonstrated. Expenses are reduced due to the low overhead costs of this non-traditional model and with the utilization of partnerships that contribute resources. The Affiliated Practice model is successful at increasing utilization of preventive dental services, increasing points of entry into the oral health care system and reducing barriers of transportation, affordability and uneven distribution of dental professionals.

Affiliated Practice Relationship in Arizona was designed to reduce many of the main barriers to oral health care that contribute to oral health disparities. Affiliated Practice has proven to be a successful model that provides affordable care and increases access to dental services. Several assessment methods have been developed by CHW East Valley Children's Dental Clinic, an Affiliated Practice dental clinic, which will demonstrate the impact on improving oral health outcomes in their patient population. Cost effectiveness of the Affiliated Prac-

tice model can be measured through analysis of the cost benefits of providing preventive dental services and the cost benefits of utilizing a non-traditional practice model with multiple partnerships and collaborations. Challenges within the Affiliated Practice model include difficulties with financial sustainability and a patient age restriction. Overall, Affiliated Practice is a strong model with a few weaknesses that will most likely resolve as the model becomes more established.

## Mobile Van Delivery of Dental Hygiene Services

*Patricia Clayton RDH, dipDH  
Owner/Operator of Right to You  
Mobile Dental Hygiene Services  
Ltd.*

In Canada, accessibility of oral health care services has been identified as a key barrier or challenge for rural-dwelling individuals and those that are home bound or living in long term care facilities. Mobile dental delivery models remove this barrier and are thereby said to increase access and utilization of dental services for those otherwise not accessing care in traditional dental settings.

Alberta is a unique province in which to provide mobile dental hygiene services. Many factors add to the "Alberta Advantage," all of which help to facilitate delivery of dental hygiene care using alternate delivery models. These advantages include the following:

- Alberta dental hygienists have the largest scope of practice with the least restrictions to practice of any province across Canada
- Dental hygienists operate on a fee-for-service basis with no fee guide (Alberta dentists do not have a fee guide either)
- Nearly 100% of insurance companies have been reimbursing independent dental hygienists at equal rates to dental hygienists providing services in traditional practice settings
- The Alberta government has a dental assistance program that provides coverage for low income seniors on a sliding scale with their income
- In Edmonton, the capital of the province and the city in which I reside, only 2 dental facilities exist that can accommodate severely disabled individuals:

The Glenrose Hospital and The University Hospital. The average wait time is greater than 3 months for routine appointments

- Alberta has a large segment of the population that is rurally located

All these factors could lead to the conclusion that demand and utilization of mobile dental services should be high. Unfortunately this is not the case, due to several difficulties.

New barriers to accessing care have arisen for Albertans located in rural communities or those that are home bound or living in long term care facilities. I have found that the lack of knowledge of oral health status and lack of perceived value of oral health care are 2 additional barriers to providing care for these populations.

*Right to You Mobile Dental Hygiene Services* began operation in May of 2008. At the start of operation, I approached 6 long-term care facilities within a 20 km radius of my residence. Only 2 sister facilities accepted the provision of services and agreed to provide information to residents and families of this relatively new delivery model of oral health service. In May of 2009, 2 more long-term care facilities have granted access to, but are not promoting, the delivery of mobile service to clients in their facilities. Accessibility of oral health services is not the only barrier that seniors in these facilities face – lack of knowledge of the availability of the service seems to be a larger barrier. Although the initial response to the provision of mobile service was lower than expected, I have been able to provide service to more than 60 clients in long term care settings.

In order to operate a successful mobile dental hygiene service, a collaborative approach to health care is essential. Developing a referral base for the continued care of clients is a

necessity. Clients living in care facilities often have more challenging needs that require the cooperation of a number of disciplines to safely and effectively meet all of their oral health needs. Nearly 80% of my clients have required a referral for further oral services. Collaboration is a necessity within the facilities. Registered nurses, practical nurses, care attendants, social workers and occupational therapists are valuable resources to improving oral care of seniors.

Collaboration is the key factor to improving the oral health of clients. I have become involved in a pilot project within our health region that is a great example of interdisciplinary collaboration. It began with a speech language pathologist, a care manager at a long term care facility and me. It has grown to include administrative nurses and government health care managers, a public health dentist, public health dental hygienists and the College of Registered Dental Hygienists of Alberta (the regulatory body that registers dental hygienists in the province).

It is an exciting project in which the ultimate goal is to improve the oral health of residents in long term care facilities in Edmonton and hopefully throughout the province. We are looking at possible legislation changes and are studying many variables, including the policies for and frequency of assessing oral health needs, tools used for providing daily oral care, dental education improvements for nursing staff and a referral resource of community dentists and denturists willing to provide services to seniors. Knowledge of current oral health status and related care needs for seniors must be addressed in order to see true improvements in the oral health status of these clients following intervention.

Alberta is well known for its oil sands located in Fort McMurray. The oil sands employ an estimated 147,000 people. It is a relatively

isolated population — the largest barrier to accessing care is time. My solution was to propose that companies offer employees on-site dental hygiene services. Providing on-site services to employees is a benefit that helps retain employees in a competitive market.

In October 2008, *Right to You* signed a contract to provide service on location at a work camp once a month for a 2 year period. The company built a room to my specifications to hold my mobile equipment. The demand for the service has been overwhelming. I work 12 hour days

providing basic dental hygiene care, emergency services such as temporary filling placement, aesthetic services including in-office whitening, and referral services to other health care providers (e.g., dentists). The average age of clients accessing my service is 50 years old and male, and the average length of time since their last visit to an oral health professional is 2.9 years.

Providing services to this population has been professionally rewarding. I have served as a change agent or a re-entry point back to oral health care. Plans are underway

to develop a second site at a neighboring camp.

While new legislation has increased opportunities for dental hygienists to provide care in a variety of alternative practice settings, including mobile dental hygiene service, new barriers did make actual implementation of services in higher areas of need more challenging. However, these barriers can be adequately addressed. Providing a mobile dental hygiene service is a small step towards the ultimate goal of improving the oral health of all Albertans.

## Delivering Care to Infants and Children

*Tammi O. Byrd, RDH  
CEO/Clinical Director, Health  
Promotion Specialists*

The greatest unmet health need for U.S. children is dental care, and dental caries is the leading chronic disease of children. Current statistics show that early childhood caries (ECC) rates continue to rise. This presents a tremendous health burden as well as a huge fiscal impact on families and governments. Dental care delivery models must be changed to increase the delivery of care and lessen the detrimental impact of this preventable disease.

Some progress has been made towards removing barriers to care, but change must continue. Increased funding for services alone will not guarantee access to care. There are fewer dentists available to provide care. This creates more choices for lucrative practices and offers little incentive to serve publicly funded and/or underfunded recipients or remain open during more easily accessible hours. In contrast, the number of registered dental hygienists is growing at a much faster rate.<sup>1,2</sup> In an effort to reach the most vulnerable populations, we must work together to integrate oral health into overall health and come together at community, educational and policy levels. We must look at oral care delivery models that increase the utilization of dental hygienists and primary care medical providers. Medical and dental teams need to be sending consistent messages about the need for and value of oral health care services.

Historically, dentistry has not felt it had a primary role in the oral health of pre-school age children (0 to 3 years old). Other health care professionals were not confident in assuming oral health related roles. However, these dynamics are start-

ing to change, as pediatric and primary care practices seek ways to improve oral health. There are 2 interventions that are strongly supported to prevent childhood dental caries – community water fluoridation and school-based sealant programs. There is also increasing evidence to support the application of fluoride varnish as an effective means of preventing ECC.

Health Promotion Specialists (HPS) is a school-based dental hygiene prevention program that has been addressing the needs of underserved children in South Carolina during a time when South Carolina law enabled school children direct access to preventive services provided by registered dental hygienists. After a turbulent start filled with character enhancing opportunities, including a settlement in its favor by the Federal Trade Commission, the program has begun building its success story since February 2002. HPS contracts with the South Carolina Department of Health and Environmental Control to provide public health services. It is a unique public/private partnership. The state does not have the responsibility or overhead of administering the program, but is able to utilize the data generated from the program to seek grant funding for other expenditures such as infrastructure and social marketing. The collaboration includes the South Carolina Department of Health and Human Services, the South Carolina Department of Education, the South Carolina Rural Health Resource Center, the USC School of Public Health and the South Carolina Office of Research and Statistics. This allows the data collected by HPS to be cross-referenced with Medicaid data and free and reduced school lunch data. From 2001 to 2007, HPS provided preventive care to over 69,000 children. Of those, 48,000 were enrolled in Medicaid. Prior to services through the HPS program, only 43% had received any form of

exam or preventive services. Over 70% of the children seen continued with exams and preventive care after being seen by HPS.

Starting in 2002, South Carolina created a state oral health surveillance system that collects statewide data every 5 years for school-aged children. HPS has been largely instrumental in the collection of this data as well as providing preventive services and education. The changes noted in oral health status from 2002 to 2007 are very promising and indicate that South Carolina is moving in the right direction. The number of children with treatment urgency dropped over 10% during the 5 year study period. Additionally, the data shows that while Medicaid enrolled children experienced higher rates of caries, they were the children who were most connected to care. The prevalence of sealants among black children is now no different than that of white children. Overall, sealant use has increased while untreated caries and treatment urgency have decreased.

While oral health is improving, there are still a number of limitations to overcome. The rural areas of the state still show greater oral health disparities. Some of the influencing factors include a shortage of dentists to see the children, transportation issues, missed time at work by caregivers and a lack of perceived value of oral health by the parents and/or caregivers. Changing the perceived value of oral health in the caregivers directly influences most of the other limitations. Long term prevention programs such as this one can improve perceptions of value. The children that have been, and will be, seen on a regular basis will become future caregivers themselves, and are an important target for educational efforts.

There are a number of factors that affect the delivery and cost-effectiveness of oral health programs. The level of impact that a program has is directly related to its

outcomes and cost. Utilizing dental hygienists without supervision to provide services may increase efficacy.<sup>3</sup> Dental hygienists can and should be actively involved in the delivery of fluoride varnish and dental sealants in a variety of settings. They must be prepared to gather the data to demonstrate the benefits of this and other preventive interventions. The strengths and limitations

of delivery models must continue to be addressed and studied.

## References

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1. Mertz E, O'Neil. The Growing Challenge of Providing Oral Health Care Services to All Americans. *Health Aff.* 2002;21(5): 65–77
2. Birch, S, Anderson, R. Financing and Delivering Oral Health Care: What Can We Learn from Other Countries? *J Can Dent Assoc.* 2005;71(4):243, 243a–243d.
3. Scherrer, C, Griffin, P, Swann, J. Public Health Sealant Delivery Programs: Optimal Delivery and the Cost of Practice Acts. *Med Decis Making.* 2007;27(6):762–771

## The Influence of Political Forces on Research Funding

*Robert J. Genco, DDS, PhD  
State University of New York at  
Buffalo*

Non-defense research carried out in American universities is 60% federally funded, and most biomedical research is funded through the National Institutes of Health (NIH). We will address the effects of political forces on the awarding of individual grants and the overall level of research funding from the NIH.

The awarding of individual grants to university faculty and other researchers by the NIH is based mainly on peer review. The process of determining the yearly national research budget, including that of the NIH, is complex as congressional appropriations wind their way through to become law. These decisions are not insulated from political influence. A recent study reported the effect of representation on congressional or senate committees involved in the grants obtained by the state or congressional region. The process behind government appropriations involves the Appropriations Committees of the House and Senate, the Labor, Health and Human Services, Education-related Agencies Subcommittee and the subcommittee of the Senate Appropriations Committee.

It all begins with a budget which is presented by the President which NIH negotiates with the Department of Health and Human Services and the Office of Management and Budget within the Executive Office of the President. The various government committees mark-up the appropriations bill from the President, and present it to the House and Senate for a vote. The allocation and disbursement of approved funding

then occurs. A recent study found that from the years 1983 to 2002, the political effect on this process ranged from 2.85% to 6.74%. Clearly, this is a minor effect, and it is encouraging to know that peer review is the main mechanism by which NIH research and training awards are made.

Major, multi-year shifts in overall federal funding of biomedical research often comes through major economic crises such as the one we are in now, or major advocacy efforts of scientists, the biomedical industry and other groups, such as patient advocacy groups working closely with legislators. Two recent examples of this include the doubling of the NIH budget from 1998 to 2003, which came about largely because of well-reasoned and coordinated arguments from scientific organizations such as the American Association for the Advancement of Science, and from biomedical device and pharmaceutical companies as well as patent advocacy groups arguing that strong basic research was needed for a viable health care system.

The most recent major change in federal funding for research resulted from efforts to reverse the results of the recent economic crisis by passing the American Recovery and Reinvestment Act (ARRA) of 2009, which was signed into law by President Obama on February 17, 2009. The overall budget of the NIH rose from \$8.3 billion in fiscal year 1984 to \$28.7 billion in fiscal year 2008, and in 2009–2010 will increase another \$10 billion based on the ARRA. The National Institute of Dental and Craniofacial Research (NIDCR) has a series of programs supported by the ARRA, and these can be reviewed at [www.nidcr.nih.gov/Recovery/](http://www.nidcr.nih.gov/Recovery/). However, these are temporary funds, and their function is to support the best science while stimulating the economy. Our

most optimistic outlook is that these funds will be dispersed to individual scientists or groups of scientists using the effective peer review system already in place at the NIH, which is relatively insulated from the political process.

Advocacy efforts for dental research are carried out mainly by 2 organizations, which interact with the NIDCR: the Friends of the NIDCR, which is a group of individuals interested in promoting the strategic plan and other programs of the NIDCR to many different audiences, including legislators. The other group is the National Oral Health Advocacy Committee, which is a combined advocacy committee of the American Association for Dental Research and the American Dental Education Association. The primary purpose of these organizations is to increase and enhance the efficacy of advocacy efforts on behalf of dental research and dental education. To this end, there is a National Advocacy Network, which is the infrastructure through which members and advocacy coordinators can carry out joint advocacy and mobilize members of the House and Senate to take legislative action. Those interested in participating in this network should contact Monette McKinnon at [mckinnonm@adea.org](mailto:mckinnonm@adea.org). Advocacy organizations can be effective vehicles for those interested in promoting broad biomedical and dental research, as can participation in the efforts of patient advocacy groups. Also, local efforts can be effective in educating legislators. A simple measure such as inviting congressmen and other legislators to visit laboratories, clinics, dental or dental hygiene schools is often effective to help convince legislators on the value of our educational and research programs to oral and general health.

## Building Relationships from an Industry Perspective

*J. Leslie Winston, DDS, PhD  
Procter & Gamble Oral Health*

Much of the interest in fostering collaborations between academia and industry began in the 1980s, when the government encouraged collaboration that would foster a quicker pace of innovation. While industry sought out relationships with universities earlier, it became more widely accepted due to the “blessing” of institutions, such as the National Institutes of Health and Medical Research Council of Canada. University–industry collaborations foster economic growth, improve standards of living and extend humanity’s intellectual reach. With these lofty goals a long-term relationship mindset is essential.

Industry enters into collaborative relationships for many reasons. Most often it is to access a technology and gain expertise. Leveraging the credibility that an investigator brings and enabling the credentialing of the end result with the broader oral health community is highly desirable.

Academia often needs expertise or capability that an industrial partner may provide. Industry has to operate efficiently to remain competitive and deliver desirable returns on investment for their shareholders. The introduction of process, a system to move towards goals efficiently, is a strength that industry cultivates in order to survive. This experience managing large programs from start to finish is a capability that industry brings to any academic and government relationship.

The classic pharmaceutical model of drug development is becoming less common, and industry is playing a lesser role in drug discovery. As universities and government develop core facilities and capabilities, the ability to leverage these

elements for the discovery phase is increasing. In order for these collaboration models to be sustainable and deliver the desired impact on oral health, they must be flexible and need proper funding from both government and industry sources to succeed.<sup>1</sup> The potential to develop common best practices is enormous and there is great need to publish the experiences with industry–university collaborations so that knowledge and experience may be disseminated appropriately.<sup>2,3</sup>

While collaborations between academia and industry are encouraged, there has been greater emphasis on whether these kinds of collaborations have the potential to create conflict of interest that may jeopardize the safety of study participants and the integrity of the data.<sup>4</sup> Escalating awareness is being driven by the intense focus of the media on these types of issues which cast an unfavorable light on many positive, productive relationships.

Over the past 20 years, fewer than a dozen dentistry-specific drugs have gained US Food and Drug Administration (FDA) approval. Only one area, locally delivered antimicrobials for periodontitis, has at least 3 new drug approvals and, sadly, none of these could readily be classified as a blockbuster. This reality has made industry question the return on investment of the drug development route. Instead, oral care research and development has more typically been focused on FDA monograph actives (fluoride for caries) and devices such as implants, toothbrushes or restorative materials.<sup>5</sup>

The risks associated with entering into university–industry collaborations on the part of a corporate entity is often framed around concerns about whether academia is unbiased and ethical, and whether the investigator or institution is respected. There are also concerns about the role of the broader university, especially when it comes to intellectual

property and publication rights. It is absolutely critical to have these elements defined up-front because this has been the cause of many irresolvable conflicts.

There are a number of potential strategies for building research relationships with industry. Enter into these relationships with eyes wide open. There will be big issues along the way that stall progress. In order to survive in the current research climate all parties need to roll up their sleeves and work through it with the end goal in mind.

The most common downfall when academia approaches industry regarding potential partnerships is a lack of understanding of the business which is targeted. Great ideas which are not framed appropriately are summarily dismissed because the audience is not understood. Identify partners with similar interests and complementary needs – all sides need to gain from the collaboration.

The most efficient way to build a research relationship is to find a way in. Champions are critical in these endeavors. Interestingly, many of these partnerships are forged through informal means such as networking during poster sessions at research conferences.

There is an increasing emphasis on translational research in the dental research community. The skill set to take the great inventions in the laboratory and make them relevant to the daily care of patients is unlikely to occur in a single individual. While dental hygienist scientists have the potential to play important roles in all phases of collaboration, this is the place where the hygienist has the highest potential. Given the close relationships that are forged between dental hygienist and their patients, the practicality and value of ideas can be fully vetted and honed into great ideas. Without the ability to leverage the outcomes of research, the return on investment for all parties is never enough.

*Disclosure: The author of this manuscript is employed by Procter & Gamble Oral Health.*

## References

1. Tralau-Stewart CJ, Wyatt CA, Kleyn DE, Ayad A. Drug discovery: new models for industry-academic partnerships. *Drug Discov Today*. 2009; 14(1-2):95-101.
2. Alexander D, Clarkson J, Buchanan R, Chadwick G, Chesters R, Drisko CL, Douglass CW, Farrell L, Fletcher K, Makoni F, Monaco M, Nordquist B, Park NI, Riggs S, Schou L, Smales FC, Stamm JW, Toh CG, Volpe T, Ward P, Warren P. Exploring opportunities for collaboration between the corporate sector and the dental education community. *Eur J Dent Educ*. 2008;12 Suppl 1:64-73.
3. Abraham E. Better infrastructure: industry-academia partnerships—a marriage of convenience? *Crit Care Med*. 2009; 37(1):Suppl,S159-64.
4. Broccolo BM, Geetter JS. Today's conflict of interest compliance challenge: how do we balance the commitment to integrity with the demand for innovation? *J Health Life Sci Law*. 2008;1(4):3-65.
5. Gerlach RW. Clinical trials and oral care R&D. *J Am Coll Dent*. 2006;7(2):26-31.

## Strategic Planning and Research Priorities in Private Industry

Karen A. Raposa, RDH, MBA  
Colgate-Palmolive Company

Prior to any strategic planning of industry-supported research work, it is important to identify the priorities of the corporate organization. These priorities will be critical to understand in order to ensure that the research you are proposing is relevant to the corporation and meets their strategic needs.

Corporations will identify their priorities based on many different approaches. One approach might be to look at market research results to consider feedback and insights from both consumers and professionals. These studies might be conducted at conventions, through experts or key opinion leaders in the field, via advisory board meetings, through focus groups (qualitative research) and/or broad surveys (quantitative research). Often during these research studies, unmet consumer/patient needs may be uncovered or an unmet need within the profession may be revealed and explored.

Many companies will also review new and emerging trends in the marketplace. These can be either product or procedure trends. Some examples of emerging markets today might be dry mouth, erosion, sensitivity, minimally invasive dentistry or even spa dentistry.

In addition to considering what research needs to be conducted in the future, companies will look to explore the research that may already exist on a specific topic to date. This research may have been conducted within the company or outside of the organization. It may be research conducted on other products, on a specific ingredient(s) or on a specific subset of the population.

Organizations seeking to identify priorities must also be aware of

competitive activity within the category they may be exploring. They need to understand the activities and products in the competitive landscape that are gaining traction. In addition, the internet can be a wonderful tool to acquire knowledge about trends and fads via Google, YouTube and various blogs.

Understanding technology, activities, products and procedures that are approved and available in other parts of the world can also be a key driver in identifying research priorities. In some cases this learning may come from a competitor, but often times it is a result of exploring worldwide trends, fads and emerging sciences.

Finally, and probably most importantly, a corporate organization must be mindful of its core competencies, but must also understand if there is opportunity to move beyond the competencies that exist today to a competency that may be acquired. Ultimately, any new competencies would need to be a strong strategic fit in order to avoid potential disastrous results.

Once the corporate priorities are identified, they must then be prioritized in order to come to a key decision on what research should be pursued. For example, recognizing the corporate strategy for the study (i.e. long or short term, local, regional or global) will be critical to the design of the study. In addition, the core competency of the organization is critical to the decision making and prioritizing process. In reviewing this aspect, it is important to determine how the option expands the current portfolio and if it does so in a meaningful way. In looking at the possibility of a product line extension, a company must consider whether the additional products in the line will contribute meaningful product benefits or will move the product line into a different or new and meaningful area. Finally, the timeline to get the results, the cost of getting those results and the re-

turn on the investment will all need to be considered.

If it is determined that the research priority will be in a non-core competency or new area, then it is important to first evaluate the cost of entry. This can be accomplished by reviewing and applying Michael Porter's "Five Forces" in his 1998 publication *On Competition*.<sup>1</sup> The company must also consider how this expansion of the corporate brand image would be perceived and what the options to entry are. For example, is it in the organization's best interest to research and develop a new product or procedure alone? Or is a strategic partnership the better choice? Is an acquisition of the product/procedure/ technology the best approach? Once the plan of entry is decided, a plan after entry must be formulated including a timeline, cost and return on investment.

Now that the key priorities have been listed, they need to be prioritized in rank order. Strategic plans, both short and long term, must then be developed around these priorities. It will be important to ensure that the appropriate resources are allocated for all proposed research and that key performance indicators are in place in order to consistently monitor the progress of the research project.

It is important to consider both the advantages and challenges associated with merging research interests between academia, government and industry. Several advantages do exist, including the fact that these types of collaborations are relationship based and develop as a result of solid relationships between academia and industry. Because of this platform, funding support is usually straightforward and predictable. In addition, there is solid support for proposed methodologies and techniques, as well as a dedicated, reliable team of corporate research and development employees who are always available as an ongoing

resource. Once the data has been collected, an additional advantage to this type of collaboration is that there are corporate employees who are able to run the statistical analyses that are needed for final report and article submissions. Finally, the end result of this type of collaboration can lead to even more interaction between these groups, such as additional studies, consulting or ongoing long-term collaborations.

The challenges with these merging research interests include the need for common interests, the fact that the priorities of either team may change mid-stream or the economic pressures that may exist as the research study progresses, as well as the level of oversight the corporation may choose to impose on the researcher. Overall, however, the advantages far outweigh the challenges and great opportunities exist

from these types of academic, government and industry research interactions and collaborations.

*Disclosure: The author of this manuscript is employed by Colgate-Palmolive Company.*

## References

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1. Porter M. On competition. Boston: Harvard Business School Publishing; 1996.

## The Academic/Industry Relationship: Common misconceptions about bias.

MaryAnn Cugini, RDH, MHP  
The Forsyth Institute

Criticisms of bias in sponsored research programs regularly generate media interest, both in the academic world and beyond. This climate of mistrust has been fueled by reports of negative study results being withheld by industry as well as falsified data being presented by academic investigators, thus questioning the validity of support for drugs and devices.

Inherent industry bias is the assumed culprit, suggesting that active sponsor involvement in study design, analysis, control of databases and publication set the stage for biased research results. Financial considerations also play an important role in the conduct of clinical trials. Product development costs, especially for drugs, can run into the millions of dollars. This financial burden relies mainly on industry. In fact, over 70% of funding from clinical trials comes from industry.<sup>1</sup> Researchers pressured to obtain funding increasingly look to industry in this era of shrinking federal dollars. Interestingly, two thirds of academic medical centers hold an equity interest in companies that sponsor research at their institution.<sup>2</sup> New approaches in the evaluation of drugs have been suggested, such as an Institute for Prescription Drug Trials within the National Institutes of Health (NIH), which would administer clinical trials sponsored by industry.<sup>3</sup> While most of the negative media is related to prescription drug trials, bias towards industry sponsored trials for oral health products exists as well. Although dental clinicians are wary of product claims when research is sponsored by industry,

one must ask who else would pay for this research. It is only through education and understanding of the research process that some of these misconceptions can be cleared.

Any scientist appreciates that reduction in bias is a basic part of the scientific method. While practicing professionals have been far removed from their basic science classes, most have forgotten that there are internal and external threats to the validity of research results. Internal threats include subject selection, history, repeated testing (learning over time) and maturation (aging process, fatigue). External threats including randomization, masking and multicenter participation are controlled so that results can be applied to other populations. Individuals involved in research consciously account for these confounding issues by rigorous approaches to study design and analysis.

There are also other, more subtle forms of bias, for example:

- Publication Bias – studies with positive findings are published more often and faster than those with negative results<sup>4</sup>
- Funding Bias – biases in research design, outcome and reporting may be influenced by the source of funding or the desire to obtain continued funding
- Outcome Bias – studies that collect many types of data often report only the significant results
- Grey Literature Bias – results appear in many forms that are not referenced in journals. This includes abstracts, working papers, conference reports, patents and progress reports that can contain conflicting data

Efforts to reduce these types of bias with the aim of “increased transparency” have been initiated by regulatory agencies, professional organizations, academic institutions and journal editors. Clinical Trial Registries, use of Consolidated Standards

of Reporting Trials (CONSORT) and Conflict of Interest statements are all initiatives created to limit bias and increase transparency in clinical trials. Regulatory efforts include established federal, professional and advertising guidelines.

The Clinical Trial Registry ([www.clinicaltrials.gov](http://www.clinicaltrials.gov)) is a repository of federal and privately funded studies conducted in the U.S. allowing consumer, industry and investigator access to clinical trials. At this time, trial registration is voluntary, except for federally funded clinical trials.

Publications in peer reviewed journals have now adopted use of CONSORT ([www.consort-statement.org](http://www.consort-statement.org)) to address publication bias. Most journals, including dental health journals, require authors reporting on clinical trial data to follow these guidelines when publishing. Use of CONSORT makes published clinical trial data more amenable to systematic reviews as the full data are included for easy access and meta-analysis.

Conflict of Interest or statements of financial disclosure are now required of investigators by most organizations. The NIH states “This regulation promotes objectivity in research by establishing standards to ensure there is no reasonable expectation that the design, conduct or reporting of research funded under NIH grants, cooperative agreements or contracts will be biased by any conflicting financial interest of an Investigator.”<sup>5</sup>

It seems that most of these efforts described have focused on the bias of the investigator. Actually, industry sponsors of clinical trials must adhere to regulations imposed by government and professional organizations. All clinical trials involving human subjects adhere to the U.S. Code of Regulations (CFR), which defines the procedures that must be met for studies involving drugs, medical devices and over the counter health products. International agencies, including Health

Canada, also provide regulations for marketing of products and approval of advertising claims. Claims used in advertising are regulated by the Federal Trade Commission (FTC) and the National Advertising Division (NAD) of the Better Business Bureau. These agencies have jurisdiction over national advertising, including print, packaging and labels, broadcast in TV, radio and infomercials, direct mail and the internet. Advertisers must substantiate all claims, whether overt or implied. For “clinically proven” claims, the FTC, working in partnership with the FDA, requires industry to supply 2 clinical trials in support of the claim. Professional associations may also oversee product claims. The American Dental Association

requires clinical claim support for all advertising. In addition, clinical study guidelines adopted by the profession often dictate what study designs are accepted for product evaluation and claim approval.

In summary, elimination of bias in clinical research is a shared responsibility. As professionals, we are called upon to be both supportive of new product development and critical of claims validity.

## References

1. Doucet M, Sismondo S. Evaluating solutions to sponsorship bias. *J Med Ethics*. 2008;34(8):627–630.
2. Bekelman JE, Li Y, Gross CP. Scope and impact of financial conflicts of interest in biomedical research: A systematic review.

*JAMA*. 2003;289(4):454–465.

3. Angell M. Industry-sponsored clinical research: A broken system. *JAMA*. 2008;300(9):1069–1071.
4. Hopewell S, Loudon K, Clarke MJ, Oxman AD, Dickersin K. Publication bias in clinical trials due to statistical significance or direction of trial results. *Cochrane Database of Syst Rev*. 2009;(1) MR000006.
5. US Department of Health and Human Services, National Institutes of Health, Office of Extramural Research. Conflict of Interest, Frequently Asked Questions [Internet]. Cited April, 2009. Available from: <http://grants.nih.gov/grants/policy/coifaq.htm>.

## Exploring the Government/Industry Interface – the NIH SBIR STTR Program

Kay Etzler

*SBIR/STTR Program, National Institutes of Health*

The National Institutes of Health (NIH) participates in 2 Congressionally-mandated programs that offer funding explicitly for small U.S. companies to do innovative research work in the biomedical and behavioral sciences that have the potential for commercialization. These are the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs.

SBIR was enacted in 1982 and has 11 federal agencies participating. In order of their SBIR budgets (largest to smallest), they are:

- The Department of Defense
- The Department of Health and Human Services (which includes NIH)
- The National Aeronautics and Space Administration
- The Department of Energy
- The National Science Foundation
- The Department of Homeland Security
- The U.S. Department of Agriculture
- The Department of Commerce
- The Department of Education
- The Environmental Protection Agency
- The Department of Transportation

SBIR's sister program, STTR, was enacted in 1992 and includes the top 5 SBIR-participating agencies.

Each agency is required to set aside 2.5% of their extramural R&D budget for SBIR and three-tenths of 1% for STTR. Combined NIH budgets over the past several years have been approximately \$650 million (\$580 million SBIR, \$70 mil-

lion STTR). Current budgets (fiscal year 2009) are \$600 million for SBIR and \$72 million for STTR (The fiscal year 2009 budgets for the National Institute of Dental and Craniofacial Research (NIDCR) are \$7.8 million and \$0.9 million).

There are 3 phases to both SBIR and STTR with federal funds available for Phases I (a feasibility study) and II (full research/R&D). Phase III is the commercialization stage and awardees are responsible for obtaining the necessary following on funding and strategic partnerships to bring the SBIR/STTR-developed products or services into the marketplace. No SBIR or STTR funding is available for Phase III.

Both of these programs share the following goals:

- Stimulate technological innovation
- Use small businesses to meet Federal R&D needs
- Foster and encourage participation by minorities and disadvantaged persons in technological innovation
- Increase private-sector commercialization innovations derived from Federal R&D

There are 2 major differences between the programs that must be considered when deciding which is best. They are the amount of subcontracting needed and the principal investigator's (PI's) employment.

The SBIR program allows collaborations with private industry, universities, foundations or other U.S. entities. However, the STTR program requires a collaborative effort between the small business and a non-profit research institution. The small business must perform a minimum of 40% of the effort and the collaborating institution a minimum of 30%. The remaining 30% may be allocated to either of these entities or an additional third party, leaving the possibility of as much as 60% of the effort to be performed by the non-profit research institution. Generally, the

maximum amounts subcontracted for the SBIR program are one-third in Phase I and one-half in Phase II. Those research projects needing substantial support by a non-profit research institution usually consider the STTR program.

The other major difference between the programs involves the PI. SBIR requires that the PI be primarily employed with the small business awardees and STTR permits the PI to be employed with either the small business or the collaborating research institution. Those projects for which the expertise, leadership and technical guidance are to be provided by a university employee usually find the STTR program is a better fit.

NIH has exercised great flexibility in the implementation of its SBIR and STTR programs to maximize their use. The following are just a few of the many nuances that have helped to make these programs not only effective, but also viable sources of funding for small businesses to consider as part of their business plans to fund their research and R&D efforts:

- NIH offers both grant and contract opportunities with most (95%) of its awards being grants. As an assistance mechanism, grants offer more flexibility than contracts which is a procurement mechanism
- NIH offers 3 grant application submission dates each year: April 5, Aug. 5 and Dec. 5
- An applicant may exceed the budgetary and project duration period guidelines, providing they are adequately justified and the research plans warrant doing so. These guidelines are:
  - SBIR Phase I – \$100,000 for 6 months
  - SBIR Phase II – \$750,000 for 2 years
  - STTR Phase I – \$100,000 for 12 months
  - STTR Phase II – \$750,000 for 2 years

- Grant applicants must respond to the NIH mission of improving human health rather than a narrowly focused scientific technical topic. This allows for submission of investigator-initiated projects for which the investigator is encouraged to “think outside of the box” to provide innovative solutions to real problems
- All applications are peer reviewed and applicants receive the reviewers’ comments. These comments are especially useful when an applicant decides to revise and resubmit their application for review and consideration again
- Applications may be given assignments to multiple NIH institutes and centers for funding consideration. For those appli-

cations that are deemed scientifically and technically meritorious, this allows for greater chance of being selected for an award

- NIH offers Phase II Competing Renewals that provide additional Phase II funding for complex instrumentation projects, clinical research tools, behavior interventions/treatments or clinical projects preparing for FDA approval
- NIH offers the opportunity to submit FastTrack applications (combined Phase I and Phase II applications). Funding gaps between phases can be dramatically reduced or perhaps eliminated for FastTrack applicants
- NIH offers technical assistance programs to help transition SBIR-developed products into

the marketplace

Only small businesses may apply and receive SBIR and STTR funds, but university involvement is also encouraged. University individuals may serve as consultants or as key personnel on subcontracts to the small businesses. In the case of STTR, they may serve as principal investigators. University individuals who own their own small companies may also apply and receive awards. However, they and their universities must be cognizant of the conflict-of-interest issues that may arise and properly handle them.

Additional information about the NIH SBIR and STTR programs and how to submit an application is available from the NIH Small Business Research Funding Opportunities Web site <http://grants1.nih.gov/grants/funding/sbir.htm>.

## Lessons Learned from Grant Writing: Establishing a Track Record for Funding and Involving Community Providers in Implementation

Margaret M. Walsh RDH, MS, MA, EdD

Professor, University of California School of Dentistry  
Department of Preventive and Restorative Dental Sciences

My career as a dental hygienist–scientist began in 1980 asking questions in unfunded pilot studies. In 1986, I began collaborating with established researchers on an epidemiology study of the oral and general health effects of smokeless tobacco among professional baseball players. After a while, they generously allowed me to conduct a qualitative pilot study of my own among some of their smokeless tobacco users to learn about reasons for use and experiences with trying to quit. Based on this work, in 1990, I successfully submitted an application for a large-scale community-based smokeless tobacco cessation intervention that involved dentists and dental hygienists in its delivery. With this funding, my research career was launched and my subsequent research has built on this initial work.

Over the years, I learned many lessons about grant writing from mentors and from professional development seminars offered at my University.<sup>1</sup> My goal today is to share with you some of those lessons. I will begin with my most important lesson: writing a clear, concise and focused grant application with good science is not enough. To be successful, the application must:

- Be tailored to the funding agency's public health mission
- Easy for reviewers to under-

stand the ideas, why the study is important and why it is reasonable and feasible

- Convince reviewers that I have the expertise to carry out the planned study and that I have the appropriate environment, equipment, collaborators and budget
- Address the NIH's review criteria of:
  - Significance
  - Approach
  - Innovation
  - Investigator
  - Environment

The following will briefly address lessons about these latter review criteria.

### Significance

Your study's significance must be made clear in direct language and answer questions such as:

- Does the study address an important problem from the funding agency's perspective?
- If the aims are achieved, how will scientific knowledge be advanced?
- What will be the effect of your study on the concepts or methods that drive the field?

### Approach

Your study's approach must answer such questions as:

- Are the conceptual framework, design, methods and analyses adequately developed, well-integrated and appropriate to the aims of the study?
- Are potential problem areas acknowledged and alternative tactics considered?

### Innovation

In addressing your study's innovation:

- State that you believe the research proposed is original and innovative, and offer examples
- Explain what your project does that challenges existing paradigms or requires developing

new methods, techniques or technologies

### Investigator

In addressing this criterion, be sure to answer the following questions:

- Are you appropriately trained and well suited to carry out this work?
- Is the work proposed appropriate to your experience level (and that of your collaborators)? Explain how the proposed study is similar to those you have already completed
- Does the investigative team bring complimentary expertise to the project?

### Environment

In addressing the environment criterion, answer such questions as:

- Does your scientific environment contribute to the probability of success?
- Does your study take advantage of the unique features of the scientific environment?
- Is there evidence of institutional support?

Other important lessons are:

- Do not make the reviewers "work hard." Make it easy for them to understand your ideas, to find things and to be your advocate
- Read the application instructions carefully and follow the instruction to the letter
- Be specific about what you want the reviewers to know and what they need to know
- Prepare a "reviewer friendly" application that is well organized and clear

I will use my remaining time to share lessons learned about the following grant application components.

### Abstract

The abstract, your research summary, may be the only part of your application reviewers read. For me, the best approach is to write it first

and revise it last when you know your final application content.

### **Specific Aims**

The Specific Aims, the most important section of the grant application, should be well focused, not overly ambitious and hypothesis-driven. It is critical to write them early, circulate them to your team of experts and incorporate their feedback before writing the rest of the proposal. Usually 2 to 4 aims are the norm.

The Specific Aims section typically includes 3 general sections:

1. The “set-up” paragraph, which explains the relationship between a pressing problem and your research theme. This paragraph should strongly persuade the reviewer that the topic is important and worthy of their attention
2. The “hypothesis” paragraph, which points to a specific problem or area and culminates in

the statement of the hypothesis

3. The “specific aims” paragraph starts with a sentence like “The specific aims of the study are to...” and then lists the aims. Each aim should allude to the techniques used to achieve each one. In listing the specific aims use active verbs, rather than passive ones.

### **Background and Significance**

The background and significance section must establish 3 things: the project is important, the science is interesting and there is a high probability of success. This is not a literature review. Educate the reviewers to your way of thinking. Put the project into context by providing essential background information for the content area. Show how the proposed project builds on previous work and identify gaps in previous knowledge.

### **Preliminary Studies**

The preliminary studies section should convince reviewers that you know what you are doing. Show that the work is feasible and that suitable groundwork has been done by you.

In conclusion, never forget that your application is a work of persuasion. It is not merely a description of the work you want to do. Rather you are making an argument that it is work that needs to be done and that you are the right person to do it.<sup>2</sup>

### **References**

1. Derish, P. Writing an effective grant proposal, section by section. Professional and Academic Success Skills 2005–2006. University of California San Francisco; 2005.
2. Mohan-Ram, V. How not to kill a grant application, Part Five, The facts of the case so far. Science. Next Wave; 2000.

## Research Priorities from the Behavioral and Social Sciences Research Program at the NIDCR

Melissa W. Riddle, PhD  
Chief, Behavioral and Social  
Sciences Branch, NIDCR, NIH

### Overview of the Program

The purpose of this talk is to highlight the funding opportunities and priorities of the Behavioral and Social Sciences (BSS) Research Program at the National Institute of Dental and Craniofacial Research (NIDCR). The BSS program supports basic and applied BSS research to promote oral health, to prevent oral diseases and related disabilities and to improve management of craniofacial conditions, disorders and injury. The BSS research program views oral health as one component of a larger system of health and well-being, and encourages both basic and applied research that incorporates other aspects of health and well-being that contribute to oral health. This view of oral health as a component of general health builds on the Surgeon General's report on oral health in America (2000), and on the 2007 report of the Office of Behavioral and Social Sciences Research (OBSSR).

### Multidisciplinary and Team Science

The program aims to draw on the expertise of researchers from multiple fields of study, including those with a focus on basic and clinical oral health and those from other fields whose research might be applicable to oral health. Depending on the research questions of interest, projects may draw from the theories, measures and methods of a single scientific discipline or from those of multiple scientific disciplines.

### Methodologies

The BSS research program encourages the use of a variety of methodologies, depending on the research questions of interest. For example, studies may utilize randomized clinical trials methodology, or may utilize other methods such as single-case, within-subjects, historical control, microanalytic change process and other designs. Studies are strongly encouraged to utilize methods that allow for a test of mechanisms of action. Mechanisms of action are causal explanations for behavior. These are distinguished from correlates, predictors, mediators, moderators, risk and protective factors, etc., which may be candidate mechanisms, but have not been demonstrated as having a causal link with the outcome(s) of interest.

### Basic Behavioral and Social Sciences Research

NIDCR supports basic BSS research that identifies the mechanisms by which behavioral and social factors contribute to oral health. Exploratory research to generate hypotheses and confirmatory research to test hypotheses are both encouraged. Basic BSS research may involve qualitative and/or quantitative research methods, and may occur in a variety of settings (e.g., research laboratory, clinic, school, community, etc.). Basic BSS research at NIDCR focuses on human populations – basic BSS studies of animal models are not supported.

### Applied Behavioral and Social Sciences Research

NIDCR supports applied BSS research that develops and tests interventions to promote or improve oral health. These interventions may target individuals, families, groups, communities and others. Investigators are encouraged to consider following intervention-development models described in one of several recent NIH Program Announce-

ments. These include a 3-stage model of intervention development outlined in a joint National Institute on Alcoholism and Alcohol Abuse/ National Institute on Drug Abuse Program Announcement (please see: <http://grants.nih.gov/grants/guide/pa-files/PA-07-111.html>) and a Program Announcement on Community Participation in Research (please see: <http://grants.nih.gov/grants/guide/pa-files/PA-08-074.html>). These encourage community-based participatory research on health promotion, disease prevention and health disparities that communities and researchers jointly conduct, along with dissemination and implementation research that focuses on sustainability of interventions in community settings (please see the materials and archived video presentations of an National Institute of Mental Health sponsored workshop entitled, "Building the Science of Dissemination and Implementation in the Service of Public Health," 9/10/07 – 9/11/07, <http://obssr.od.nih.gov/di2007/agenda.html>).

### Health Behaviors Research

Basic health behaviors research clarifies how health behaviors, including oral health behaviors, develop and are maintained across the lifespan. Applied health behaviors research develops and tests interventions that promote oral health. Interventions may target prevention of oral disease or appropriate treatment for an existing oral or craniofacial condition, disease or injury. Interventions may target a general, specific or clinical population. Development and testing of community-wide or public health interventions to promote health and oral health are also encouraged.

### Stress and Health Research

Basic stress research clarifies how behavioral and social factors influence inflammation, wound healing, immunity to infection and

other health and oral health outcomes. Applied stress research develops and tests interventions to improve wound healing, immunity to infection and other health outcomes relevant to oral health.

### **Pain Research**

Basic pain research clarifies the mechanisms linking psychosocial processes (e.g., cognitive, emotional, behavioral and social processes) and the experience of acute and/or chronic pain. Applied pain research develops and tests interventions to prevent or manage acute and/or chronic pain conditions.

### **Health Communication Research**

Basic health communication research clarifies the role of health communication in oral health, including communication between patients and oral health care professionals, communication between

oral health and other health care professionals, oral health literacy (i.e., an individual's ability to utilize oral health care), diffusion and dissemination of health information, etc. Applied health communication research develops and tests interventions to improve oral health by improving oral health communication among patients, communities and oral health care professionals.

### **Research on Managing Serious and/or Chronic Illness**

Basic research clarifies the mechanisms by which serious and/or chronic craniofacial illnesses (e.g., temporomandibular joint disorders, craniofacial anomalies and injuries, oral, head or neck cancers, oral complications of HIV infection, etc.) are related to patient, family and social functioning. Basic research also clarifies the barriers to better oral health for individuals with serious

and/or chronic illnesses (e.g., those with congenital or acquired cognitive, neurological or psychiatric conditions, those with cancers, HIV or AIDS, diabetes, etc.). Applied research develops and tests interventions to support patients, families and others in the social environment in managing serious and/or chronic craniofacial conditions or illness, including temporomandibular joint disorders, craniofacial anomalies and injuries, oral, head or neck cancers, oral complications of HIV infection and others. Applied research also develops and tests interventions to eliminate barriers to better oral health for individuals with serious and/or chronic illnesses (e.g., those with congenital or acquired cognitive, neurological or psychiatric conditions, or those with cancers, HIV or AIDS, diabetes, etc.).

## Research Priorities in Women's Health

Jane C. Atkinson, DDS  
Director, Center for Clinical Research  
National Institute of Dental and Craniofacial Research

Research related to women's health is sponsored by all of the individual institutes of the National Institutes of Health (NIH). Coordination is provided by the Office of Research on Women's Health (ORWH). ORWH works in partnership with NIH institutes and centers to ensure that women's health research is part of the scientific framework at NIH and throughout the scientific community.

### Overview of the Office of Research on Women's Health (see <http://orwh.od.nih.gov/>)

The ORWH was established in September 1990. Dr. Vivian Pinn is the NIH Associate Director for Research on Women's Health and Director at the ORWH.

#### ORWH:

- Promotes, stimulates and supports efforts to improve the health of women through biomedical and behavioral research on the roles of sex (biological characteristics of being female or male) and gender (social influences based on sex) in health and disease
- Works in partnership with NIH institutes and centers to ensure that women's health research is part of the scientific framework at NIH and throughout the scientific community
- Advises the NIH Director and staff on matters relating to research on women's health
- Strengthens and enhances research related to diseases, disorders and conditions that affect women

- Ensures that research conducted and supported by NIH adequately addresses issues regarding women's health
- Ensures that women are appropriately represented in biomedical and biobehavioral research studies supported by NIH
- Develops opportunities for and supports recruitment, retention, re-entry and advancement of women in biomedical careers
- Supports research on women's health issues

In 2009, ORWH is holding 4 regional scientific workshops and public hearings to update the women's health research agenda. The overarching theme of this ORWH strategic planning initiative is "*Moving Into the Future: New Dimensions and Strategies for Women's Health Research for the National Institutes of Health.*" These meetings will be held in St. Louis, San Francisco, Providence and Chicago. The goal of the ORWH strategic planning effort is to look ahead for the next 10 years to ensure that women's health research continues to be scientifically relevant, anticipates new approaches to research on women's health or modifies existing research to apply to women's health research and employs the most advanced techniques and methodologies in new and creative ways. Ideas and recommendations from regional workshops will be integrated, with further input from the NIH. The final strategic plan will be presented to the NIH, Department of Health and Human Services and Congress in September, 2010.

### Women's Health Research Sponsored by the National Institute of Dental and Craniofacial Research

The mission of the National Institute of Dental and Craniofacial Research (NIDCR) is to promote the general health of the American people by improving craniofacial, oral and dental health through research.

This includes funding clinical and basic research to understand, prevent and treat oral and craniofacial diseases that disproportionately or solely affect women. These diseases include orofacial pain, diseases of the temporomandibular joint and muscles (TMJMD), osteoporosis of the craniofacial complex, salivary gland diseases, autoimmune diseases and oral diseases of pregnant women.

Clinical initiatives sponsored by the NIDCR include large cohort studies designed to identify risk factors and to characterize diseases impacting women. One study is following over 3,000 young women to identify those who develop TMJMDs. Two groups supported by the NIDCR continue to characterize individuals with Sjögren's syndrome, an autoimmune disease that severely impacts oral health. Over 90% of patients with Sjögren's syndrome are female.

Other recent studies sponsored by the NIDCR investigated the benefits of adjunctive therapies for treatment of periodontal disease in osteopenic women, treatments for severe TMJ and the effect that treatment of periodontal disease during pregnancy has on the incidence of preterm birth and associated growth restriction. Other studies of poor inner city women helped define factors that make them more susceptible to oral diseases.

The NIDCR also supports basic science studies examining growth and development of teeth, cartilage and bone. These studies have led to advances in biomaterials research and to the emerging field of tissue engineering and biomimetics, fields that use the body's own cellular and molecular processes to repair and regenerate tissues and organs. These include in-depth studies of the characteristics of the TMJ disk at the cellular level.

Recognizing the importance of gene-to-gene, gene-environment and behavioral interactions, the

NIDCR has long emphasized the importance of genetic, behavioral, social science and epidemiological research. Researchers supported by the NIDCR have defined genes associated with primary Sjögren's syndrome, cleft lip and palate and characterized features of women more likely to develop chronic pain. On-going studies hope to define susceptibility genes for TMJMD and other genes associated with craniofacial diseases. Complete re-

ports covering women's health research sponsored by NIH are available at [http://orwh.od.nih.gov/pubs/pubs\\_reports.html](http://orwh.od.nih.gov/pubs/pubs_reports.html).

### **Grants and Funding**

NIDCR is the nation's leading funder of oral, dental and craniofacial research. Approximately 75% of NIDCR's budget goes to the support of grantees at universities, dental schools and medical schools across the country and around the

world. Research grant applications are solicited through Funding Opportunity Announcements (FOAs) that are posted on the NIDCR Web site at <http://www.nidcr.nih.gov/GrantsAndFunding/>. General guidelines, including electronic grant application forms, application instructions and deadline information, are found at <http://grants.nih.gov/grants/oer.htm>.

## **Tobacco Control Research Priorities at the National Cancer Institute**

*Cathy L. Backinger, PhD, MPH  
and Deirdre Lawrence, PhD,  
MPH  
National Cancer Institute*

The health effects and the economic burden of tobacco use are well known. Enormous progress has been made in decreasing the use of tobacco by both adults and youth in this country. Since the 1964 Surgeon's General report which highlighted cigarette smoking as a health hazard, the prevalence of smoking in the U.S. has decreased from approximately 42% in 1965 to 20% in 2007 for adults and approximately 37% in 1975 to 23% in 2005 for youth.<sup>1,2</sup> Currently, approximately 45.1 million adult Americans are smokers.<sup>1</sup> In 2006, overall cancer rates dropped for the first time in a century, a milestone attributed to the significant reductions in smoking.<sup>3</sup>

Despite this enormous progress, it is unlikely that the Healthy People 2010 objectives of reducing smoking prevalence to 12% or less in adults and 16% or less in youth will be reached on schedule. Though adolescent smoking rates steadily declined from 1997 to 2005, this downward trend is now flattening. Furthermore, rates of adult smoking held relatively steady from 2004 to 2006, after declining steadily for 8 years.<sup>1</sup> Though the vast majority of smokers wish to quit, less than 5% are successful in any year. Certain racial, ethnic and population groups are disproportionately at risk to tobacco-related cancers because of factors related to disparities in tobacco-use and access to effective interventions. The recent epidemiological data on the stabilization of adult and youth smoking rates underscore the need for vigorous research. To-

bacco control research across the discovery and delivery continuum, which includes genetics, gene-environmental interactions, bioinformatics and health informatics, disparities and disproportionate risk and prevention and treatment, needs to be accelerated in order to reduce the disease burden caused by cancer.<sup>4</sup> In addition, scientists need to respond to the dynamic landscape. Tobacco use changes among populations (e.g., initiation by youth and young adults, established smokers and disproportionate use), tobacco control resources (e.g., funding, research capacity) and the tobacco industry (e.g., new products such as snus and water pipe use, evolution of existing tobacco products, marketing and advertising).

The mission of the Tobacco Control Research Branch (TCRB) of the National Cancer Institute (NCI) is to "lead and collaborate on research and to disseminate evidence-based findings to prevent, treat and control tobacco use." As such, TCRB funds a large portfolio of grants and contracts. For example, over the past 10 years TCRB has funded or co-funded specific research initiatives in the following areas: youth tobacco prevention and cessation, transdisciplinary tobacco use, international tobacco intervention research, analysis of tobacco industry documents, research on tobacco products and state and community interventions. Because some tobacco products are marketed with claims that imply reduced harm, NCI currently funds a research and development contract to develop methods and measures for product testing in order to advance scientific knowledge about the toxic and addictive properties of these products.

Several conferences and reports highlight and prioritize important tobacco control research questions. Such reports include the 2006 National Institutes of Health (NIH) State-of-the-Science Conference on Tobacco Control report "Tobac-

co Use: Prevention, Cessation and Control," the 2006–2007 President's Cancer Panel report "Promoting Health Lifestyles," the 2006 NCI-designated Cancer Center Directors report "Accelerating Successes Against Cancer" and the 2007 Institute of Medicine's report "Ending the Tobacco Problem: A Blueprint for the Nation." Using these reports as input, TCRB recently developed 3 research initiatives:

1. "Improving Effectiveness of Smoking Cessation Interventions and Programs in Low Income Adult Populations"
2. "Measures and Determinants of Smokeless Tobacco Use, Prevention and Cessation"
3. "State and Community Tobacco Control Media and Policy Research"

The first 2 funding opportunities are closed to applications and will be funded by September, 2009. The latter research initiative is slated for announcement in June, 2009 with funding by September, 2010. These 3 research initiatives combined represent an investment of almost \$100 million over 6 years to address these high priority research areas.

TCRB funds research to prevent and control tobacco use and tobacco-related cancers through a variety of means. They generate new information about the factors that influence tobacco use and addiction, second-hand smoke (SHS) exposure and tobacco-related cancers, they create and evaluate tools and interventions for tobacco use, addiction and SHS and apply, promote, and disseminate evidence-based interventions in clinical and public health practice and policy development. Research is funded primarily through request for announcements (RFAs), with approved set-aside funds for a specific initiative or investigator-initiated research using a variety of mechanisms to support worthy research ideas with funds from a common budget or "pool." Most research within TCRB is funded

via the common pool 3 times a year using the following mechanisms: small grants (R03), behavioral exploratory and developmental grants (R21), traditional research grants (R01) and program projects (P01). All of these grant mechanisms could be appropriate for dental hygiene research addressing tobacco depending on the training and experience of the principal investigator and research team and the type of research project. If dental hygienist researchers have any questions about funding opportunities or the grant process, please contact a member of the TCRB staff. Information about TCRB and how to reach us,

research initiatives, funding opportunities and other resources can be found at our Web site: <http://www.tobaccocontrol.cancer.gov>. Weekly information about all NIH funding opportunities can be found at <http://grants.nih.gov/grants/guide/> and information about cancer control funding opportunities can be found at <http://cancercontrol.cancer.gov/funding.html>.

## References

1. Centers for Disease Control and Prevention. Tobacco use among adults—United States, 2007. *Morb Mortal Wkly Rep.*

2008;14;57(45):1221–6.

2. Centers for Disease Control and Prevention. Cigarette Use Among High School Students — United States, 1991—2007. *Morb Mortal Wkly Rep.* 2008;57(25); 689–91.
3. Thun MJ, Jemal A. How much of the decrease in cancer death rates in the United States is attributable to reductions in tobacco smoking? *Tob Control.* 2006;15(5):345–7.
4. Morgan GD, Backinger CL, Leischow SJ. The future of tobacco-control research. *Cancer Epidemiol Biomarkers Prev.* 2007;16(6):1077–80.

## Behavioral and Integrative Treatment Development Program

Debra S. Grossman, MA  
National Institute on Drug Abuse

The National Institute on Drug Abuse supports an ongoing program of research on behavioral and integrative treatments for drug abuse, including nicotine dependence. The term “behavioral treatments” is used in a broad sense and includes various forms of psychotherapy, behavior therapy, cognitive therapy, family therapy, couples and marital therapy, group therapy, skills training, meditation and counseling. “Integrative treatments” refers to treatments that combine behavioral interventions with other treatments, including other behavioral therapies, medications or complementary/alternative therapies. Behavioral and integrative treatment research has been conceptualized, for the purpose of this program, to consist of 3 stages.

Stage I, or early treatment development, involves research on the development, refinement, and pilot testing of behavioral and integrative interventions. Stage I may include translational research that incorporates concepts, methods or findings from other disciplines (e.g., neuroscience) into the development of behavioral and integrative treatments. Stage Ia can be viewed as the most exploratory part of the treatment development process, in which theories of behavior change are tested, and the critical therapy development groundwork is laid. Late Stage I or Stage Ib, although still exploratory, can be viewed as the phase of Stage I in which theory-relevant data continues to be obtained, and the treatment undergoes pilot testing to determine whether or not a Stage II (or Stage III) study is warranted. Stage I may also include research to develop or adapt treatments to become

more community-friendly. When evidence-based treatments need to be adapted to be delivered by community treatment providers, such as in medical or dental settings, that adaptation is considered to be early treatment development. Such Stage I research may be conducted with research therapists or community treatment providers and may focus on developing technology-assisted treatment and training or modifying treatments to be briefer, less complex and/or less intensive. Stage I also involves testing the theory upon which a treatment is based to understand the mechanisms and principles of behavior change.

Stage II involves testing treatments that show promise. Stage II studies may include examinations of the components of treatments, dose-response and individual differences in treatment response. Stage II provides unique opportunities to further test the principles and mechanisms underlying behavioral change associated with treatment. If results are robust, Stage II studies may progress to Stage III. However, information obtained from Stage II studies may also be used to inform future Stage I studies. For example, if it is shown that a treatment works for some people, but not for others, a Stage II study may lay the groundwork for a Stage I proposal aimed at developing a treatment (or modifying the treatment) so that it works on the patients who were unresponsive to the initial treatment.

Stage III is research aimed at determining if and how efficacious behavioral treatments may be applied to community settings. Stage III may include studies that test treatments in community settings with community therapists. Stage III may also include studies that develop or test methods of training treatment providers to administer treatments.

The ultimate goal of treatment development is to produce treatments that work, and continue to

work when used in the community. Stage III research is aimed at obtaining knowledge and methods to ensure that an evidence-based treatment will retain its potency when delivered by community treatment providers. One question relevant to Stage III research is: “Does this treatment work when administered by community treatment providers?” Another question relevant to Stage III research asks: “How can this treatment be made to work when administered by community treatment providers?” Examination of the mechanism of action of treatments and/or training procedures is considered to be an integral part of Stage III. As is the case for Stage II, information obtained from Stage III studies may also be used to inform future Stage I studies. For example, if it is shown in Stage III that a treatment works for some people, but not for others, a Stage III study may lay the groundwork for a Stage I proposal aimed at developing a treatment (or modifying the treatment) so that it works on the patients who were unresponsive to the initial treatment.

Behavioral treatments play a critical role in most evidence-based drug abuse treatments, and often constitute the entire treatment. This program is intended to promote all of the necessary stages of behavioral and integrative treatment research so that better treatments are developed as advancements in science are made, and so that evidence-based treatments may be readily transported to the community. Over the past 2 decades, numerous evidence-based behavioral and integrative treatments for drug abuse and addiction have been created. With recent advances in science, particularly in neuroscience, it is evident that more can be done to incorporate new scientific discoveries into behavioral treatment development in order to improve treatment effects. In addition, as more is known about mechanism

of action of treatment, and as new technologies are developed, it is clear that more can be done to make treatments more easily transportable to community settings.

It is NIDA's objective to ensure sufficient emphasis and support for all stages of behavioral and integrative treatment research, so that scientific knowledge can readily be incorporated into newer and better behavioral interventions and treatments, and so that treatments can be effectively transported from research to the community.

# Poster Sessions

## Health Promotion/Disease Prevention – Original Research

### Comparing Consumer Acceptance and Perceived Benefits Of Two Floss Technologies

*\*Christine A. Charles, RDH, BS; Lai Hing Vair, BS; Daniel Queiroz, BS; JA McGuire, MS; Carol Gell, PhD; Elizabeth Channell, MS; Angela D. Morris, RDH, MS*

*Johnson & Johnson Consumer & Personal Products Worldwide, Division of Johnson & Johnson Consumer Companies, Inc.*

**Purpose:** The purpose of this quantitative, in-home use study was to evaluate consumer acceptance and benefits of a new floss technology regarding parameters of perceived cleaning efficacy, comfort and overall liking.

**Problem statement:** Can a consumer perceive differences between 2 floss technologies in factors that might affect patient compliance, such as perceived cleaning efficacy, comfort and overall liking?

**Methods:** Two-hundred and sixteen respondents, across 6 different geographic locations in the U.S., completed a questionnaire in this blinded, paired-comparison, 2-way crossover home use study evaluating 2 dental floss products. Respondents were instructed to use each product at least 3 times over a 3 day period with 1 day of rest between test periods. Responses were scored on a 9-point hedonic/intensity, or a 5-point agree/disagree scale. Data was analyzed using a 2-way ANOVA with respondent and floss product as factors.

**Results:** Results demonstrated that the Micro-Grooves™ technology monofilament floss (Reach® Ultraclean™ floss) was superior to a standard monofilament floss (Crest® Glide® Original Mint floss) for overall liking (7.05 vs. 5.99,  $p < 0.05$ , 1 = dislike extremely, 9 = like extremely), perceived cleaning (7.55 vs. 6.99,  $p < 0.05$ , 1 = extremely ineffective, 9 = extremely effective) and comfort (“comfortable to hold” (7.29 vs. 6.14,  $p < 0.05$ , 1 = extremely uncomfortable, 9 = extremely comfortable), “comfortable to grip” (4.10 vs. 3.25,  $p < 0.05$ ) and “having better control while flossing” (3.97 vs. 3.28,  $p < 0.05$ , 1=completely disagree, 5=completely agree)).

Additionally, both flosses were similar for “resistance to shredding or fraying” and easy sliding (“easy to insert,” “easy to remove” and “easy to slide between teeth”), with one exception. Among Crest® Glide® floss users, the new technology was perceived as significantly easier to insert.

**Conclusion:** This home use test demonstrated consumer perceivable differences between 2 floss technologies and the superior performance on overall liking, perceived cleaning efficacy and comfort of a new monofilament floss with Micro-Grooves™ technology compared to a standard monofilament floss.

### The Epidemic Of Dental Disease In Poor Children Of Northeast Philadelphia

*Judy E. Gelinas, RDH, BS; Iain F. S. Black, MD; Wilma B. Yu, RN, MS*  
*St Christopher's Foundation for Children*

**Purpose:** To determine the extent and severity of dental disease in 2 to 9 year olds in a targeted low socioeconomic Northeast Philadelphia population.

**Problem Statement:** Data compiled by St Christopher's Foundation for Children found in children 2 to 3 year olds 28.4% had dental decay. By 8 to 9 years old, incidence rose to 72.4%. These rates are double those of the state and Philadelphia and triple the Healthy People 2010 target.

**Methods:** The study was a quantitative retrospective study of 2,527 children, ages 2 to 9 years old, treated through the St Christopher's Foundation for Children's Mobile Dental Program (Ronald McDonald Care Mobile) during a 2 year period from Jan. 1, 2007 to Dec. 31, 2009. Data is compiled by age and looks at the children seen with dental decay expressed as number of children and percentage by grouping. The study compiled the severity of dental decay by recording the number of teeth with decay per child.

**Results:** Data showed a significant incidence of disease starting in toddlers, with over 28% of children in this group suffering from decayed teeth. By kindergarten, the incidence doubled to 56.7% and the trend continued to reach 72.4% by age 9, when the incidence began to

level off. Looking at severity, 30% of the 2 to 3 year olds had decay in 5 or more teeth – this increased to 43% by age 8.

**Conclusion:** Dental disease is a major concern for Northeast Philadelphia. The earlier a child accesses dental care, the more likely the child will have fewer decayed teeth. Early intervention reduces the number of decayed teeth, reduces the need for restoration, reduces the cost of dental treatment, reduces the chance of recurrent decay and increases the chance a child will maintain healthy dentition.

## Strengthening The Quality Of Oral Cancer Screening

*DM Laronde, RDH, MSc, PhD (Candidate);1,2  
PM Williams, BSN, DMD, FRCD(C);2,3 TG  
Hislop, MDCM;2 JL Bottorff, PhD, RN, FCAHS;2,3  
CF Poh, DDS, PhD, FRCD(C);2,3 S Ng, DMD,  
FRCD(C);2 MP Rosin, PhD;1, 2  
Simon Fraser University, Burnaby, B.C.; 2 B.C.  
Cancer Agency; 3 The University of British  
Columbia*

**Purpose:** To study current oral cancer screening practices, identify factors that influence this behavior and study the effects of using a novel adjunctive screening device (fluorescence visualization (FV)) within community dental offices.

**Problem Statement:** Oral cancer screening is a noninvasive, quick and painless skill that oral health professionals are taught, yet less than 30% of people surveyed have ever been screened. More than 40% of oral cancers are diagnosed at a late stage where 5-year survival is poor. There is a need for continuing education to maintain and promote this skill, and to incorporate this behavior into consistent daily routine.

**Methods:** Fifteen dental offices from the Vancouver area took part in a 1 day oral cancer screening workshop, offering both didactic and clinical components. Offices screened patients 21 years of age and older for 11 months, collecting demographic, clinical and FV information by questionnaire. Two focus groups were used to identify factors influencing screening behavior and the value of FV. Suspicious lesions were referred to a specialty clinic or reviewed by a community facilitator.

**Results:** Of the 2,599 patients screened, 438 lesions were recorded. Ninety-four of 133 patients asked to return in 3 weeks were reassessed. Twenty-six patients

were referred directly to a specialty clinic while a further 34 were reviewed by a study facilitator who referred an additional 7. Seven patients were biopsied resulting in 3 dysplasia cases.

**Conclusions:** Future workshops should focus on clinical presentation of benign and variations of normal mucosa. Reviewing a lesion 3 weeks after the initial visit greatly reduced the number of confounders and unnecessary referrals.

**Acknowledgements:** Supported by NIDCR grant R01DE13124 and a scholarship from the Michael Smith Foundation for Health Research to DML.

## Biofilm Removal With A Dental Water Jet

*\*Deborah M. Lyle, RDH, MS  
Water Pik, Inc.*

**Purpose:** To evaluate the effect of a dental water jet on biofilm using scanning electron microscopy (SEM).

**Problem Statement:** Traditional measures of detecting biofilm by staining and viewing with the naked eye (Plaque Index) provide limited information on the impact to the biofilm by a device. This study was designed to provide information on biofilm removal at the microscopic level.

**Methods:** Eight teeth with advanced aggressive periodontal disease were extracted. Ten thin slices were cut from 4 teeth. Two slices were used as the control. Eight were inoculated with saliva and incubated for 4 days. Four slices were treated using a standard jet tip and 4 slices were treated using an orthodontic jet tip. The remaining 4 teeth were treated with the orthodontic jet tip but were not inoculated with saliva to grow new biofilm. Experimental teeth were treated using a dental water jet for 3 seconds on medium pressure. Images of the control and samples were taken with the SEM from representative areas of treated and untreated regions of the tooth slices, and total bacteria numbers were counted on standard areas of 10  $\mu\text{m}$  x 10  $\mu\text{m}$ . The mean was determined and the results were extrapolated on a standard area of 1  $\text{cm}^2$ . The extrapolated area was then multiplied with the number of bacterial layers of the biofilm. The total bacterial load was calculated.

**Results:** The standard jet tip removed 99.99% of the salivary (ex vivo) biofilm, and the orthodontic jet tip removed 99.84% of the salivary biofilm. Observation of the remaining 4 teeth by the naked eye indicated that the orthodontic jet tip removed significant amounts of cal-

cified (in vivo) plaque biofilm. This was confirmed by SEM evaluations.

**Conclusion:** The dental water jet (Water Pik, Inc, Fort Collins, Colo.) can remove both ex vivo and in vivo biofilm. Water Pik, Inc. donated the dental water jets used in this study. Water Pik, Inc. has provided unrestricted research grants to the Center for Biofilm, USC School of Dentistry.

## References

1. Gorur A, Lyle DM, Schaudinn C, Costerton JW. Biofilm removal with a dental water jet. *Compend Contin Dent Ed.* 2009;30(Special Issue 1):1–6.

## Effect Of Low-Temperature Atmospheric Pressure Plasma Pencil On Streptococcus Mutans

Margaret Lemaster, BSDH, RDH, MSc; \*Gayle McCombs, RDH, MS; Michele Darby, BSDH, MS; Wayne Hynes, PhD; Mounir Laroussi, PhD  
Old Dominion University

**Purpose:** This study was conducted to determine if low-temperature atmospheric pressure plasma (LTAPP) has the ability to inactivate dental caries causing bacteria, specifically *Streptococcus mutans*.

**Problem Statement:** Given the limited knowledge available on the bactericidal effects of LTAPP, this investigation set out to determine if LTAPP was effective at inactivating the caries causing bacteria *S. mutans*.

**Methods:** *S. mutans* were inoculated at a 1:100 dilution in brain heart infusion broth and exposed to LTAPP at various time intervals (60, 120, 180 and 300 seconds). Seventy-two samples of *S. mutans* were exposed and 18 samples served as controls. Samples were plated on Mitis salivarius agar and incubated 48 hours at 37°C. The number of colony forming units (CFU) and inactivation factor were determined. Data were analyzed using repeated measures ANOVA at 0.05 $\alpha$  significance.

**Results:** Analysis revealed a statistically significant bactericidal effect of *S. mutans* when exposed to LTAPP at each time exposure of 60, 120, 180 and 300 seconds. There was an average 95% inactivation factor for the 300 second exposure.

**Conclusion:** LTAPP has a statistically significant bactericidal effect at 60, 120, 180 and 300 second exposures, as measured by CFU. Inactivation effect on *S. mutans* at 300 second exposure were 95%, 92% at 180 second exposure, 76% at 120 second exposure and 53% at 60 second exposure.

## Comparative Plaque Removal Evaluation Of Two Floss Technologies

\*Angela D. Morris, RDH, MS; Sylvia L. Santos, RDH, MS

Johnson & Johnson Consumer & Personal Products Worldwide, Division of Johnson & Johnson Consumer Companies, Inc.  
Matthew J. Cronin, DMD

New Institutional Service Co., Inc.  
Chhaju R. Goyal, BDS; Naresh C. Sharma, DDS  
BioSci Research Canada, Ltd.

JA McGuire, MS

Johnson & Johnson Consumer & Personal Products Worldwide, Division of Johnson & Johnson Consumer Companies, Inc.

**Purpose:** The objective of these 4 independent clinical studies was to compare the interproximal plaque removal efficacy of Reach® Ultraclean™ floss versus various marketed flosses (Crest® Glide® Original Mint, Oral-B® SATINFloss®, Crest® Glide® Deep Clean, Crest® Glide® Whitening Plus Scope®, Crest® Glide® Comfort Plus and Crest® Glide® Shred Guard).

**Problem Statement:** Can a new monofilament dental floss with Micro-Grooves™ technology provide greater interproximal plaque removal than various marketed floss products?

**Methods:** Each Internal Review Board approved clinical study followed the same design: observer-blind, randomized, 3-way crossover, controlled design. A trained dental examiner performed pre-flossing plaque evaluations on subjects according to the Proximal/Marginal Index (PMI), and qualified subjects were randomly assigned to their sequence of treatments. A registered dental hygienist performed surrogate flossing on the 8 incisors followed by post-flossing PMI assessments. Subjects visited the clinical site 3 times with at least a 24 hour rest period between each visit. Data was analyzed based on an ANCOVA model with sequence, period and treatment as fixed effects, subject within sequence as random effect and the corresponding pre-flossing score as a covariate.

**Results:** In these 4 studies, Reach® Ultraclean™ floss removed statistically significantly more interproximal plaque than the comparator dental flosses ( $p < 0.001$ ) with percent reductions from pre-flossing plaque means as follows: Reach® Ultraclean™ (41.7%, 43.4%, 52.7% and 67.27%), Crest® Glide® Original Mint (19.3% and

28.8%), Oral-B® SATInfloss® (21.6% and 29.9%), Crest® Glide® Deep Clean (19.0%), Crest® Glide® Whitening Plus Scope® (17.2%), Crest® Glide® Comfort Plus (31.34%) and Crest® Glide® Shred Guard (32.15%).

**Conclusion:** Reach® Ultraclean™ floss with new Micro-Grooves™ technology removed significantly more interproximal plaque than the comparators tested. Presented at IADR/AADR/CADR 87th General Session and Exhibition, Miami, Florida, April 1–4, 2009, Abstract 1574.

## Understanding Dental Hygienists As Adult Learners In Social Action

*\*Ellen J. Rogo, RDH, MEd, PhD (Candidate)  
Associate Professor, Idaho State University,  
Department of Dental Hygiene*

**Purpose:** The underserved population is more vulnerable to oral diseases from the lack of access to care, preventive services and comprehensive care. Dental hygienists are engaged in social action to improve access to care by providing direct care to the underserved population and working on legislative initiatives to expand the scope of practice. The purpose of the study was to understand dental hygienists as adult learners in social action.

**Problem Statement:** The problem addressed by the study was the evolving role of practitioners as they challenged and changed the systems and policies to improve population health, which has not been addressed from the dental hygiene perspective. The significance of the inquiry was to understand what and how dental hygienists learned in their struggle to improve access of care.

**Methods:** A qualitative approach to data collection included personal interviews with 8 participants from California, Oregon and Washington who met the inclusion criteria. Data was analyzed using constructivist grounded theory methods and situational analysis.

**Results:** The grounded theory analysis revealed 3 categories of participant experiences: awareness, adaptation and relationships. Awareness was supported by the subcategories self-awareness, status quo, recognition of power and injustice of systems. Adaptation was supported by the 2 subcategories specialization and creativity, while relationships were supported by the connectedness and collaboration subcategories. The situational analysis illuminated learning in formal settings, non-formal settings and the informal settings of nursing home practices, public health practices, community health center and the professional association. Three significant issues emerged from the analysis: dental insurance reimburse-

ment, dental hygiene education and improving the oral health delivery system.

**Conclusion:** Dental hygiene practitioners as adult learners used a variety of strategies in their work place and as members of the professional association to learn in social action.

## Expanding The Role Of Dental Hygienists Providing Access To Care Using A School Based Model And Teledentistry

*\*Melanie L. Simmer-Beck RDH, MS; Cynthia C. Gadbury-Amyot, BSDH, EdD; Hayley Barker Ferris, RDH, BSDH, ECP; Bill Marse BS, Harvey Eplee, DDS  
University of Missouri–Kansas City*

**Purpose:** To provide preventive oral health services in a school based setting.

**Problem Statement:** Can a school-based preventive oral health program improve access to care? How will this affect the rate of decay and number of sealants in children?

**Methods:** This model replicates the “Community Collaborative Practice” model developed by Apple Tree Dental. It allows universal access by providing care “directly in the child’s school.” It expands the role of dental hygienists in the delivery of preventive care services by establishing telehealth links with dentists. The infrastructure promotes holistic care by integrating all health care-related services. Services are provided by dental hygiene students supervised by faculty holding a Kansas dental hygiene extended care permit.

**Results:** Approximately 916 children were eligible to participate in this program during the 2008–2009 school year, with 450 children enrolling. Baseline data from the first target school were collected on 189 children with 119 (63%) exhibiting active decay. Sealants, restorative dentistry and dental hygiene care were rare. Children in our target population had a much higher rate of decay and significantly fewer sealants than children documented in a recent statewide survey, “Smiles Across Kansas 2007 Update.” Additionally, they did not meet the goals of Healthy People 2010 to reduce the proportion of children, adolescents and adults that have untreated dental decay to less than 21%, and to increase the proportion of children who receive sealants on their molar teeth to 50%. As a result, all 189 children received preventive services including teeth cleanings, fluoride, x-rays, seal-

ants and education. Children who had decay were referred to dentists in the community that were part of the program “Dentists Community Care.”

**Conclusion:** This model significantly increased access to care in both unserved and underserved populations. Future efforts will be directed toward obtaining funding to extend the program. This project was approved by the University of Missouri–Kansas City IRB and funded by the REACH Health care Foundation.

## Health Promotion/Disease Prevention – New Programs

### Beneficial Outcomes From A Service–Learning Community Program

*\* Carolyn H. Ray, RDH, MEd  
University of Oklahoma College of Dentistry  
Department of Dental Hygiene*

**Purpose:** The purpose of this program was to report the benefits of a school–based sealant program that was a service–learning opportunity for dental hygiene students.

**Significance:** Dental and dental hygiene schools have the opportunity to become involved in programs that benefit their communities and make a significant impact on the oral health of the children in those communities. More outcomes need to be reported on the retention rates of pit and fissure sealants (PFS) placed in school–based sealant programs to provide evidence of the effectiveness of these programs.

**Key features:** Many service–learning activities in dental hygiene curriculum are one–time opportunities for students to experience community service. This program provided feedback on the 1 year retention rates of sealants placed by dental hygiene students using only donated and volunteer resources.

**Evaluation:** During the spring of 2008, the dental hygiene faculty coordinator returned to 5 elementary schools to complete visual dental exams on third graders who received PFS the year before. Of the 205 students in the program, 174 (71.7%) were available to be re–examined. A total of 479 PFS were placed on the first molars of these students. This represented approximately 71% of the total sealants placed during the spring of 2007. Two hundred eighty–nine sealants were identified by visual oral exams. The retention rate was 60.3%. The outcomes from this program suggest that a potential of 289 first molars were protected from dental caries.

## A Team Approach For Community Outreach

*\* Maureen Tsokris, RDH, MPS; Laura Joseph, RDH, EdD  
Farmingdale State College*

**Purpose:** The purpose of this program was to increase collaborative partnerships with the School of Dental Medicine at Stony Brook University and the Suffolk and Nassau County Dental Societies, in order to provide preventive oral health services to underserved children in the community. Program goals were to reach children in the community who do not have access to oral health care, to provide students the opportunity to participate in a large community outreach program and to increase student’s competency in assessing, managing and treating children of all ages.

**Approach:** As a host site, the dental hygiene program utilized sophomore students as care providers, freshman students as assistants and dental residents to provide urgent care. Notification of the event was given to local elementary schools via the school health nurse. Appointments were made in blocks of 25 and all children were accompanied by a legal guardian. Once arriving at the site each child was paired with a dental hygiene student who reviewed the health history and consent form, completed an intra and extra oral exam, provided oral health education, performed an oral prophylaxis, placed dental sealants and fluoride varnish. Dental hygiene faculty reviewed student findings and the supervising dentist signed the screening forms.

**Evaluation:** Students performed 106 dental screenings and 98 oral prophylaxes, 101 dental sealants were placed, 2 children received urgent care and all children and parents participated in an oral health education program. Of the 106 children seen at Farmingdale, 58% presented with decay, indicating the need for such outreach programs. This collaborative approach toward community outreach was an outstanding way to unite the dental community in reducing health disparities and improve oral health outcomes.

## Application Of Evidence In Health Care Practice: A Cross-Discipline Comparison

*\*Joanna Asadoorian, AAS (DH), BScD (DH), MSc Associate Professor, School of Dental Hygiene, Faculty of Dentistry, University of Manitoba*  
*Brenda Hearson, RN, MN, CHPCN(C) Clinical Nurse Specialist, Winnipeg Regional Health Authority Palliative Care Program and Canadian Virtual Hospice*  
*Satyendra Satyanarayana, BSc, MSc, MD, FRCPC Staff Psychiatrist, Centre for Addiction and Mental Health, Assistant Professor of Psychiatry, University of Toronto*  
*Jane Ursel, PhD Associate Professor, Department of Sociology, Faculty of Arts, University of Manitoba*

**Purpose:** The purpose of this study was to explore the understanding and experiences of evidence-based practice (EBP) in 3 different disciplines: dental hygiene, nursing and psychiatry.

**Problem Statement:** Research has demonstrated that there is a delay between new research findings and their application to practice. These delays can have serious implications for patient/client outcomes and treatment costs.

**Methods:** This exploratory, qualitative study used a grounded theory approach. A purposeful, convenience sample of 10 health care professionals (n = 3 dental hygienists, n = 4 nurses, n = 3 psychiatrists) was selected based on the individual researchers respective backgrounds. Researchers conducted individual interviews using a semi-structured interview approach. Data was first organized into substantive codes based on predetermined sensitizing concepts (enhancers and barriers to implementing EBP). Next, researchers identified emergent themes. Finally, participant experiences were compared across professions.

**Results:** Over 100 pages of transcribed data were available for analyses. The majority of study participants demonstrated an understanding of EBP, but most described a somewhat limited interpretation, only recognizing the "research" component. All participants were able to identify enhancers and barriers to implementing EBP, and over 50 substantive codes were revealed, which all

fit within the 2 sensitizing concepts. Seven major themes emerged from these codes that researchers categorized as either being individual knowledge and attitudes factors or structural characteristics of the workplace. Through cross discipline comparisons, both differences and similarities within and across the 3 professions emerged.

**Conclusions:** This study revealed that many individual characteristics and attitudes and the workplace culture act together on health care practitioners' ability to implement EBP, which is consistent with the work of others. The investigators concluded that there is a complex interplay between individual factors and, critically, the unique cultural features of different health professions that affects one's implementation of evidence into practice.

## Identification Of Pathogen And Host-Response Markers Correlated With Periodontal Disease

*\*Janet S. Kinney, RDH, MS, MS; Christoph A. Ramseier, DMD; Amy Herr, PhD; Thomas Braun, PhD; James V. Sugai, BS; Charles A. Shelburne, PhD; Lindsay A. Rayburn, BS; Huu M. Tran, BA; Anup K. Singh, PhD; William V. Giannobile, DDS, DMedSc*  
*Michigan Center for Oral Health Research, University of Michigan School of Dentistry, and Sandia National Laboratories*

**Purpose:** This study sought to determine the ability of putative host and microbially-derived biomarkers to predict periodontal disease status from whole saliva and plaque biofilm.

**Problem Statement:** Periodontal disease afflicts over 50% of the adult population in the U.S., with approximately 10% displaying severe disease concomitant with early tooth loss. The development of rapid point-of-care (POC) diagnostics has the potential for early detection of periodontal infection and progression to identify incipient disease and reducing health care costs.

**Methods:** One hundred subjects were equally recruited into a low-risk disease cohort and a periodontal disease population. Whole saliva was collected and analyzed using antibody arrays to measure the levels of multiple pro-inflammatory cytokines and bone resorptive/turn-over markers. Salivary biomarker data were correlated to comprehensive clinical, radiographic and microbial plaque biofilm level for the generation of models for periodontal disease identification.

**Results:** Significantly elevated levels of MMP-8 and MMP-9 were found in subjects with advanced periodontitis with Random Forest importance scores of 7.1 and 5.1, respectively. Receiver operating characteristic curves demonstrated that permutations of salivary biomarkers and pathogen biofilm values augmented the prediction of periodontal disease category. Multiple combinations of biomarkers (especially MMP-8, MMP-9 and osteoprotegerin) combined with “red complex” periodontal pathogens displayed highly accurate predictions of periodontal disease category. Elevated salivary MMP-8 and *T. denticola* biofilm levels displayed robust combinatorial characteristics in predicting periodontal disease severity (AUC = 0.88; OR = 24.6, 95% CI = 5.2, 116.5).

**Conclusions:** We have identified host and bacterial-derived biomarkers correlated with progression of periodontal disease. This approach offers significant potential for discovery of biomarker signatures for the development of rapid POC diagnostics for oral and systemic diseases. This work was supported by NIH/NIDCR U01-DE014961 and NCRR UL1RR024986.

## Increasing Utilization Of Preventive Dental Care Services Through Affiliated Practice Dental Hygiene

\* Michelle L. Gross-Panico, RDH, MA  
Arizona School of Dentistry & Oral Health

**Problem Statement:** Minority children and children from lower income families more likely experience the burden of dental disease. Since oral disease reduces quality of life, it is a priority to increase utilization of preventive dental services.

**Purpose:** Through Arizona’s Affiliated Practice Relationship, hygienists are permitted to provide preventive dental services to qualified underserved children in a variety of community-based health and educational settings without a prior examination by a dentist. The research questions addressed in this study are: “Does Affiliated Practice increase utilization of preventive dental services by underserved children of age birth to 18 years?” and “What are the barriers and the level of importance of these barriers that impede underserved populations from receiving preventive dental services?”

**Methods:** The survey was constructed and administered to parents/guardians of patients of age birth to 18 years old who received preventive dental services from Catholic Health care West (CHW) East Valley Children’s Dental Clinic, the Affiliated Practice dental clinic at San Marcos Elementary in Chandler, Ariz.

**Results:** Thirty-four surveys were completed – 21 in English and 13 in Spanish. The data was analyzed for descriptive statistics and non-parametrically analyzed using the Friedman’s Test, Kendall’s W Test and the Wilcoxon Signed Ranks Test.

**Conclusion:** The study concluded that Arizona Affiliated Practice dental clinics increase utilization of preventive dental services for underserved children of age birth to 18 years old, primarily due to the reduced cost of receiving care from these clinics. Based on this outcome, future funding efforts and legislative policies should support this dental care delivery model of Affiliated Practice to include treatment for adults and seniors. IRB approval from CHW and Northern Arizona University. No funding required for this project.

## Knowledge Translation Along The Continuum From Research Question To Policy

\*Joanne B. Clovis, RDH, PhD

Dalhousie University

Sandra J. Cobban, RDH, PhD (Candidate)

University of Alberta

Debora C. Matthews, BSc, DDS, Dip. Perio, MSc;

Mark J. Filiaggi, PhD; Mary E. McNally, MSc, DDS, MA

Dalhousie University

**Purpose:** Traditional dissemination of research through peer-reviewed presentations and publications leaves gaps in knowledge translation that are critical to moving research into policy. Funding agencies recognize these gaps in knowledge uptake and increasingly require detailed plans for knowledge translation along the continuum from research question, method and results, to practitioners and to decision-makers. A recent call for SEED grants on oral health disparities in Canada required a separate module on the knowledge translation (KT) plan. This presentation describes that process and result.

**Problem Statement:** The development of a KT plan requires prior identification of key points in the continuum along with knowledge translation strategies to inform policy development.

**Methods:** Expertise in KT required the addition of a new type of investigator to the research team. Specific audiences, partners and stakeholders were identified with complementary KT strategies to address groups at

each of the milestones during the research project. The research is informed by social networking theory using linkage mechanisms consistent with the interaction model of KT. These linkages provide greater likelihood that this research will be useful to both researchers and users, increasing the possibility that the findings will be applied and providing maximum benefits to all communities.

**Results:** Dissemination activities include stakeholder networks and key messaging, along with formal reports and professional presentations. Utilization of communication technologies such as video conferencing and Web sites are integral to the KT plan. Five elements suggested by Lavis et al – the message, audience, messenger, process and effect – provide the evaluation framework for the KT strategies for the project. The KT plan with the SEED grant application was funded as 1 of only 4 in Canada.

**Conclusions:** The ultimate success of the KT plan is dependent on successful execution of the research, the communication strategies and careful evaluation of the components.

## Professional Education And Development – Original Research

### Dental Hygienists' Perceptions Of The Bachelor's Degree In Dental Hygiene And The Advanced-Degree Oral Health Care Practitioner

*\*Kelly L. Anderson, RDH, MHS; Barbara S. Smith,  
PhD, PT  
Wichita State University*

**Purpose:** Determine hygienists' perceptions about 2 dental hygiene educational issues: bachelor's entry level and the oral health practitioner (OHP).

**Problem statement:** Many dental hygiene educators/students feel that sufficient educational activities/courses are completed to meet requirements for a bachelor's degree in dental hygiene (BSDH). The OHP is one avenue to improving access to care that is not well received by all stakeholders. Information concerning these 2 initiatives would be useful to those trying to implement these proposals.

**Methods:** A survey, sent to 564 graduates of a Midwestern University's dental hygiene program, consisted of statements about the BSDH and the OHP. A 5-point Likert scale evaluated respondents' perceptions. Stu-

dents also ranked perceived benefits/negative impacts. The usable return rate was 33.6%. Data was analyzed using descriptive statistics and Chi-square tests.

**Results:** More than 70% agreed with the statement "An associate degree sufficiently prepared dental hygienists for their positions." Over 20% would leave dental hygiene if practice required a BSDH. Number of years since graduation and age group were significantly associated with 3 statements about the BSDH. In ranking BSDH limitations, the most frequently checked response was "no personal benefit." More than 70% also agreed with the statement "The OHP would have a positive impact on access to dental care." Age and professional association membership were most associated with positive OHP statements. Seventy-five percent felt the master's educated hygienist would be adequately prepared to perform the proposed OHP functions. Approximately 50% did not view the OHP as a direct threat to dentists. In ranking OHP limitations for the current practitioner/student, many checked lack of time/money.

**Conclusions:** Mostly younger dental hygienists view the BSDH in a positive light. Practicing dental hygienists view the OHP as a positive factor in providing more access to care and in advancing the dental hygiene profession. Future research should evaluate other stakeholders' responses to these important issues in dental hygiene education. This study was funded through the Department of Dental Hygiene, Wichita State University. This study was approved by the Institutional Review Board of Wichita State University.

### Tobacco Cessation Training For The Oral Health Care Team

*\* Sharon M Compton, RDH, BSc, MA, PhD  
University of Alberta*

**Purpose:** The project assessed effectiveness of workshop training for oral health care professionals on changing practice to increase provision of an intervention for tobacco cessation counseling.

**Problem Statement:** The dental/dental hygiene appointment provides a teachable moment for discussing patient's tobacco use and providing guidance and support. However, many oral health care professionals don't address patient's tobacco use, citing lack of time, knowledge and confidence for providing an intervention.

**Methods:** Seven face-to-face interactive workshops were conducted in 7 urban cities in Canada. Dentists, dental hygienists and assistants participated. Workshop

content included an overview of motivational interviewing, identification of Stages of Change, basic facts about pharmacotherapy and nicotine replacement therapies and 2 video vignettes of tobacco users discussing their quit attempts. Evaluation included pre and immediate post-workshop surveys, a 3 week post-workshop telephone interview and a 3 month post-workshop mailed survey. Surveys questions were formatted using 5-point Likert responses and written feedback.

**Results:** Numerical data from the 3 written surveys was entered using SPSS. Written responses were grouped according to specific themes. Data analysis is ongoing but preliminary analysis on 5 components has displayed similar trends. Each of the 5 components for the clinician's knowledge, motivation, skills, importance of providing an intervention and availability of time to complete an intervention show an increase immediately following the workshop compared to pre workshop responses. However, this decreases at 3 months post-workshop training.

**Conclusion:** Preliminary analysis supports that the interactive workshop was successful in immediately increasing desired practices regarding tobacco cessation interventions by oral health care professionals. However, the level decreased at 3 months, and further training or other resources may be needed to maintain implementation.

**Funding:** Funding for this project provided by Alberta Alcohol and Drug Abuse Commission.

## Comparison Of 1-Year And 2-Year Degree Completion Students

*\* Bonnie J. Craig, Dip DH, MEd, RDH; Susanne Sunell, EdD, RDH*

*Faculty of Dentistry, University of British Columbia*

**Purpose:** To compare the academic success of 1 and 2 year dental hygiene degree completion students at the University of British Columbia (UBC).

**Problem Statement:** The UBC Dental Hygiene Degree Program enables graduates with 2 and 3 years of post-secondary education to earn a 4 year degree by building onto their diploma-level education. It was important to explore the outcomes of these 2 options within the program.

**Methods:** The admissions and academic progress records of students from 1992 to 2008 (n=93) were analyzed to determine whether demographic variables were determinants of academic success. The analysis was based on graduating GPAs and was related to learners'

continuation to graduate education. T-tests and ANOVAs were conducted to assess differences between students who required 1 and 2 years of academic work to complete the program.

**Results:** Data revealed that students are distributed across Canada but concentrated in British Columbia and Ontario. No statistically significant differences were found in the students who entered the third and fourth year with respect to the length of previous diploma education, years of practice experience, province of education and diploma GPA. To date, 25% of graduates have completed or are in a graduate program. Students who entered at the fourth year were more likely to pursue graduate studies than those who entered at 3rd year.

**Conclusions:** The lack of difference in GPAs between groups upon graduation suggests that the third year of the degree program adequately compensates for any differences in dental hygiene background. On-going research is necessary to determine if this trend continues with the on-line approach introduced in 2006. Further investigation is also warranted to further explore the variables influencing the pathways to graduate education.

## Assessing Where And How Dental Hygiene Students Apply Women's Health Knowledge

*\*Joan C. Gibson-Howell, RDH, EdD*

*The Ohio State University College of Dentistry,  
Division of Dental Hygiene*

**Purpose:** These studies were to investigate the settings and methods dental hygiene students apply knowledge about women's health learned in school and investigate if there is a significant difference based on program degree.

**Problem Statement:** Many women live in settings that prohibit access to oral health care and wellness. Having dental hygiene students provide oral health care education and services to women in alternative living situations promotes students' "experiential learning" and enhances self-confidence.

**Methods:** Dental hygiene directors were surveyed in 2001 and 2007, and were asked what settings and methods students experienced to apply women's general and oral health knowledge. The response rate was 62.1% (159 out of 256) for 2001 and 25.34 % (73 out of 288) for 2007. The Over Dispersed Poisson regression and Fisher's exact test were used to analyze the data with JMP.

**Results:** Both surveys identified that students most commonly applied women's health knowledge in dental hygiene clinics, community/public health clinics and nursing homes. Other sites were hospitals, public/private schools, domestic violence shelters, penal institutions and rehabilitation centers. The most common methods of applying knowledge were research projects, course work with dental students and community based research. Other methods included interdisciplinary work with medical, nursing or allied health professionals, treating patients in clinic and schools. No statistically significant relationship was identified based on program degree.

**Conclusions:** It was identified that the most commonly applied setting and method was the dental hygiene clinics and research projects and, although it is evident that students are working with women in alternative living situations, there are different settings and methods that may be considered. It is important that dental hygiene students and professionals learn women's general and oral health issues and use this information to improve women's access to health care in order to comprehensively treat females throughout life.

## Implementation Of A Tobacco Use Intervention (TUI) Program Into Clinical Dental Hygiene Education

*\*Barbara D. Strecker, RDH, MS, UTHSCSA;  
Renee Cornett, RDH, MBA  
Austin Community College  
Mary E. Jacks, RDH, MS  
University of Texas Health Science Center at San Antonio*

**Purpose:** A simplified tobacco use intervention (TUI) program was tested to determine if students can learn to address tobacco use and non-use with patients. This involves brief cessation intervention with users and health promotion with non-users. The program's effects on students' comfort, confidence and intentions to continue providing TUI in their future clinical practice were evaluated.

**Problem Statement:** Educational institutions need curriculum components to prepare health care graduates with knowledge, skills and attitudes to effectively counsel tobacco-using patients. Tobacco use is the number one preventable cause of disease and premature death in the U.S. This includes both oral and systemic diseases.

**Methods:** This program focused on simplified, brief interventions with tobacco users (such as "Ask," "Advise"

and "Refer" to cessation professionals), rather than on complex cessation counseling and pharmacotherapy. It also emphasized health promotion with non-users. A pretest/post-test survey used 14 questions with a convenience sample of 16 second year students with a 100% response rate.

**Results:** Contingency tables demonstrated increased TUI health promotion with non-users and brief cessation counseling with tobacco-users, while complex cessation counseling decreased. Reports of comfort and confidence in providing TUI were stable or slightly increased. Students reported intentions to consider, plan or provide TUI to at least 75% of their future patients. SPSS sign tests did not demonstrate statistical significance, most likely due to small sample size. Responses to 3 questions, addressing asking about tobacco use and time spent talking about tobacco, approached significance at .065 to .180. Eleven items had significance levels  $>.280$ .

**Conclusions:** This early study of the clinical TUI program indicated that it may have supported students' learning and provision of TUI for every patient. Simplified TUI programs during the formative education of dental hygienists may support their integration of TUI into the process of care that they provide with ease and consistency for their future patients.

## Professional Education And Development – New Program

### An Experiential Learning Model For Teaching Social Advocacy Education

*\*Eunice M. Edgington, RDH, BScD Med; \*Janice FL. Pimlott, RDH, BScD, MSc  
University of Alberta*

**Purpose/Goals:** Growing oral health disparities in vulnerable populations and increasing inequities in access to oral health care services are driving the need for change in oral health policy. In response the Dental Hygiene Degree Program at the University of Alberta provides an innovative curriculum to prepare graduates for the role of social advocate.

**Significance:** Education socializes dental hygienists for future role of advocate.

**Approach/Key Features:** This course simulates a realistic advocacy planning initiative where the class determines the advocacy issue. Each student participates in 1 of several advocacy planning committees: political action,

coalitions, message, communication and issues. Community experts act as mentors to guide students through coordinated activities specific to the individual committee responsibilities. Students work collaboratively with a high degree of communication to coordinate and synthesize their collective work toward the common advocacy goal. An experiential learning model based on concrete knowledge, reflection and active application is designed to move students' from passive dependent learners to motivated, autonomous and self-directed learners. Using this pedagogical approach, the course content not only encompasses the theory of advocacy planning and health policy development, it also leads students to a broader range of skills, including problem solving, critical thinking, negotiation, facilitation and team development.

**Evaluation:** Pre and post test survey results showed that by participating in this course students gained a greater understanding of the advocacy planning components and process, an increased belief that they can contribute to oral health policy change and greater confidence and willingness to be involved in future advocacy initiatives.

## Clinical Dental Hygiene Care – Original Research

### How Impactful Are Your Recommendations?

*\* Wendy Bebey, RDH, BS; Sharon Efron, RDH, BS  
The Procter & Gamble Company*

**Purpose:** To understand the effectiveness of dental professional manual toothbrush recommendations to their patients.

**Problem Statement:** Patients frequently look to the dental team to provide them with understanding about their unique dental health needs. The ability to effectively communicate evidence-based clinical recommendations is critical to the success of promoting a healthy lifestyle and preventing disease in patients.

**Methods:** The U.S. Nielsen Household Panel (HHP) Recommendation Analysis 2007–08 and the U.S. Usage and Recommendation Study 2008 were utilized to compare the recommendation habits and recall between dental professionals and patients. The HHP survey was fielded to 53,000 representative sample online and non-online households. Overall, 55,958 members from 38,428 households responded to the survey. The purchase data reflects consumer purchases from February 2007 through February 2008. The professional phone survey was taken from a nationally representative ran-

dom sample of 200 dentists and 150 dental hygienists, geographically balanced by U.S. Census divisions.

**Results:** The HHP survey indicated that 63.6% of respondents went to the dentist within the previous 12 months. Forty-seven percent of the recommendations that patients remembered came from a dental hygienist and 20.1% from both the dentist and the dental hygienist. Of those receiving a recommendation, 93% received a free toothbrush sample when they visited the office. Interestingly, only 47% recall receiving a recommendation for a toothbrush. Sixty-four percent of dental professionals believed they gave their patients a branded manual toothbrush recommendation but only 18% of patients recall being instructed that a certain brand of toothbrush is preferred.

**Conclusions:** The survey confirms that the majority of recommendations that patients remember come from their dental hygienist. While the data presented pertains to manual toothbrushes it has broader implications on the role of the dental hygienist in closing the gap between intended and recalled recommendations, especially when evidence-based treatment decisions are being communicated to patients. Funding for this study was provided by The Procter & Gamble Company.

### Oral Malodor –Comparison Of Subjective And Objective Measurements

*\* Rebecca VanHorn, RDH, BA; Beth Jordan, RDH, BS  
The Procter & Gamble Company*

**Purpose:** To understand the strength of the relationship between subjective organoleptic and objective instrumental measures of oral malodor.

**Problem Statement:** While second-person grading is often considered the “gold standard” method for measuring oral malodor, it is highly subjective, making evaluation of available literature problematic. The addition of objective measurements of oral malodor should allow for more systematic interpretation of product efficacy.

**Methods:** This randomized and controlled crossover clinical trial compared the breath protection effectiveness of 0.454% stabilized stannous fluoride (SnF<sub>2</sub>) dentifrice to a 0.243% sodium fluoride (NaF) negative control dentifrice over 24 hours in 29 healthy adults. Subjects brushed twice daily, with breath quality evaluated at 1.5, 3, 8 and 24 hours after initial dosing by monitoring of volatile sulfur compounds (VSCs) using a halimeter and

second-person organoleptic grading. A washout of 2 to 3 days followed between treatment periods. The natural logarithm of total VSCs measured by a halimeter and the organoleptic assessments by a panel of 4 judges was analyzed using analysis of covariance. Pearson correlation coefficients were computed separately at each time point to measure the strength of the relationship between the organoleptic scores and the VSC levels.

**Results:** The SnF2 dentifrice provided significantly superior reductions in VSCs relative to the NaF negative control when measured via a halimeter and odor-judges ( $p < 0.05$ ). The Pearson correlation coefficients between the organoleptic scores and the VSC levels across all study evaluation time points were positive, ranging from 0.59 to 0.77, with an overall correlation of 0.88.

**Conclusions:** The result of the positive correlation between the halimeter and organoleptic data generated in the trial confirms the relationship which exists between an objective method of breath evaluation versus the subjective second person breath perception. The objective VSC measures allow for reliable assessment of product efficacy, which may be easily translated to a clinical setting. Funding for this study was provided by The Procter & Gamble Company.

## Enamel Fluoride Uptake And Antimicrobial Effectiveness Of An Herbal Fluoride Mouth Rinse

*Carlos González-Cabezas, DDS, PhD  
Indiana University Oral Health Research Institute  
Anne D. Haffajee, BDS; Tina Yaskell, BS  
The Forsyth Institute  
\*Connie Gregson, MS  
Natural Dentist, Inc.*

**Purpose:** The objectives of the study were to determine the Enamel Fluoride Uptake (EFU) of The Natural Dentist Anticavity Fluoride Rinse (TND) and to determine its antimicrobial effectiveness as measured by its Minimum Inhibitory Concentration (MIC) against predominant oral pathogens.

**Problem Statement:** Natural oral health products are alternatives if they demonstrate comparable or greater effectiveness as compared to conventional products.

**Methods:** For the EFU, human enamel specimens were prepared. Each sample was demineralized and pre-treatment fluoride and calcium contents were measured. A caries-like lesion was formed in each specimen, and the specimens were treated with the assigned mouth rinse (TND, ACT or Phos-Flur). Post-treatment specimens

were demineralized and the resulting solutions were analyzed for fluoride and calcium. For the MIC, an agar dilution method was used to test the agents against 44 oral bacteria. Serial dilutions of TND and Listerine were prepared. The media and the test agents were prepared into petri plates and inoculated with the cultured bacterial species. The MIC was interpreted as the lowest concentration of the agent that inhibited the growth of the test species.

**Results:** Fluoride uptake was calculated by subtracting the pre-treatment level of fluoride from the post-treatment level. A 1-way analysis of variance model indicated significantly greater EFU with TND and Phos-Flur as compared to ACT ( $p < 0.05$ ). Regarding the MIC, TND inhibited the growth of all 44 bacterial species tested. For several oral pathogens, TND had significantly lower MICs in comparison to Listerine.

**Conclusions:** The data from these in vitro studies indicate effectiveness with TND Anticavity Fluoride Rinse in terms of fluoride uptake and antimicrobial activity. Funding for this project supported by Natural Dentist, Inc.

## Dental Hygienists' Social Sensitivity Regarding Access To Dental Care Issues For The Underserved Population

*\*Lynn A. Marsh RDH, BSDH, MS  
Farmingdale State College*

**Purpose:** This research project investigated the perception of dental hygienists' regarding the access to care issues and solutions of children and the aging population.

**Problem Statement:** Dental care is critical to the overall health and well-being for the population. The demand for dental services among the elderly to preserve their natural teeth has continued to increase, despite this population facing a limited income.

Children are included in the underserved population as the number of children without dental care available to them continues to grow. Barriers to care must be overcome to assist the underserved population receive dental treatment.

**Methods:** Seven dental hygienists participated in this study through qualitative face-to-face, 1-on-1 interviews with open ended questions. The randomly chosen participants included registered dental hygienists, dental hygiene educators, government employed dental hygienists and dental hygienists within the state association. Responses were coded for key words in context, ideas and concepts.

**Results:** The average of the participants practicing dental hygiene was 20.5 years. Each participant indicated that some type of service should be provided for the underserved population. Four participants responded that dental schools and public services should be responsible for the underserved population. Three participants responded that dental health professionals should volunteer time to provide care to the underserved population. Only one participant felt there was a social responsibility for oral health care professionals to provide care for the underserved population. The goal of all participants was to help people attain optimum oral health which in turn aids in optimum overall health.

**Conclusions:** The perception of participants in this research study was that of placing the responsibility of the underserved population on dental schools and public services for treatment rather than on dental hygienists. Additional research is necessary to add validity to this study.

## Bisphenol A Blood And Saliva Levels Prior To And After Dental Sealant Placement In Adults

Joyce M. Downs, RDH, MS; \*Deanne Shuman, BSDH, MS, PhD; Robert Ratzlaff, PhD (School of Life Sciences); Sharon Stull, BSDH, MS  
College of Health Sciences, School of Dental Hygiene, Old Dominion University

**Purpose:** The purpose of this study is to examine the presence of bisphenol A (BPA) in saliva and blood after placement of pit and fissure sealants in adults.

**Problem Statement:** Sealants are formed by reacting glycidyl methacrylate with BPA. BPA is a hormonally active, synthetic chemical that is part of a broad group of chemicals known as endocrine disrupting compounds, xenoestrogen, which mimic bioactivity of estrogen. Laboratory studies using rodents with BPA exposure as low as 2.5ug/kg body weight/day reveal increased fertility and mammary and prostate cancer. BPA leaches from a dental sealant if not completely polymerized and is released into the oral cavity as a degradation product.

**Methods:** Subjects were 30 adults, 18 to 40 years of age, of mixed gender and ethnicity. IRB approval (#05-070) was granted prior to study initiation. BPA was measured using a direct-competitive Enzyme Linked ImmunoSorbent Assay. Differences in BPA comparing low-dose (1 sealant) and high-dose (4 sealants) groups were examined at 1 hour prior, 1 hour post, 3 hours post and 24 hours after sealant placement using saliva samples. Blood

samples were collected 1 hour prior and 1 hour post sealant placement. Data was analyzed using a parametric, 2-way analysis of variance for repeated measures, 0.05 alpha level.

**Results and Conclusions:** BPA was detected in saliva of all subjects prior to sealant placement and ranged from 0.07–6.00 ng/ml. Salivary BPA levels peaked at the 3 hour period following placement and returned to baseline levels within 24 hours. BPA was significantly elevated at all post sealant placement time periods for both low-dose and high-dose sealants groups, with peak levels of 3.98 ng/ml and 9.08 ng/ml, respectively. BPA was not detected in serum samples after sealant placement. Detectable BPA concentrations at baseline signify exposure to BPA from sources other than sealants. Results from this study will assist practitioners in product selection and usage protocol. Funding for this project was obtained from the American Dental Hygienists' Association Institute for Oral Health.

## References

1. Downs J., Shuman D., Stull S, Ratzlaff, R. Bisphenol A Blood and Saliva Levels Prior to and After Dental Sealant Placement in Adults. Abstract. Journal of Dental Hygiene, 2007;Oct(4):108.

## Comparison Of A Novel Interdental Brush To Dental Floss For Reduction Of Plaque And Bleeding In Sites Of Intact Interdental Papillae: A Randomized Controlled Clinical Trial

\*Pauline H Imai, CDA, Dip DH, BDSc (DH), MSc (DSc), RDH, Clinical Assistant Professor; Penny Hatzimanolakis, Dip DH, BDSc (DH), MSc (DSc), RDH, RDH, Clinical Instructor, Faculty of Dentistry University of British Columbia  
Bill Mercer, PhD, Statistician  
Director, Projects Applied Research & Evaluation & Evaluation Services, University of British Columbia

**Purpose:** To compare the efficacy of interdental brush to dental floss for interproximal plaque and bleeding reduction in subjects with intact interdental papillae.

**Problem statement:** Periodontal disease is prevalent interproximally, yet compliance with dental floss is low because of lack of ability and motivation. The interdental brush is an easy to use, self-care aid, but is it effective for treating early disease when the papilla is intact?

**Methods:** Examiner-blinded, split-mouth, 3 month, randomized controlled trial comparing interdental brush to positive control and dental floss on premolars and molars in 32 healthy adults with intact, but bleeding interdental papillae. Silness and L  e plaque and Eastman bleeding indices conducted at weeks 0, 6 and 12. Subjects received nonsurgical debridement 2 weeks prior to baseline. Interdental brush size determined with Curaprox color coordinated probe. OHI at Weeks 0 and 6, modified Bass twice a day, flossing once a day and interdental brush inserted in/out once a day. All oral health products controlled. Subjects complete a 4-item questionnaire at week 12 to compare products ease of use, preference and provide comments.

**Preliminary Clinical Results:** One-way ANOVA. Statistical unit: interproximal site. The interdental brush and floss were not statistically different for plaque and bleeding scores at week 0 ( $n = 240$  sites,  $p = 0.262$ ;  $n = 240$  sites,  $p = 0.243$  respectively), week 6 ( $n = 162$  sites,  $p = 0.739$ ;  $n = 160$  sites,  $p = 0.062$  respectively) and at week 12 ( $n = 85$  sites,  $p = 0.876$ ;  $n = 86$  sites,  $p = 0.215$  respectively) with alpha at 0.05,  $df = 1$ .

**Conclusion:** Preliminary clinical results indicate that the interdental brush removes interproximal plaque and reduces bleeding as well as dental floss in subjects with intact interdental papillae. Subjects' qualitative feedback for the interdental aids will be determined at study completion. Study has received ethical approval from UBC Clinical Ethics Research Board (#H08-01078). Funding for this project was obtained through CFDRH, BCD-HA, Enterprise Dentalink Inc. (Curaprox Swiss) and the Faculty of Dentistry, UBC.

## Perceptions Of Individuals Who Frequently Vs. Occasionally Whiten Their Teeth

*Terri S.I. Tilliss, RDH, PhD; Kari Amick, DMD  
Department of Dental Hygiene, University of  
Colorado School of Dental Medicine*

**Purpose:** The objective of this study was to compare perceptions of a group who frequently whiten (FWG) their teeth to achieve the whitest shade possible, with a group who are satisfied with occasional whitening (OWG).

**Problem Statement:** There is not enough dialogue between patients and practitioners concerning expectations of whitening outcomes. Practitioners need to initiate this dialogue so that consensus on color shade can be reached.

**Methods:** Twenty individuals in each group were re-

cruited through e-mail from faculty, students and staff of a large university health sciences campus. Inclusion criteria for both groups included age 18 to 60, self-reported history of whitening and no history of dental industry employment for self/family. Inclusion in FWG also required a history of frequent whitening and teeth matching 1 of the initial 4 shades of the VITA Bleachedguide 3D-Master. A 30 minute, 2-part oral interview was conducted with all subjects, which consisted of a 43-item questionnaire exploring perceived values and attitudes about teeth and a photographic survey of 22 digitally retouched stock photographs depicting 11 individuals with both a lighter and darker dentition shade. Subjects were asked to estimate the age of the individual pictured, to evaluate the appropriateness of tooth color and to explain their answers. Responses were tallied and constant comparative analysis utilized for qualitative data.

**Results:** FWG is somewhat more likely than OWG to evaluate age as younger when teeth are lighter. Also, FWG is more likely to feel that brighter teeth are "just right" and darker teeth "too dark." OWG is somewhat more likely to assess that brighter teeth are "too light" than FWG. When asked what the appearance of one's teeth communicates to others, the most frequent answer from both groups was "overall health and well-being."

**Conclusion:** Differences in perceptions between individuals with varying whitening expectations can guide oral health care providers during consultation. Use of serially whitened photographs, such as those utilized in this study, can assist practitioners in initiating the necessary dialogue for reaching consensus on whitening expectations.

## Role Of Oral/Dental Procedures In Causing Infections Associated With Vascular Access Devices In Hemodialysis Patients

*\*Sandra D'Amato-Palumbo, RDH, MPS; 1 Andre Kaplan, MD; 2 Rajesh V. Lalla, DDS, PhD, CCRP1  
1 Department of Oral Health and Diagnostic Sciences and 2 Department of Nephrology,  
University of Connecticut Health Center*

**Purpose:** To identify the specific microorganisms responsible for infection associated with vascular access in patients undergoing hemodialysis; to determine the potential role of oral/dental procedures in causing infection associated with vascular access in these patients.

**Problem Statement:** Each year, approximately 40% of hemodialysis patients have an infection related to the dialysis access site, leading to significant morbidity. Conse-

quently, physicians or dentists often prescribe prophylactic antibiotics to prevent vascular access infection (VAI) in patients on hemodialysis undergoing invasive dental treatment. However, there is no evidence that dental procedures lead to VAI. Further, antibiotic prophylaxis may lead to allergic reactions, emergence of resistant species and increased health care costs. There is a pressing need for collecting additional data on whether oral microorganisms can lead to infections associated with vascular access in hemodialysis patients.

**Methods:** This IRB-approved retrospective study was conducted using an electronic medical record system. VAI data was collected on 218 patients receiving hemodialysis for various periods between Jan. 1, 1999 and Feb. 27, 2009. Diagnosis of VAI was confirmed by review of clinical notes and laboratory testing. A range of culture results were collected from blood, urine, sputum, catheter tips, fistula and/or graft sites. Specific microorganisms identified in association with each infection were recorded. Data was recorded and analyzed in an Excel database.

**Results:** Of the 218 patients, 103 (47.25%) had at least 1 VAI associated with their hemodialysis. The predominant microorganisms associated with the VAIs were staphylococcus and enterobacter species. In very few cases, organisms indigenous to the oral cavity were associated with VAIs.

**Conclusions:** Results suggest that oral microorganisms are rarely associated with VAI. Thus, routine oral manipulation does not have a significant role in causing such infections. Further, the data suggests that routine antibiotic prophylaxis for dental procedures may not be necessary.

## Clinical Dental Hygiene Care – New Program

### A Simplified Table To Identify Pediatric Dental Clients Needing Further Evaluation Of Blood Pressure

*\*Frieda A. Pickett, RDH, MS*

*Former Associate Professor, Caruth School of Dental Hygiene, Baylor College of Dentistry  
David C. Kaelber, MD, PhD, MPH  
School of Medicine, Case Western Reserve University*

**Purpose/Goals:** To create a tool to easily identify pediatric clients with elevated blood pressure (BP) who need referral for medical evaluation of BP.

**Significance:** In 2004, new guidelines (Fourth Report) were published regarding the diagnosis, evaluation and treatment of high blood pressure in children and adolescents. The guidelines recommend screening BP from ages 3 to 18 to be taken at all visits for health care, including dental appointments. The charts within the guidelines require distinguishing between 7 height percentiles to identify elevated BP. Seventy-four percent of pediatric hypertension is undiagnosed. Hypertension in childhood can lead to cardiovascular disease in adulthood. Providers cannot easily determine elevated values based on height percentiles. Tools and strategies need to be developed to aid health care practitioners in detecting pediatric clients who have BP above the normal limits.

**Approach/Key Features:** A simplified abnormal BP table to identify children and adolescents who need further medical evaluation of BP was developed. This table relies only on knowledge of the gender and age and is based on the Fourth Report. The simplification is done by taking the lower limit of the abnormal BP for a given gender and age, regardless of height, resulting in a single systolic and diastolic blood pressure. Any BP reading greater than or equal to the chart values are prehypertensive or hypertensive and should be medically evaluated. This table provides an opportunity to screen pediatric patients for elevated BP when a height measurement is not available.

**Evaluation:** This approach provides a simplified table for screening BP, with 100% sensitivity for identifying abnormal pediatric values. While 100% sensitive, this approach will produce some false positive results in children within the tallest height percentile. However, given the significant under-diagnosis of pediatric hypertension and the potential effects on cardiovascular health from chronic hypertension, we feel this is a positive trade off. No funding for this project was received.

## Technology – Original Research

### Course Management Systems: Implications For Hybrid Course Development

*Maureen Tsokris RDH, MPS; \*Maureen Capone RDH, MS*

*Farmingdale State College*

*Helen C. Wittmann, EdD; Elsa-Sofia Morote, EdD  
Dowling College*

**Purpose:** The purpose of this study was to examine whether faculty conceptions or misconceptions regarding the use of hybrid instruction differ between faculty

teaching in traditional classroom settings who utilize course management systems (CMS) and faculty teaching in traditional classroom settings who do not utilize CMS. In addition, this study examines whether faculty who are utilizing a CMS are more willing/and or likely to develop a hybrid course.

**Statement of the Problem:** Faculty misconceptions regarding hybrid instruction may prevent educators from utilizing new technologies in course development.

**Methods:** One-hundred and twenty-nine faculty at 4 independent institutions of higher education in New York State responded to an on-line survey. In addition to basic demographic information, the survey contained 14 conceptual questions regarding hybrid learning, which required either a true, false or no basis for knowing response. Ninety of the respondents taught in a traditional classroom setting. Forty-nine of those were teaching in traditional classroom settings utilized Course Management Systems.

**Results:** Data from this survey was analyzed by performing independent samples t-test, frequencies and cross tabulation. Data analysis indicated faculty who teach in traditional classroom settings utilizing CMS have less misconceptions in regard to hybrid learning than faculty who teach in traditional classroom settings who do not utilize CMS. More specifically, 53% of faculty who utilized a CMS responded correctly to the statement “teacher student interaction is difficult when using hybrid learning technology to deliver instruction,” as compared to only 29.3% correct responses by those who do not use a CMS. Similarly, in response to the statement “cheating in a hybrid course is a common threat to the quality of hybrid courses,” 29% of those who use a CMS answered incorrectly while 46% of those who do not use a CMS answered incorrectly. Eighty-nine percent of faculty who were utilizing a CMS responded positively to the question “In the future would you use hybrid learning to deliver instruction?”

**Conclusions:** Results of this study suggest institutions of higher learning should encourage faculty to utilize CMS as a transition to distance education. In addition, faculty development workshops designed to address the common misconceptions held by faculty in regard to hybrid learning may encourage more faculty to participate in this method of delivering course instruction.

## Clinical Assessment Of Remineralization From Fluoride Varnish Treatments

George K. Stookey, PhD; \*Amy J. Nuñez, LDH, BS; Maki Minami DDS, PhD; Jun Ge, PhD; Denise A. Allen, LDH, BS  
Therametric Technologies, Inc.  
Roger L. Issaacs, DDS  
Oral Health Research Institute

**Purpose:** The purpose of this study was to determine the ability of a new fluorescence assessment instrument to detect the effect of a fluoride varnish on white spot lesions in a small group of children within a 6 month period.

**Problem Statement:** Traditional methods for detecting caries (visual, tactile and radiographic) cannot detect the early, non-cavitated stages of development. Once cavitation has been identified, lesion reversal is impossible. Consequently, there is a need to detect early stages of demineralization, because non-cavitated lesions are completely reversible.

**Methods:** Forty-eight children ages 7 to 17 participated in this study. All participants had 2 white spot lesions. Subjects were stratified by age and gender, and were randomly assigned to 2 groups that received a series of 4 weekly applications of either a fluoride or placebo varnish. The white spot lesions were examined clinically at baseline, 3 weeks, 3 and 6 months using ICDAS criteria and fluorescence measurements with QLF and an early prototype of a new instrument, FluoreCam. Change from baseline was calculated for each of the outcomes measured using the analysis of variance (ANOVA) model. Treatment comparisons were conducted by modeling these changes with a linear model including fixed effects for treatment, month and treatment-by-month interaction.

**Results:** None of the examination methods detected significant differences between groups in changes from baseline prior to 6 months. At 6 months, the results from ICDAS and QLF exams showed non-significant directional differences. However, a statistically significant difference ( $p < .05$ ) occurred between the fluoride group showing remineralization ( $-6.3$ ) and the placebo group showing demineralization ( $+30.9$ ) where  $p = 0.0498$ .

**Conclusions:** The use of the FluoreCam instrument permitted the detection of the ability of a fluoride varnish to remineralize incipient carious lesions in a small group of children within a 6 month test period. This investigation was funded by the NIH/NIDCR.

## An Analysis Of Student Performance Benchmarks In Dental Hygiene Via Distance Education

*\*Jodi L. Olmsted, RDH, PhD  
University of Wisconsin, Stevens Point*

**Purpose:** Currently, 3 graduate, 35 undergraduate and 12 dental hygiene degree completion programs in the U.S. are using varying forms of distance learning (DL) for course offerings. A 10 year, longitudinal examination considered student performance differences in a distance education (DE) dental hygiene program. The purpose of this research was to determine if there were differences in performance between learners taught in a traditional classroom compared to their counterparts taking classes through an alternative delivery system.

**Problem:** Relying heavily on DL for offering educational programs leaves an unanswered question: Is learner performance on standardized benchmark assessments impacted when using technology as a delivery system?

**Methods:** A longitudinal, ex post facto design was used. Two-hundred and sixty-six subject records were examined. Seventy-seven individuals were lost through attrition. One-hundred and eighty-nine records were used as the study sample. One-hundred and seventeen individuals were located face-to-face while 72 were at a distance. Independent variables include time and location, while dependent variables include course grades, grade point averages (GPAs) and the National Board of Dental Hygiene Examination (NBDHE). Three research questions were asked: 1) Were there statistically significant differences in learner performance on the National Board of Dental Hygiene Examination (NBDHE)? 2) Were there statistically significant differences in learner performance when considering GPAs? 3) Did statistically significant differences in performance exist relating to individual course grades? T-tests were used for data analysis in answering the research questions.

**Results:** From a cumulative perspective, no statistically significant differences were apparent for the NBDHE and GPAs. From a cumulative perspective, similar results were found for individual courses.

**Conclusion:** Interactive Television (ITV), the DL system examined, was considered effective for delivering education to learners if similar performance outcomes were the evaluation criteria.

## Technology – New Programs

### Gingivitis – Objective Measurement Utilizing Digital Imaging

*\*Patricia A. Walters, RDH, MS; Matthew Barker, PhD; Robert Gerlach, DDS, MPH  
The Procter & Gamble Company*

**Purpose:** This is an overview of a novel measurement instrument for assessing gingivitis with the potential to replace subjective examiner grading with objective grading. A clinical validation program was designed to quantify sources of variability and population definition pertinent to sample size determination and study design. Measurement validity in 3 critical areas was examined: natural disease history, active versus placebo and dose sensitivity. The use of a validated objective clinical measurement tool measuring gingivitis should be considered by dental hygienists when making evidence based decisions regarding product and treatment recommendations.

**Significance:** The Löe–Silness Gingivitis Index is the gold standard measurement for gingivitis clinical trials and the 1961 publication is the most cited paper in dentistry. Clinical trials using examiner grading are time consuming, expensive and unpredictable. Gingivitis image analysis utilizes a high-resolution camera for image capture and focuses on the facial surfaces of the 12 anterior teeth. The gingival color change is captured by assessing the red–green–blue quantification during analysis. The final data point reflects the change in color before and after intervention.

**Key Features:** Pictorial display of images from the natural history and active versus placebo validation exercises will demonstrate the usefulness of the objective measurement tool in research. Limitations concerning this measurement tool will be presented so the clinician can judge the usefulness of the data in subjects with gingivitis when critiquing the literature.

**Evaluation:** Gingivitis image analysis has been shown to correlate with the Gingival Index commonly used in research. In addition, large scale clinical testing confirms the usefulness of this measurement tool. The method is highly sensitive and the analysis has good discrimination power. The method allows for visual presentation of the data and, when used in clinical research, the cost and time is significantly reduced. Funding of this program was provided by The Procter & Gamble Company.

## Objective Grading Of Tooth Color Change

*\*Mary Lontchar, RDH, MA; Patricia Walters, RDH, MS*

*The Procter & Gamble Company*

**Purpose:** This is an overview of a novel tooth color measurement system that has been validated both clinically and instrumentally. The measurement system allows for more expedient testing of products that can be used in patients with intrinsically stained teeth. The system effectively measures both mild and severe stain, including fluorosis and tetracycline stain.

**Significance:** Application of digital imaging has been extensively reported in the literature for the measurement of tooth color. Digital imaging provides the lowest variability and is most sensitive to tooth color changes. The system conforms to an ASTM (American Society for Testing and Materials) standard.

**Key Features:** The images are obtained by a high-resolution digital camera and fixed lighting conditions. From each image a Munsell calibration standard L\*, a\* and b\* value is determined separately for each tooth and is defined as overall color change relative to white. Pictorial display of images before and after use of a whitening product demonstrates the usefulness of the objective measurement tool.

**Evaluation:** Digital Imaging is an objective method for assessing tooth color changes. The method allows for visual presentation of the data, research is quick and inexpensive to execute. The method has shown it is reproducible and repeatable from study to study and between research sites. The points of difference between subjective and objective grading are issues that the dental hygienist would consider when critically analyzing the literature and making evidence based decisions related to product and treatment recommendations. Funding for this project was supported by The Procter & Gamble Company.

## Objective Grading Of Plaque – Digital Image Analysis

*\*Lois Rigmont Barber, RDH, BSEd; Patricia Walters RDH, MS*

*The Procter & Gamble Company*

**Purpose:** This is a presentation of a novel plaque measurement tool which dimensions how a 32 site partial mouth plaque grading can replace the conventional 168 site whole mouth plaque grading routinely used in dental

research. The testing of products using the plaque measurement tool will enable the development of clinically meaningful technologies in a more efficient and less costly research program.

**Significance:** As an objective measure, digital plaque imaging analysis is used to assess plaque coverage before and after product use. A dental hygiene clinician will be able to use data generated from this objective measurement tool to make sound decisions before recommending products and determining treatment plans for their patients.

**Key Features:** The method involves plaque disclosure with a fluorescein dye followed by a digital image. Using UV illumination with standardized lighting conditions, the anterior facial tooth surface images are analyzed for total pixel area of teeth and plaque coverage. Pictorial display of images before and after tooth brushing and mouth rinse use, as well as data from a large cross-sectional study showing partial mouth plaque measurement compared to whole mouth plaque scores, will demonstrate the usefulness of the objective measurement tool.

**Evaluation:** Digital plaque imaging is an objective method for assessing plaque coverage. The method is highly sensitive and the analysis has good discrimination power. The method allows for visual presentation of the data, and the execution of the research is both efficient and less costly. The method has shown it is ideal for repeated measures and is reproducible and repeatable from study to study and between research sites. Funding for this project was supported by The Procter & Gamble Company.

## Translational Research In Oral Cancer – Original Research

### Pre-clinical Evaluation Of Genistein And Biochanin A Inhibition Of Fak In Oral Squamous Cell Carcinoma Cell Lines

*\* Tara L. Johnson, RDH, PhD*

*Department of Dental Hygiene, Kasiska College of Health Professions, Idaho State University  
Maria B. Lai; Alok Bhushan, PhD; James C.K. Lai, PhD*

*Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy and Biomedical Research Institute, Idaho State University*

**Purpose:** The focal adhesion kinase (FAK) is an intracellular tyrosine kinase associated with the regulation of cell growth, migration and survival, and has been linked

to oral squamous cell carcinoma (OSCC). The purpose of the current study was to determine the effects of isoflavones on proliferation, invasion and decreases in expression of the FAK protein.

**Problem Statement:** The survival rate for patients with OSCC remains poor, despite advances in diagnosis and treatment. OSCC usually develops in areas of the epithelium exposed to carcinogens and likely results from the accumulation of genetic alterations, which lead to aberrant expression of many proteins involved in cell growth regulation. Molecular inhibition of 1 or several of these proteins may impede or delay the development of cancer.

**Methods:** We examined the effects of 2 isoflavones, namely genistein and biochanin A, on proliferation, inhibition of FAK and invasion in 2 human OSCC cell lines by MTT assay, Western blot analysis and invasion assay. The significance of differences between the control and treatment values will be determined by ANOVA followed by the post hoc Tukey test using KaleidaGraph (Synergy Software for Windows and Macintosh, Reading, PA).

**Results:** Preliminary results show that treatment with genistein and biochanin A induced decreases in survival of both OSCC cell lines in a dose-dependent manner. Both isoflavones caused decreases in protein expression of FAK and inhibition of invasion in a dose-related way.

**Conclusions:** Genistein and biochanin A have both anti-proliferative and anti-invasive effects in OSCC cell lines. These findings suggest that inhibition of FAK might be a novel treatment or preventive strategy in OSCC.

## Clinical Research/Behavioral Science – Original Research

### Participation In Clinical Research: Understanding Motivation And Attitudes

\* Karen B. Williams RDH, MS, PhD; Lynn R.

Friesen DDS, MS

University of Missouri–Kansas City School of Dentistry

**Purpose:** Understanding subjects' relative attitudes and motivation for participating in clinical trials may assist researchers in subject recruitment and retention activities.

**Problem Statement:** Therefore, this study explored research subject attitudes, satisfaction with participation,

reason for participation in research and issues related to subjects' awareness of informed consent as a function of demographics in a population of individuals currently enrolled in a dental clinical trial at a Midwestern academic institution.

**Methods:** Participants were asked to complete a voluntary questionnaire to elicit their level of agreement with 40 statements. Items were measured using a 5-point Likert response scale. One-hundred and sixty-seven individuals completed the questionnaire out of the 180 total participants.

**Results:** Subjects were predominantly female (66%). Seventy-four percent of subjects ranged in age from 30 to 59. Fifty-nine percent self-identified as white, 25% as African-American, 8% Latino and 6% other. Principal components analysis with varimax rotation was used to explore the underlying factor structure of the 40 items. Eleven factors were identified (eigenvalues > 1.0) and explained 71% of item variance. Factors included: study satisfaction, fate, social norms, pain, purpose, negative effects, free dental care, informed consent/study knowledge, financial issues, autonomy, health worries and need for dental research. Mean subscale scores were computed for subsequent comparisons. Women were more likely to report they understood their consented rights ( $p = .005$ ) than men, and they worried less about their health ( $p = .024$ ). African-Americans were more likely to report that fate guided their health ( $p = .0001$ ), as well as to report negative social norms about participating in research ( $p = .005$ ). Additionally, middle aged adults (45 to 59) are less likely to participate because they needed the money compared to younger and older groups ( $p = .025$ ).

**Conclusions:** These results suggest that motivation for participating in research differs among demographic groups and should be considered in the conduct of clinical research.