Proceedings of the 3rd North American/Global Dental Hygiene Research Conference

October 16–19, 2014
Bethesda, Maryland, USA

OVERVIEW

The 3rd North American/Global Dental Hygiene Research Conference, "Beyond the Boundaries: Discovery, Innovation and Transformation," was held October 16–18, 2014, in Bethesda, Maryland. An additional half-day session was held on October 19 for educators, entitled "A Practical Guide to Incorporating Research & Evidence-Based Decision Making into the Dental Hygiene Curriculum." The conference provided an opportunity for dental hygiene researchers from the United States, Canada, Asia, Europe, and Australia to convene and explore commonalities in their research interests, learn from each other about new and ongoing research programs, and foster future collaborations. It was our hope that discussion and interest generated at the conference would provide the networking support and intellectual stimulation needed to systematically and purposefully move our research forward. To that end, the conference brought the international dental hygiene community together to:

- share new knowledge obtained through research investigations;
- explore how to translate research into practice in a meaningful and useful manner;
- disseminate new knowledge gained from research to support evidence-based practice;
- increase and diversify the number of individuals engaged in oral health research;
- build collegial relationships among oral health researchers and organizations representing academia, government, and industry;
- captivate, advance, and nurture a cadre of dental hygiene researchers;
- provide information about valid and useful research tools and resources;
- provide workshops for "hands-on" training in scientific writing, editorial review, searching for best evidence, and teaching research methods; and
- mentor student and novice investigators in preparation for careers in research.

In order to achieve these objectives, a program devoted to a wide range of topics was created. Senior scientists were invited to present their ideas and summaries of ongoing research related to tobacco addiction and treatment, and the role of the oral microbiome in oral cancer development. Distinguished dental hygiene scientists discussed the development of a scholarly identity and its relationship to advancing the profession. Invited researchers shared their work, including an examination of the relationship between preventive services and quality of care; how an interprofessional collaboration between nursing and dental hygiene improved health outcomes in patients in the ICU; and the impact of health literacy on health outcomes. Dental hygiene researchers from around the world presented their original work during both poster and oral scientific sessions in support of national and global oral health research agendas. This year, there were 42 poster and 33 oral presentations.

Finally, based on the outcomes of the second conference, which took place in October 2011, 7 different continuing education workshops were designed to enhance training and skill development on the following topics: using best evidence to enhance dental hygiene clinical decision making; overcoming the fear of statistics; millennials and dental education: using technology for effective teaching; getting your name in print; becoming an effective journal reviewer; navigating the IRB; and constructing and maintaining a usable dataset. Educators learned best practices for incorporating research and evidence-based decision making into the dental hygiene curriculum. More than 18 hours of continuing education credits were offered over the 3½ day conference.

This conference required more than 1 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 again partnering with the National Center for Dental Hygiene Research & Practice to invite dental hygienists from across the continent to participate in this event. We also thank the American Dental Education Association and the American Association for Dental Research for their support and participation. Eleven countries were represented at the conference; attendees came from 34 states in the United States; 6 Canadian provinces; 7 European countries; South Korea; and 2 of the 6 states of Australia. There were 41 international participants from outside of the

United States; 36 graduate dental hygiene students; 13 full-time dental hygiene clinical practitioners; 126 full- and part-time faculty from universities, dental schools, and community colleges; 3 practitioners from hospital settings; 9 representatives from health organizations; 15 professional association representatives; 7 journal editors; 30 dental hygienists and dentists representing various industries; 9 independent consultants; and 1 person representing the military.

We thank the members of our Advisory Board* for volunteering their time and talents, for facilitating workshops, and for moderating sessions during the meeting. We also thank our volunteers for managing the registration tables and the many companies who graciously donated copies of their research to share with all of the conference participants to further our knowledge and understanding of their products and services.

Most importantly, we extend our deepest and most heartfelt gratitude to our corporate sponsors: The Procter & Gamble Company, Colgate-Palmolive Company, Colgate Oral Pharmaceuticals, Philips, Johnson & Johnson, Sunstar, Dentsply, Waterpik, and Premier. This conference would not have been possible without educational grants from our corporate partners, and we thank them for their kindness and generosity.

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Dental hygiene's scholarly identity and roadblocks to achieving it

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Dental hygiene scholarship development exists on a continuum. At one end, scholarship begins in entry-level dental hygiene programs and then progresses to higher levels of scholarship in research-oriented master's degree programs and in research-oriented doctoral degree programs that require learners to conduct original independent research.[1] Although nursing, physical therapy, and audiology have developed doctoral programs to prepare graduates to engage in discipline-specific research,[2-4] to date there are no US dental hygiene doctoral programs.

The question needs to be asked: Why is dental hygiene so far behind other health professions in establishing doctoral programs to conduct rigorous discipline-specific research? Could it be that dental hygienists are not fully aware of the discipline's hierarchy of knowledge and of the importance of developing a scholarly identity related to it?[1] Could it be that there are maladaptive patterns of behaviour among dental hygienists that create roadblocks to moving the discipline forward, of which we are unconscious? And, if these threats are real, then what can be done to counteract them? The purpose of this paper is to challenge our thinking about these questions and to provide some essential information to consider in answering them. Specifically, this paper will discuss 1) the dental hygiene discipline's hierarchy of knowledge; 2) the dental hygiene scholarly identity and its importance to the discipline's advancement; 3) the "imposter" phenomenon[5,6] and the "queen bee" syndrome[7] as roadblocks that may jeopardize our discipline's ability to move forward; and 4) the role of "followership"[8] in diminishing these potential roadblocks.

The structural hierarchy of knowledge

A discipline's structural hierarchy of knowledge specifies its unique perspective and distinguishes one discipline from another. Its components consist of the discipline's definition, its paradigm concepts (which are the major concepts selected for study), global definitions of the paradigm concepts, and conceptual models that shape the direction and methods of the practitioners, educators, and researchers (Figure 1).[9-11] The dental hygiene discipline is defined as "the study of preventive oral healthcare including the management of behaviors to prevent oral disease and to promote health." This definition is unique because its focus is on oral disease prevention and health promotion *directed by the dental hygienist.*[9]

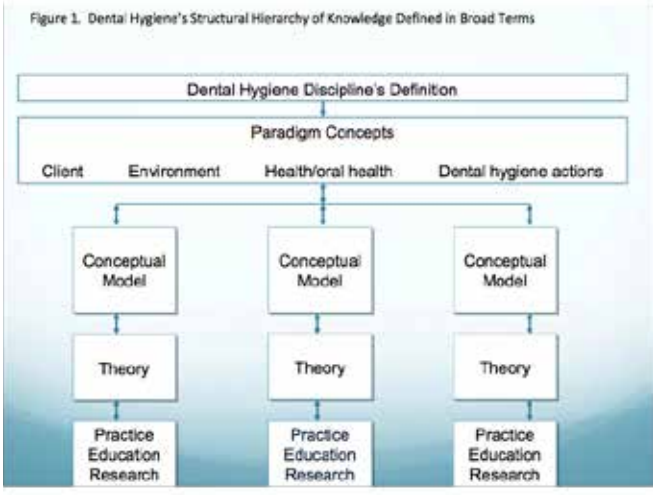
Dental hygiene's four paradigm concepts selected for study—the "client," the "environment," "health/oral health," and "dental hygiene actions"[12,13]—are defined very broadly to allow for the development of conceptual models that are defined by specific theories. For each conceptual model, related theories are tested by scholars who ascribe to a particular model. Findings contribute to the discipline's body of knowledge, providing evidence that influences dental hygiene practice, education, and research. To build the discipline's body of knowledge, dental hygiene graduate learners and established researchers need to develop and promote a dental hygiene "scholarly identity" in addition to mastering research-related competencies for the development of dental hygiene scientists.

The scholarly identity[1,14]

Dental hygiene researchers who have a scholarly identity are dental hygiene scientists who

- ask and answer research questions central to the discipline while reaching across disciplines;
- have a sense of the dental hygiene discipline as a whole;
- incorporate the norms and values of the practitioners into, and conceptualize theory central to the discipline for further knowledge development;
- have a life-long commitment to the development of the discipline's knowledge base;[1,2]

Figure 1. Dental Hygiene's Structural Hierarchy of Knowledge Defined in Broad Terms



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- welcome philosophical debate about the discipline;
- use evidence to support their viewpoint;
- report their results in the context of those of others in the field as well as those of other disciplines;
- disseminate the findings of their work through scientific publication;[1]
- have a dedicated and passionate commitment to how their science relates to the discipline's mission, its values, and its effects on humanity.

Equating the development of a scholarly identity only with research methods, statistics, and design courses in isolation from the context of the dental hygiene discipline constrains the development of the dental hygiene scholarly identity. Knowledge gained in research methodology courses needs to be augmented with a critical knowledge of the dental hygiene discipline's research priorities in conjunction with learning how interdisciplinary approaches can be used to address those priorities. Moreover, professional socialization and peer interaction are critical for developing the dental hygiene scholarly identity. A dental hygiene scholarly identity is not realized unless a whole culture is created to promote and nurture it.[1,14] It must be acknowledged that dental hygiene doctoral educational programs are needed to enhance the dental hygiene's scholarly identity; this evolution is the essential next step for continued progress in the dental hygiene discipline.

Potential roadblocks to developing a scholarly identity and dental hygiene doctoral education

Two behaviour patterns prevalent among women who have succeeded in their careers which are potential roadblocks to developing a scholarly identity and dental hygiene doctoral education are the "impostor" phenomenon and the "queen bee" syndrome.[15] The impostor phenomenon, prevalent among high-achieving women, was first described as the perception of oneself as having an "intellectual phoniness."[5,6] Although studies report that men also experience the phenomenon, the impostor phenomenon's characteristics have a more deleterious effect upon a woman's career. Women who experience it believe that, despite outstanding academic and professional accomplishments, they really are incompetent––and that anyone who believes otherwise has been fooled. Anxiety, self-doubt, inability to accept positive feedback, fear of failure, and guilt about success undermine their ability to function at their highest level. For example, a high achieving dental hygiene leader who suffers from the imposter phenomenon may not be able to find her voice to defend her support of dental hygiene doctoral education when confronted by skeptical questions from members of a more dominant group perceived as having greater prestige, power, and status.

To counteract the potential for the imposter phenomenon each one of us must realistically assess our traits and celebrate our individual strengths and successes while forgiving our imperfections and mistakes. Being aware of and sensitive to the imposter phenomenon allows one to establish control and identity driven by inner strength, not fear, with an on-going desire to improve ourselves and to be of service to others.

The queen bee syndrome, first defined in 1973, describes a woman in a position of authority who treats subordinates more critically if they are female. The "queen bee" is one who has succeeded in her career, but refuses to help other women do the same.[7] This phenomenon has been documented by several studies.[16] The "queen bee" protects her status by developing behaviours that are rooted in self-centred motivation. Queen bee leaders often shun their dental hygiene affiliation in order to align themselves with what they perceive as a more powerful reference group, such as dentists. These talented but maladaptive dental hygiene leaders often have the opportunity to support dental hygiene goals, but frequently do not. For example, the queen bee who has risen to the level of a deanship or higher and who has considerable influence over academic decisions about the creation of innovative academic programs may sabotage a proposal for the establishment of a doctoral dental hygiene program. Instead of being supportive, the queen bee is a barrier to power and achievement for other women, especially if they are members of a subordinate group of which the queen bee originally was a member. Therefore, it is critical that we seek and only count on her support if we already have received the endorsement of someone else in the dominant culture who has more prestige than she.

Queen bee leadership often leads to divisiveness and competition among dental hygienists and cannot be counted on to foster united efforts to develop a scholarly identity, establish dental hygiene doctoral programs or to initiate any changes in the system that would benefit the dental hygiene community. Dental hygienists must engage in self-reflective processes and look beyond the role of the queen bee for other leadership styles that will complement not only the needs of the leader incumbent, but also those of the dental hygiene profession and its members and clients. Required leadership behaviours may be found in the concept of followership that is discussed below.

Followership

Taking action to adopt effective follower characteristics may be key to overcoming roadblocks to developing a scholarly identity. Followership theory[17-24] views leaders and followers as "two sides of one process, two parts of a whole."[24] It points out that "...performance challenges—not position—should determine when one should follow and when one should lead."[21] The term "followership" honours the crucial role that followers play in organizational life and recognizes that followers and leaders are dynamic roles that can be exchanged. Much of a leader's success depends on effective followers, and both roles deserve

equal weight. We should no longer equate leaders with supervisors and followers with subordinates.

Conclusion

Having a community of passionate dental hygiene scholars with their doctorate in dental hygiene who will ask and answer questions related to the discipline's whole while reaching across disciplines for assistance is essential for our discipline and profession to reach parity with other health professions and to address the oral health challenges of our nation and elsewhere.[25]

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Advancing the profession

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In his discussion of professionalization, Greenwood stated that one of the characteristics of a profession was a systematic body of theory, which required the application of the scientific method to the service situations encountered.[1] He regarded the use of the scientific method as paramount to the development and sustenance of a profession, noting that growth of the profession would occur with a "perpetual readiness to discard any portion of the system, no matter how time-honored it may be, with a formulation demonstrated to be more valid."[1] Given the nature of this research conference, the purpose of this paper is to address how to advance the dental hygiene profession through research.

In examining research needed in dental hygiene to advance the profession, it is important to consider oral health status from a global and national perspective. According to the World Health Organization (WHO),

- worldwide, 60% to 90% of school children and nearly 100% of adults have dental caries;
- severe periodontal disease is found in 15% to 20% of middle-aged (35–44 years) adults;
- about 30% of people ages 65 to 74 have no natural teeth;
- oral disease in children and adults is higher among poor and disadvantaged population groups;
- risk factors for oral diseases include an unhealthy diet, tobacco use, harmful alcohol use, poor oral hygiene, and social determinants.[2]

Further, the WHO states that most oral diseases require professional oral health care. However, because of limited availability or accessibility, the use of oral health services is markedly low among older people, people living in rural areas, and people with low income and education. To combat oral health diseases and inequalities, the WHO advocates for stimulating the development and implementation of community-based projects for oral health promotion and prevention of oral disease with a focus on disadvantaged and poor population groups; for a common risk factor approach to prevent oral and other chronic diseases; and for providing technical support to countries to strengthen their oral health systems and integrate oral health into public health.[2]

From a national perspective, the oral health status of people in the United States is remarkably poor, as illustrated in the following key bullet points.[3-5]

- Tooth decay is the most common chronic illness among school-age children.
- From 2007 to 2011, the percentage of persons ages 2 years and older who had a dental visit in the past 12 months decreased by approximately 6%.
- Approximately 23% of children ages 2 to 11 years have at least one primary tooth with untreated decay.
- In 2010, 22% of low-income adults had gone 5 years or more without a dental visit or had never had a visit.
- Nearly half (44%) of all Medicare beneficiaries report no dental visit in the past year, and 22% report they have not seen a dental provider in the last 5 years.

Solutions to address the oral health conditions of the public should be considered as one component of advancing the profession. Proposed solutions include using professionally applied fluoride gel and varnish treatments; placing dental sealants on permanent molars; providing early identification of those at high risk for oral disease and delivery of effective interventions; providing access to a dental home by the time a child is 1 year old; addressing oral health literacy; implementing and evaluating activities that have an impact on health behaviour; facilitating collaboration between state public health and medical assistance departments and other groups to deliver preventive oral health care; and increasing the number of community health centres with an oral health component.[3,4]

Another avenue for advancing the profession is to consider the research agendas of key groups and how these agendas might influence the research agenda of the discipline of dental hygiene. Three research agendas reviewed included the WHO Global Oral Health Programme, the International Association of Dental Research–Global Oral Health Inequalities Research Agenda (IADR–GOHIRA®), and the Patient-Centered Outcomes Research Institute (PCORI).

The WHO Global Oral Health Programme focuses on multiple aspects of oral health research. Examples of topics within this agenda include the following.

- modifiable common risk factors to oral health and chronic disease, particularly the role of diet, nutrition, and tobacco
- oral health–general health interrelationships
- inequality in oral health and disease and the impact of sociobehavioural risk factors

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Table 1. Research agenda of the Patient-Centered Outcomes Research Institute[8]

Topic	Agenda
Assessment of prevention, diagnosis, and treatment options	Comparing the effectiveness of safety of alternative prevention, diagnosis, and treatment options to see which ones work best for different people with a particular health problem.
Improving health care systems	Comparing health system-level approaches to improving access, supporting patient self-care, innovative use of health information technology, coordinating care for complex conditions, and deploying workforce effectively.
Communication and dissemination research	Comparing approaches to providing comparative effectiveness research information, empowering people to ask for and use the information, and supporting shared decision making between patients and their providers
Addressing disparities	Identifying potential differences in prevention, diagnosis, or treatment effectiveness, or preferred clinical outcomes across patient populations and the healthcare required to achieve best outcomes in each population
Accelerating patient-centred outcomes research and methodological research	Improving the nation's capacity to conduct patient-centred outcomes research by building data infrastructure, improving analytic methods, and training researchers, patients, and other stakeholders to participate in this research.

- evidence in oral health care: clinical care and public health practice
- translation of knowledge into clinical and public health practice and operational research on effectiveness of alternative community oral health programmes.[6]

The IADR–GOHIRA® identified 10 major areas of research. A sample of their research agenda follows.[7]

- Develop and implement, in partnership with cognate evidence-based medical and dental organizations, a knowledge base that uses a standard set of reporting criteria and includes a registry of implementation trials.
- Emphasize the importance of multidisciplinary and translational research, seeking input from a range of social scientists and health professionals.
- Develop disease prevention strategies based on broad social and environmental determinants of health, adopting upstream rather than downstream strategies.
- Develop community-based regional- and country-level systems for oral health promotion and health care, recognizing previous experience and resource implications, and, where appropriate, emphasizing whole and at-risk populations.

The Patient-Centered Outcome Research Institute promotes 5 main areas as their research agenda. These areas are assessment of prevention, diagnosis, and treatment options; improving health care systems; communication and dissemination of research; addressing disparities; and accelerating patient-centred outcomes research and methodological research.[8] These categories are further defined in Table 1.

To advance the dental hygiene profession, it is recommended that a new global dental hygiene research agenda be formulated based on the oral health status of the public, proposed solutions to the oral health crisis in the nation and the world, and other targeted research agendas. Specifically, it is recommended that this new dental hygiene research agenda be streamlined and focused on improving the health of the public. Research should target the most vulnerable populations, address risk-based health promotion and disease prevention strategies (such as caries, tobacco cessation, obesity, and human papillomavirus infection) and health literacy, and test new workforce models. Given the limited number of dental hygiene researchers and funding options available, this research agenda should promote a coordinated, collaborative effort creating teams of national and international dental hygiene researchers that can share resources and broaden data collection using systematic metrics so that findings are robust and meaningful. Further, this coordination of dental hygiene researchers should focus on increasing partnerships among interprofessional groups, agencies, and policy makers to promote and sustain research initiatives.

Advancing the profession of dental hygiene requires new initiatives and ways of thinking that are focused on key areas that can be effectively researched with the resources available. In doing so, the profession may grow while simultaneously discovering methods that significantly improve the health of the public.

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Interrupting the disease of tobacco addiction

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"The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being."

—The Constitution of the World Health Organization

Tobacco is the only legal consumer product that kills at least 1 out of 2 of its regular users when used as intended by the manufacturer.[1] There are approximately 1.1 billion smokers worldwide, and it is predicted that the use of tobacco could kill 1 billion people during the 21st century. Cigarettes contain tobacco, and tobacco contains nicotine, delivered rapidly to the brain when smoking tobacco. Nicotine is a single psychoactive substance that affects the brain and the central nervous system, among others. The disease of tobacco addiction (nicotine dependence, tobacco use disorder) is recognized as a chronic disease by most authorities including the United States Department of Health and Human Services (USDHHS), Health Canada, many countries' medical associations, and the World Health Organization; it is identified as such in major disease classification systems.[2,3] However, not every person who uses tobacco is addicted to nicotine.

Addiction is a pediatric disease

Tobacco addiction is a treatable disease and not simply a lifestyle choice. Addiction is a primary, chronic, neurobiological disease with genetic, psychosocial, and environmental factors influencing its development and manifestations. It is characterized by behaviours that include one or more of the following: impaired control over drug use, compulsive use, continued use despite harm, and craving.[3] This condition is typically induced by repeated exposure to nicotine from tobacco, producing changes in the brain's motivational system as a consequence of which a reward-seeking behaviour has become out of control.[4,5] Decision making and behaviour are subsequently influenced by the underlying pathophysiological changes in the brain. Ninety per cent of the population will try tobacco at least once in their lifetime, and about 90% of persons who become addicted will do so before the age of 18.

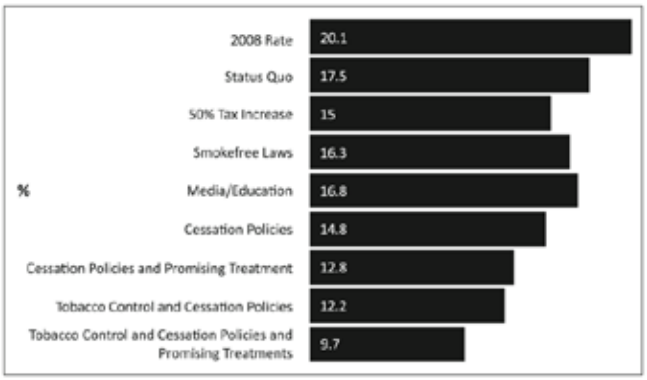
Global approaches to tobacco control

Although much progress has been made in many countries, our current country-specific prevalence rates cannot be seen as the endpoint for success. Increasing adult cessation is considered a major determinant for reducing smoking-related death and disease over the next few decades.[6] The first international public health treaty—the Framework Convention on Tobacco Control (FCTC)[7]—represents a milestone for public health. Article 14 of the FCTC addresses cessation. In its MPOWER initiative, the WHO describes the 6 key policy strategies that have been demonstrated to denormalize and reduce tobacco use[1]:

M: Monitor tobacco use and prevention policies
P: Protect people from tobacco smoke
O: Offer help to quit tobacco use
W: Warn about the dangers of tobacco
E: Enforce bans on tobacco advertising, promotion and sponsorship
R: Raise taxes on tobacco

Simulation models examine the overall effect of tobacco control policies and other interventions on estimated population quit rates (Figure 1).[8] Figure 2 demonstrates some of the lost opportunities for cessation interventions on primary care for different disciplines.

Figure 1. Projected effect of tobacco control policies and other interventions on smoking prevalence, 2008–2020



Despite the devastating health effects and the associated costs to society, and the availability of safe and effective measures to treat tobacco addiction, tobacco control's impact appears to have plateaued. There are numerous plausible explanations for this, including lost opportunities for safe and effective interventions by health professionals. The reality is that, despite the proven beneficial impact of remedying the tobacco epidemic, treatment of tobacco use and addiction continue to be vastly neglected.[9]

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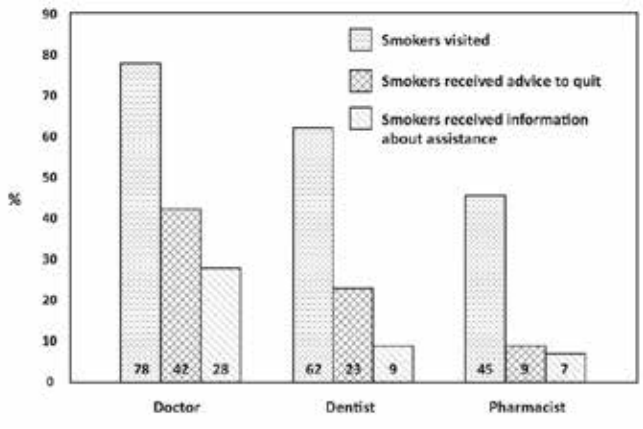
Figure 2. Lost opportunities for tobacco cessation interventions[10]



Treatment approaches

There is a robust body of evidence guiding effective tobacco cessation, and there exists a wide array of internationally recognized guidelines and opportunities for intervention with tobacco use and addiction. The US Public Health Service-sponsored Clinical Practice Guideline update identifies the "5-A" model for treating tobacco use and dependence.[9] This model includes asking about tobacco use with every patient at every visit, advising tobacco users to quit, assessing willingness to make a quit attempt, assisting those willing to attempt quitting by offering counselling and medication, motivating future quit attempts in those unwilling, and arranging for follow-up contacts.

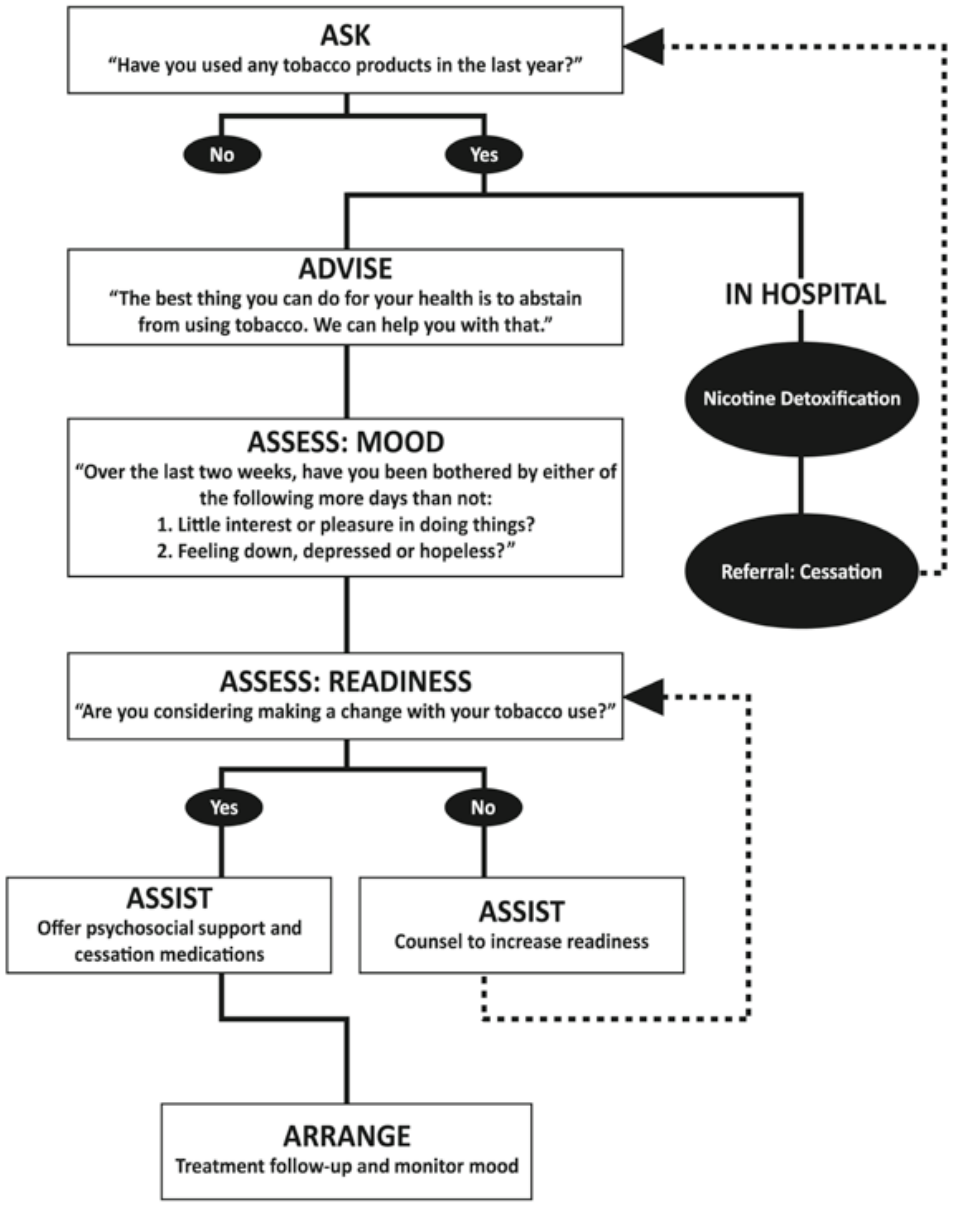
USDHHS guideline: Key recommendations for tobacco use and dependence[9]

The overarching goals of these recommendations are that clinicians strongly recommend the use of effective tobacco dependence counselling and medication treatments to their patients who use tobacco, and that health systems, insurers, and purchasers assist clinicians in making such effective treatments available.

1. Tobacco dependence is a chronic disease that often requires repeated intervention and multiple attempts to quit. Effective treatments exist, however, that can significantly increase rates of long-term abstinence.
2. It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.
3. Tobacco dependence treatments are effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use the counselling treatments and medications recommended in the guideline.
4. Brief tobacco dependence treatment is effective. Clinicians should offer every patient who uses tobacco at least the brief treatments shown to be effective in the guideline.
5. Individual, group, and telephone counselling are effective, and their effectiveness increases with treatment intensity. Two components of counselling are especially effective, and clinicians should use these when counselling patients making a quit attempt:
    a. practical counselling (problem-solving/skills training)
    b. social support delivered as a part of treatment
6. Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). Seven first-line medications (5 nicotine and 2 non-nicotine) reliably increase long-term smoking abstinence rates:
    a. bupropion (Sustained Release [SR])
    b. nicotine gum
    c. nicotine inhaler
    d. nicotine lozenge
    e. nicotine spray
    f. nicotine patch
    g. varenicline

    Clinicians should consider the use of certain combinations of medications identified as effective in the guideline.
7. Counselling and medication are effective when used by themselves for treating tobacco dependence. The combination of counselling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counselling and medication.
8. Telephone quitline counselling is effective with diverse populations and has broad reach. Therefore, both clinicians and health care delivery systems should ensure patient access to quitlines and promote quitline use.
9. If a tobacco user currently is unwilling to make a quit attempt, clinicians should use the motivational treatments shown in the guideline to be effective in increasing future quit attempts.
10. Tobacco dependence treatments are both clinically effective and highly cost-effective relative to interventions for other clinical disorders. Providing coverage for these treatments increases quit rates. Insurers and purchasers should ensure that all insurance plans include the counselling and medication identified as effective in the guideline as covered benefits.

Figure 3. Safety sensitive algorithm[11]



Consistent with FCTC Article 14,[7] Canada released its first federally funded set of clinical practice guidelines through the Canadian Action Network for the Advancement, Dissemination and Adoption of Practice-informed Tobacco Treatment (CAN-ADAPTT).[11] Given the high level of co-occurrence of mood symptoms in persons who use tobacco and/or stop its use, the basic algorithm included in CAN-ADAPTT allows integrated and brief screening of mood in the treatment of tobacco use and addiction (Figure 3).

Among those who currently smoke tobacco, approximately 70% would like to stop and about half of these will try to quit at least once this year.[10] The use of short-term, acute care models to manage chronic, non-communicable diseases is theoretically inconsistent. Hypertension, hypercholesterolemia, obesity, diabetes, depression, chronic obstructive lung diseases, and addiction are some diseases that often require repeated interventions. Following a short-term approach for tobacco-addicted individuals is equally illogical and compromises the chances of long-term cessation success. Evidence-based smoking cessation is both safe and effective and appears to be one of the most robust and clinically meaningful interventions that health care professionals could offer.

Conclusions

Tobacco use remains the leading preventable cause of death and disease worldwide and, having taken into consideration impressive progress over decades, existing smoking rates (as an endpoint) cannot be regarded as a success. Yet the problem of tobacco does not have to be

an intractable one. It has been estimated that some of the greatest declines in smoking-related death over the next few decades will come from increasing adult cessation. Tobacco (nicotine) addiction is a chronic disease amenable to treatment. Health professionals are ideally placed to make a substantial difference, utilizing clinical practice guidelines.[12] Despite the highly significant health threat of tobacco, the existence of robust interventions, and the desire of most individuals to quit, opportunities continue to be neglected. Evidence tells a vivid and chilling story of the dire and urgent need to support cessation.[12]

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The oral microbiome and cancer

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The human microbiome is defined as the collective genomes of the microbes (composed of bacteria, bacteriophages, fungi, protozoa, and viruses) that live inside and on the human body. There are approximately 10 microbes and 100 microbial genes for each human cell and gene, respectively. Collectively the human genome and microbiome is known as the metagenome. The oral microflora comprises a number of specific ecological surface niches (biofilms) that evolve from birth through to death: initially as populations adherent to mucosal surfaces passed on from maternal flora, to tooth-adherent populations following eruption of the dentitions, and with changes in both supra and subgingival niches (i.e., dental plaque/biofilm). In disease states, there is a shift in the equilibrium away from the dynamic synergistic interplay of these healthy oral microbial populations towards a narrower diversity of healthy populations in antagonistic interplay with pathologic populations, and coupled with variable inflammatory host immune responses. The structure and function of the oral microflora (and associated microbiome) have been investigated in numerous oral diseases caused by bacteria, fungi, and viruses (e.g., periodontal diseases) and the systemic diseases linked to chronic infections (e.g., diabetes mellitus, cardiovascular disease, and cancer). The purpose of this paper is to provide an updated understanding of the oral microbiome in health and disease, with a particular emphasis on its relationship to cancer, not only oral and pharyngeal cancers, but also other cancer sites.

Our understanding of the microbiome has been limited by our inability to detect important microbial populations using culture-based methods. Advances in high-throughput genome sequencing led the National Institutes of Health (NIH) to launch the Human Microbiome Project (HMP) as an extension of the Human Genome Project (see http://commonfund.nih.gov/hmp), catalyzing multiple studies to explore the diversity of the microbiome across different body habitats in both health and disease states. An initial landmark study explored the human bacteriome in health by sampling multiple habitats (i.e., oral, gut, urogenital, and skin sites) over 2 time points in a cohort of more than 240 "healthy" adults.[1,2] An analysis of bacterial diversity was performed using complex methodology including 16S ribosomal RNA gene profiling and shotgun metagenomic sequencing.[3] In general, the results showed that there is considerable intra and interpersonal variation in the composition of the microbiome, yet despite such complexity, sophisticated data analysis incorporating demographics (e.g., gender, education levels), lifestyle factors (e.g., diet), and environmental exposures (e.g., breast feeding) has allowed a distillation into distinct groups or communities within habitats that share similar signatures. Further investigation is needed to establish if these communities predict risk of disease.[4]

In general, the oral microbiome is diverse, and oral wash samples (surrogates for the oral flora) from 20 healthy subjects analysed using high-throughput methods revealed the presence of 5 major phyla (Firmicutes, Proteobacteria, Bacteroidetes, Actinobacteria, and Fusobacteria) and that *Streptococcus, Veillonella, Leptotrichia, Prevotella*, and *Haemophilus* genera were the most abundant.[5] In an effort to discern differences across the different oral niches, a landmark HMP study explored the microbiome of samples collected from 9 distinct oral/pharyngeal sites: saliva, supragingival plaque, subgingival plaque, keratinized gingiva, buccal mucosa, tongue dorsum, hard palate, palatine tonsils, and posterior pharyngeal wall. Similar phyla were represented in these samples, and statistical analysis allowed a distillation into 3 distinct community groups:

- *Group 1* (buccal mucosa, keratinized gingiva, and hard palate) demonstrated a predominance of organisms from the phylum Firmicutes (with a very high proportion [approximately 50%] from the genus *Streptococcus*) followed in relative abundance by the phyla Proteobacteria, Bacteroidetes, and either Actinobacteria or Fusobacteria;
- *Group 2* (saliva, tongue, tonsils, and posterior pharyngeal wall) demonstrated a decreased relative abundance of Firmicutes compared to Group 1 replaced by increased levels of 4 phyla: Bacteroidetes, Fusobacteria, Actinobacteria, and the candidate phylum TM7, and with a predominance of *Streptococcus* (approximately 20%), followed by approximately equal abundance of the genera *Veillonella, Prevotella, Neisseria, Fusobacterium, Actinomyces* and *Leptotrichia*;
- *Group 3* (the sub and supragingival plaque biofilm) showed the greatest bacterial diversity and had a further decrease in Firmicutes compared to Groups 1 and 2, with a marked increase in the relative

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abundance of Actinobacteria and with a similar profile of genera as Group 2 plus *Corynebacterium, Capnocytophaga, Rothia,* and *Porphyromonas*.[6]

Further analysis of these groups revealed that a low but non-zero abundance of known bacterial pathogens in the oral cavity habitat were also consistently detected in these healthy subjects, namely *Treponema, Aggregatibacter, Porphyromonas,* and *Tannerella* species. In addition, comparison of the supragingival and subgingival subsites epitomized niche specialization and confirmed the physiological distinctions known between these two sites: with facultative anaerobic and obligate anaerobic genera populating the supragingival and subgingival sites, respectively.

Despite the focus on the oral bacteriome, the diversity of both the oral mycobiome and virome, and their interplay with bacterial communities have been explored. In a study of 20 healthy individuals sampled by an oral rinse at baseline, 85 genera and 101 fungal species were detected. *Candida* species were the most frequently obtained genera, isolated from 75% of all study participants, followed by *Cladosporium* (65%), *Aureobasidium, Saccharomycetales* (50% for both), *Aspergillus* (35%), *Fusarium* (30%), and *Cryptococcus* (20%), suggesting that fungi play an important role not only in disease states but also in the healthy microbiome.[7] The oral virome is mainly comprised of "commensal" bacteriophages mirroring the diversity of the oral bacteriome rather than pathogenic eukaryotic viruses.[8] Bacteriophages are involved in the exchange of genetic material and hence provide another intricate layer of complexity to the microbiome. Human papillomavirus communities across various habitats in healthy patients have also recently been described.[9]

In terms of the functional attributes of the oral microbiome in health, little is currently understood and more studies are needed to identify the significance of the communities (i.e., the metaproteome or metametabalome). Techniques such as shotgun metagenomic sequencing data provide some insight into the metabolic pathways and, as an example, bacterial small sugar transporters were shown to be of particular abundance in the oral cavity sites.

There is a large literature exploring the oral microbiome in various disease states but a discussion of this literature is beyond the scope of this paper. In terms of cancer, however, it was the discovery of the association of *Helicobacter pylori* infection with gastric adenocarcinoma that spawned an exploration for other cancer-infectious disease associations. Epidemiologic studies have long reported an alleged association of periodontal diseases and tooth loss with cancer, and there are data to support an association with oral, esophageal, gastric, and pancreatic cancer, even after controlling for confounding factors such as tobacco use.[10,11] More recently, the principal periodontal pathogen *Porphyromonas gingivalis* has been identified as a biomarker for orodigestive tract cancer death (colorectal and possibly pancreatic cancer).[12] Recent microbiome studies lend support for the association of upper digestive tract flora with gastric and esophageal cancers.[13] There is also some evidence to support associations between both oral fungal and viral organisms and cancer. As an example, human papillomavirus 16 (HPV-16) infection is an established cause for the majority of oropharyngeal squamous cell carcinomas.[14]

The mechanisms by which oral bacterial flora might cause carcinogenesis are hypothetical, particularly for sites distant to the oral cavity, and may include local activation of carcinogens by oral microbes (e.g., conversion of ethanol to acetaldehyde)[15] or release of pro-inflammatory mediators that can dysregulate cellular cycling, disrupt signaling mechanisms, and act as tumour promoters.[16]

Early studies using culture-dependent assays concluded that oral squamous cell carcinomas (compared to normal tissues with the same patient) have a significantly increased abundance of both aerobic and anaerobic bacteria, with increases in *Veillonella, Fusobacterium, Prevotella, Porphyromonas, Actinomyces* and *Clostridium* (anaerobes), and *Haemophilus, Enterobacteriaceae* and *Streptococcus* species (aerobes). In addition, approximately 30% of cancers were shown to harbour *Candida albicans*, but not at control sites.[17] The oral microbiome in oral squamous cell carcinomas has been recently studied using culture-independent assays. In one pilot study, the microbiome in a series of 10 oral tongue/floor of mouth cancers was compared to that of normal tissue in the same patients using a 16S rRNA assay coupled with denaturing gradient gel electrophoresis (DGGE). *Streptococcus intermedius* was present in 70% of both cancer and normal tissues. *Streptococcus sp*. oral taxon 058, *Peptostreptococcus stomatis, Streptococcus salivarius, Streptococcus gordonii, Gemella haemolysans, Gemella morbillorum, Johnsonella ignava* and *Streptococcus parasanguinis* were highly associated with the cancers, and *Granulicatella adiacens* was prevalent the normal tissue.[18] Recently, a cohort of oral cancers and premalignant oral lesions matched with normal contralateral tissue sites from the same patient were profiled by sequencing 16S rDNA hypervariable region amplicons. In cancer samples, the abundance of the phyla Firmicutes (especially *Streptococcus*) and Actinobacteria (especially *Rothia*) were significantly decreased relative to contralateral normal samples. Significant decreases in abundance of these phyla were observed for pre-cancers, but not when comparing samples from contralateral sites (tongue and floor of mouth) from healthy individuals.[19]

In summary, technological advances have provided insights into the structure of the oral microbiome in health and, to a lesser extent, in disease. Further research is needed to explore the functional implications of the oral microbiome for diagnosis and risk assessment of disease (i.e., cancer) or possibly therapeutic strategies to restore the health of the oral ecosystem.

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Creating a risk-based model for dental benefit design

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For generations, Americans have been exhorted to "see your dentist twice a year." This cultural axiom is deeply embedded in the minds of the American psyche. Although the earliest origin is in dispute, this advice was featured in toothpaste advertising in the 1950s and was later adopted by both the dental profession and the dental benefits industry. The influence that this cultural meme continues to exert on the dental profession, the dental benefits industry, and the public is profound. Despite advancements in understanding the pathophysiology, epidemiology, and systemic implications of oral disease,[1,2] standard dental benefit designs help to perpetuate the archetype of the biannual dental visit, during which many patients receive the same preventive services at the precise frequencies allowed by their dental plan.

Both dental insurers and clinicians benefit from the simplicity of this approach. Patients and dentists tend to "follow the benefits" spelled out in the plan design. Claims submission and processing are simplified when most beneficiaries have the same benefits, helping to control the costs for administration. When the risk for oral disease is not considered, the result can be a trade-off between administrative efficiency and effectiveness in improving oral health care outcomes. The "standard" benefit can encourage overtreatment for the healthiest individuals and discourage recommended treatment for those at greater risk.

Strategies for disease prevention and management have been developed based on the concept of individual risk assessment.[3-6] Risk assessment tools use standardized questions to identify factors such as medical history, caries and restoration history, diet, oral hygiene practices, family history, and clinical information such as pocket depth, clinical attachment loss, bleeding, and tooth loss, that influence the likelihood that a person will develop the target condition. The information is weighted based on an estimated value that these factors have as determinants of future disease, which is then converted to a numerical score or descriptive ranking (e.g., low, moderate or high risk). Most risk assessment tools use paper checklists that guide the user to determine the patient's risk for oral disease and assist oral health care providers in developing prevention-based treatment plans.

Electronic risk assessment technologies have advantages over paper forms including more accurate data entry, automated calculation of scores, customized reports based on each individual's risk factors, and secure transmission to third-party payers. Electronic risk assessment reports can also be stored for later review by the dentist to create a chronological record of an individual's oral health status. Risk assessment data can be used to create population health reports for employer groups which can reveal whether or not treatment being provided for patients matches a population's oral health risk profile.

The growing evidence of relationships between oral and overall health and evidence that improving oral health can help employers to lower medical claims expenses has encouraged many dental benefit companies to provide additional preventive services, such as prophylaxis and periodontal maintenance for members with medical conditions including diabetes, heart disease, and pregnancy. However, providing these services on the basis of a medical diagnosis may miss the chance for primary prevention of dental caries and periodontal disease. Patients should not have to wait until they get sick before they receive benefits for the oral preventive care they need to stay healthy.

Stand-alone dental benefit carriers face a common dilemma: how can they provide wellness programs for purchasers and their insured members that would match the promises made by competing multiline carriers to reduce medical costs without access to medical claims data and diagnostic coding? Northeast Delta Dental's choice was to create an oral health and wellness program focused on primary prevention of caries and periodontal disease as opposed to medical diagnoses. We believe that the use of predictive risk assessment for oral disease to authorize guideline-based preventive benefits could encourage the delivery of care matched to individual needs, and actively engage patients and providers to change behaviours and adopt clinical best practices to improve health outcomes.

We developed a set of "enhanced" preventive dental benefits which were mapped as closely as possible to the preventive best practice guidelines from the American Dental Association[7] and the American Academy of Pediatric Dentistry[8] for dental caries; and from the American Academy of Periodontology for periodontitis.[9] Eligible patients who have been assessed by their dentist using a standardized electronic risk assessment tool and found to be at moderate to high risk for caries or periodontal disease are pre-authorized for preventive benefits including topical fluoride treatment and sealants without age limitation, up to 4 prophylaxis and periodontal maintenance visits per year, and oral health counselling. Northeast Delta Dental chose a commercially available clinical risk assessment software platform that provides fully automated risk

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assessments for caries, periodontal disease, and oral cancer for this purpose.[10]

When data are entered by the patient or the dental office, the data are uploaded to the risk assessment software company's Health Insurance Portability and Accountability Act (HIPAA)-compliant database where the patient's risk and disease severity scores are calculated. Risk profile reports are automatically sent securely to the patient or dental office. The data are also downloaded to a proprietary data integration hub jointly developed by Northeast Delta Dental and the risk assessment software vendor. The data integration hub securely aggregates both self-assessed and clinically generated risk assessment data and can automatically authorize guideline-based enhanced benefits in the dental insurance company claims processing system. To be eligible for enhanced benefits, qualifying members also use the data hub to register for an oral health and wellness score which allows us to engage members to optimize self-management for their oral health.

Employers can also use an online oral health self-assessment tool to gain insights into the population health of their employees and their families by aggregating the risk and disease data into the data hub to create a population oral health report that estimates the prevalence of caries, periodontal disease, and oral cancer risk among the insured population, as well as the number of smokers and persons in the population with chronic disease who also have greater risk for periodontal disease. When dental claims data and population health risk profiles are compared, areas where the treatment being provided does not match a population's oral health risk profile can be determined. These "gaps to fill" can help focus efforts to improve patient self-management and the utilization of preventive benefits by dentists through outreach and engagement.

To gain the most from their dental benefits and achieve optimal oral health, members must be engaged and empowered with personalized, objective, and actionable information and resources. The oral health risk assessment data hub also provides a communication module that uses patient-provided data to send individualized, HIPAA-compliant text and email messaging to engage individual members based on their unique oral health and personal profile.

Conclusion

Northeast Delta Dental has developed a comprehensive oral health and wellness program for employer groups based on an understanding that "one size does not fit all" when it comes to dental benefits. The program provides evidence-based preventive dental benefits matched to each patient's individual needs in order to improve oral health care outcomes for individuals and populations. The program provides employers with an objective analysis of the oral health status of their covered populations, and recommends strategies to close gaps that may exist between the preventive oral health care their employees are receiving and best practices for oral prevention. The program engages and empowers patients to take steps to achieve their personal best oral and overall health, and encourages dentists to use evidence-based preventive benefits matched to the needs of their patients to deliver evidence-based oral preventive care.

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Using prevention and measurement to drive quality improvement

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The term "quality" can mean many things to many people. In health care, we speak of "quality of care" to mean "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."[1] In order to drive quality improvement, the Centers for Medicare & Medicaid Services (CMS) is pressing forward with the "Triple Aim" goals of 1) better individual health care; 2) better population health; and 3) lower per capita costs called for in health reform's Affordable Care Act.[2] CMS' Quality Improvement Roadmap promotes a vision for "The right care for every person every time" with a goal of making care safe, effective, efficient, patient-centred, timely, and equitable: indicators of quality for care delivery.[3]

An assumption in health care was that clinical judgement was sufficient to guide wise decision making. This emphasis on the art of medicine was grounded in a tradition that education, the knowledge of pathophysiology, and sufficient clinical experience were all that was needed to develop sound treatment recommendations.[4] The result of basing care on such personal opinion is a wide variation in clinical practice where the most effective treatment is not always used and ineffective treatments often persist. Such issues are indicators of a poor quality health care delivery system. To address the goal of quality through the delivery of effective care, Eddy and others postulated that what happens to patients should be based upon "evidence" to produce recommendations that are valid, reliable, and objective.[5]

The goal of patient-centred care (PCC) is an important component of prevention. Prevention of adverse outcomes is enhanced when patients comply with treatment recommendations, prescriptions, homecare, and postoperative instructions. Studies show that PCC results in increased patient satisfaction and improved patient adherence with recommended care, each of which can improve care outcomes.[6]

Within oral health care, the Triple Aim can be best achieved through a focus on prevention consistent with evidence-based guidelines published by the National Guideline Clearinghouse, the American Academy of Pediatric Dentistry, and the American Dental Association's Center for Evidence-Based Dentistry.[7] A focus on prevention can improve health outcomes as shown in several evidence-based guidelines and can also lower per capita costs over time. However, in order to improve, we must measure the degree to which our dental care system supports the provision of preventive services.

In 2009, the Children's Health Insurance Program Reauthorization Act (CHIPRA) called for the Secretary of Health and Human Services to establish an evidence-based pediatric quality measures program for primary and specialized pediatric health care professionals, including dental professionals. A measure is a mathematical ratio expressed as a percentage, with exclusions of patients who should not be incorporated for various reasons. An example would be a measure for placement of sealants on first molars. This could be described as the number of patients ages 6 to 8 years with sealants who have had a restoration in the past 3 years divided by the total number of patients in the measured population ages 6 to 8 years who have had a restoration in the past 3 years. Included are those at risk for decay, as indicated by restorative history, while excluding children whose adult molar teeth have not erupted.[8] Measurement allows for tracking the success in delivering care to those in need and it can be benchmarked to incentivize care delivery.

To promote quality measurement, CMS encouraged the establishment of the Dental Quality Alliance (DQA) in 2010. The DQA is a multi-stakeholder alliance from across the oral health community, including federal agencies, payers, professional associations, and public representation, with a mission to advance the field of performance measurement to improve oral health, patient care, and safety.[9] In 2012, the DQA approved its first fully tested set of 10 measures: *Dental caries in children: Prevention and disease management*.[10] These were developed over 2 years after rigorous testing. These DQA measures are validated at the program and plan level and are meant to hold health plans accountable for utilization and quality.

Through a consensus process of its stakeholders, the DQA builds measures that are evidence-based.[11] An example would be the DQA's sealant and fluoride measures. These are constructed from anticipated outcomes found in the ADA's evidence-based clinical recommendations.[12] Measuring the delivery of care with proven outcomes will promote utilization of these services and raise the

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level of oral health for the targeted population. Tracking measurement performance will provide administrators with the tools that they need to be confident that their plans are designed to promote quality.

Measuring the delivery of preventive services with an anticipated outcome for at-risk patients will drive quality improvement. For example, reduction of caries incidence in children and adolescents after placement of resin-based sealants ranges from 58.6% at 4 years to 76.3% during this period when reapplied as needed.[13] Use of the DQA's sealant measure will provide assessment of a plan's performance that those covered individuals are receiving this evidence-based preventive service. Failure to achieve anticipated outcomes could signal to administrators that flaws exist within their system, which impact the delivery of quality care.

The Institute of Medicine in its 2012 report, *Best care at a lower cost. The pathway to continuously learning health care in America*, called for "continuous learning health systems."[14] Measures are an integral component of this concept due to the cyclic nature of evidence, leading to anticipated outcomes, which lead to clinical guidelines for care decisions, which are then measured. Once measured, the realized outcomes create new evidence and the process revolves.

The rapidly changing landscape of health care financing will result in greater reliance on quality measures. Employers and purchasers will drive accountability through measurement. Consumers and providers are often fearful that plan design will focus on cost containment at the expense of improving utilization and prevention. Measurement will identify when plan design restricts access to care or impedes improvement of oral health, patient care, and safety.

Often measures are designed for reporting using administrative enrollment and claims data. This method can pose issues with transparency as many administrators view claims data as proprietary. A solution found in several states is the creation of "All-Payer Claims Databases" (APCD).[15] These APCD may help to address concerns over transparency, as well as the call for "continuous learning health systems" through the application of data to a "dashboard of measures" to show how our providers, health systems, and plan administrators are achieving measurement goals and improving the health and safety of covered populations.

Clinicians interested in elevating the quality of care in their practice can adapt measure concepts for individual use. Using sealants as an example, clinical software systems can generate a list of children ages 6 to 8 years who have had a filling in the past 3 years and those who have had sealants placed. Monthly tracking of performance becomes an exercise in data analysis. A more basic approach could use a spreadsheet on which individual providers track patients seen at preventive visits who are at elevated risk for decay and are in need of sealant care. Regular reporting of results within a practice can provide incentive for utilizing preventive services and enhance overall quality of care.

Assuming that a covered population remains with a plan long enough to reap the benefit, access to preventive services and the delivery of that care will improve oral health and decrease health care costs by reducing the need for more costly care in the future. This result is most likely to occur when evidence-based preventive services are targeted effectively to at-risk groups and individuals. The transparent use of measures will provide the incentive for the use of preventive services to drive quality improvement and build evidence on the effectiveness of these interventions for the development of future care recommendations.

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Opportunities to increase prevention in dentistry

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According to the Centers for Disease Control and Prevention (CDC), between 12.1% and 41.9% of the American population ages 5 years and older (depending on age and income level) has untreated dental caries.[1] In addition, the percentages of those who have restorations vary from 44.5% to 92.6%. Children at or below the federal poverty level (and most likely Medicaid eligible) have the highest untreated dental caries rates for children, at 25.4%. Yet nationally, only 46.9% of children receiving Medicaid, on average, were able to access any dental care in 2013.[2] Limited Medicaid budgets often lead to Medicaid fees that are below the cost of providing surgical treatment to repair the damage caused by caries. However, it is possible to provide effective preventive treatment by dental hygienists or other health professionals at lower costs before the disease progresses to an irreversible state that necessitates surgical repair.

The construct of classifying health services into 3 levels of prevention to differentiate them from curative treatment was developed by Leavell and Clark in 1965.[3] More recently, Jekel and colleagues defined the levels of prevention as listed in Table 1.[4]

Our knowledge of dental disease and how to prevent it has increased significantly, which opens opportunities to provide beneficial care to many people who otherwise would not receive it and who would ultimately suffer the consequences of untreated disease. The DentaQuest Institute has been partnering with Boston Children's Hospital (BCH) since 2008 on an Early Childhood Caries Collaborative that makes extensive use of primary, secondary, and tertiary prevention. The ECC Collaborative's protocol includes performing a risk and behaviour assessment to determine which risky behaviours parents are exhibiting and whether they are using protective factors.[5] When it comes to the determinants of health, we know that behaviour may contribute 40%, while health care services may only contribute 10%.[6] Changing behaviour can have a profound effect, and the clinical staff in the collaborative was trained in motivational interviewing, behaviour modification and simple goal setting. Parents are taught the causes of tooth decay. Most are not aware that the apple juice they put in a sippy cup has a pH of 3.5% or that milk in a bottle at bedtime damages their child's teeth. Goal setting asks parents to pick just one risky behaviour to work on during the next month, such as putting water in the sippy cup or the bedtime bottle. Or they may choose to add a protective factor, like brushing the child's teeth with a smear of fluoridated toothpaste. BCH found that it was able to reduce the risk status of children from high risk to moderate risk after 3 of these visits.

Secondary prevention is employed after the patient has developed a carious lesion but before it has cavitated. Figure 1 shows several interproximal carious lesions. The upper bicuspids appear to have demineralization that extends into the dentin and probably have cavitated. They will most likely require surgical repair. However, the lower bicuspids show examples of demineralization that do not appear to be into dentin. A patient with only early stage

Table 1. Levels of prevention[4]

Stage of disease	Level of prevention	Definition (from Jekel et al.)
Pre-disease but at-risk	Primary	Keeps the disease process from becoming established by eliminating causes of disease or increasing resistance to disease. Primary prevention refers to **health promotion**, which fosters wellness in general and thus reduces the likelihood of disease, disability, and premature death in a nonspecific manner, as well as **specific protection** against the inception of disease.
Presymptomatic	Secondary	Interrupts the disease process before it becomes symptomatic. Secondary prevention refers to the **detection and management of presymptomatic disease**, and the prevention of its progression to symptomatic disease.
Symptomatic	Tertiary	Limits the physical and social consequences of symptomatic disease. Tertiary prevention refers to the treatment of symptomatic disease in an effort to prevent its progression to disability or premature death. [Tertiary tends to apply to chronic diseases, such as diabetes, which cannot be cured but can be managed to prevent them from progressing to more serious conditions.]

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demineralization could be managed medically rather than surgically by applying topical fluoride and prescribing 1.1% sodium fluoride or calcium phosphate/fluoride enhanced toothpaste to remineralize early stage lesions. The resulting remineralization would be better quality care than a restoration, because the fluoride would incorporate into the tooth structure and the pH would have to drop significantly before that area would demineralize. In contrast, placing a restoration would increase the probability that the area would need retreatment at some point in the future. At BCH the result of behaviour modification and goal setting along with frequent application of fluoride varnish and home fluoride toothpaste was a reduction of 65% in new cavitation.[5] Both of these procedures can be performed by non-dentist health professionals, achieve better health outcomes, and cost less than placing restorations.

In addition to these primary and secondary preventive treatments, BCH used tertiary prevention on cavitated lesions. Many very young children are treated at BCH because their disease is so extensive that they cannot be managed in a clinical setting and they are referred for operating room (OR) treatment under general anesthesia. Because of the high demand at BCH, the waiting time for the OR (prior to adoption of the ECC protocol) was between 6 and 9 months—plenty of time for caries to advance into the pulp or cause the child considerable pain.

The ECC protocol includes removing caries with hand instruments without local anesthesia, applying fluoride varnish, and placing an interim therapeutic restoration (ITR) of glass ionomer. This treatment stabilizes the infection and reduces pain, and many of these children are subsequently able to be managed in a clinical setting. This tertiary prevention reduced the need to treat the children in the operating room by 48% at BCH, which is a better experience of care since the use of general anesthesia in young children has inherent risks. In addition, the protocol reduced reported pain by 38%, again a better experience of care. The new ECC protocol was able to reduce the average cost of care for their population of children by 37% in the first year.[7]

The primary focus of the Patient Protection and Affordable Care Act (PPACA) is to bring down the escalating costs of health care that are threatening the American economy and to improve the quality of care. The goal of the Triple Aim is to simultaneously improve the health outcomes for a population, improve the patient's experience of care, and to lower the per capita cost of care.[8] BCH with its ECC protocol was able to achieve the Triple Aim. But one of the challenges to spreading this protocol is the fact that Medicaid and commercial insurers do not cover many of these procedures. They do not pay for disease management or motivational interviewing even though they both can achieve dramatic results. Usually they will pay for only 2 fluoride treatments in a 12-month period, and the ECC protocol may call for 3 or more. Many do not cover interim therapeutic restorations. These benefit programs are hesitant to cover additional services because of the potential to provide them to children who are not at high risk and thus would drive up cost without providing additional health benefit.

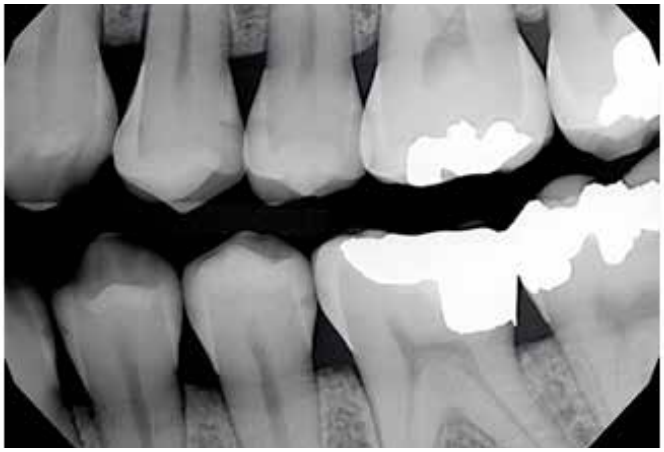
However, a new opportunity may be developing. The PPACA encourages the formation of Patient-Centered Medical Homes (PCMH) and other Accountable Care Organizations in the belief that they can control costs and improve quality.[9] A PCMH is:

> A primary care practice that gives patients the individualized care and support they need to stay healthy [...] the patient, the primary care physician and a medical team work together to develop and implement a plan of care for the patient that details the patient's optimal medication use, diet, exercise, behavioral health treatments, etc. to get and keep the patient healthy.[10]

These types of patient-centred health homes can include dental professionals and could potentially cover other populations besides Medicare recipients. They can share in savings they create. Had BCH been part of a Patient-Centered [Medical] Home that qualified to share savings, they could have received substantial payment for achieving their outcomes. Before adopting the ECC protocols, the average cost to the hospital of providing care was $2,023 per child, and after adopting the protocol, it dropped to $1,271, for a savings of $752 per child.[7] For their population of 395 children, they lowered their costs by almost $300,000. Had they received just 20% of that expense, they would have more than covered their costs of disease management and extra fluoride, earned additional revenue while also saving the Medicaid program money.

It is possible to expand the use of primary, secondary, and tertiary prevention to achieve improved health outcomes, better patient experience of care, and lower cost of care, which could allow existing benefit dollars to cover more patients and increase access.

Figure 1. Radiograph of interproximal caries



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Interprofessional practice: Translating evidence-based oral care to hospital care

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Oral hygiene in hospital settings

A diagnosis of ventilator-acquired pneumonia (VAP) is made when an intubated, mechanically ventilated patient is diagnosed with pneumonia 48 hours after admission. VAP has been associated with poor oral hygiene, and this link has galvanized health care workers and researchers to explore effective methods of oral hygiene to reduce rates of VAP and other nosocomial infections.[1] Oral care regimens to improve oral health have been well established in the outpatient setting, but such standards are not as consistent in critically ill hospitalized patients. While intensive care unit (ICU) nurses rate oral care as important, most oral care practices in the ICU are inadequate. Protocols usually consist of foam sticks, standard toothpastes, and a saline rinse. Although the American Association of Critical-Care Nurses (AACN) has advocated toothbrushing and declared it to be one of the standards of critical care, less than 44% of critical care nurses report brushing teeth.[2]

Toothbrushing has been described as the single most important oral hygiene activity,[3] and toothbrushing twice daily reduces oral debris and biofilm. Over the past decade, electric toothbrushes have been shown to be superior to manual toothbrushes in biofilm reduction and improved gingival health. The benefits of oral care for critically ill, intubated patients have been conceded by health care professionals.[4] Studies that have been conducted to examine this link are important but inadequate. One reason that critical care nurses in the neurosurgical field may be reluctant to perform consistent toothbrushing for intubated patients is the concern that toothbrushing may contribute to increased intracranial pressure (ICP). Therefore, some nurses prefer foam swabs to toothbrushes, despite the fact that toothbrushing is the standard of care recommended by the AACN.[5] Patient safety is a critical aspect of oral health that must be addressed before oral care efficacy trials can be implemented.

Oral hygiene for intubated patients may be hindered by the presence of the oral endotracheal tube, oral gastric tubes, bite blocks, and the adhesive tape that secures such devices. As a result of restricted access to the oral cavity, nurses may delay tasks such as toothbrushing, which creates a worsened pathogenic state within the patient's mouth.

The Center for Medicare and Medicaid Services has restricted or ceased payment for infections acquired in a hospital setting, and approximately 99,955 beds are dedicated to ICUs in the US. Thus, evidence to support the safety and efficacy of oral hygiene for the critically ill patient must be demonstrated to reduce the risk of hospital-associated infection and VAP.

Translating oral hygiene into practice: Results of a randomized controlled trial

Recognizing the need for more research on oral hygiene and associated VAP, we performed a randomized controlled trial (RCT) to monitor changes in ICP and cerebral perfusion pressure (CPP) while providing oral care. Over a 2-year period, we compared variations in oral health during intubation to changes in oral and respiratory nosocomial colonization among intubated neuroscience ICU patients.

Patients were randomized to 1 of 2 groups: those who would receive a standard oral care protocol, and those who would receive a comprehensive oral care protocol. The tools used for the standard oral care protocol included a manual pediatric toothbrush, standard foaming toothpaste, and water-soluble lubricant. The equipment provided for the comprehensive protocol group consisted of a tongue scraper, a power oscillating rotating toothbrush with a non-foaming toothpaste, and a moisturizing agent. Both groups received the assigned oral care protocol twice daily, with toothbrushing lasting 2 minutes per occasion. Chest radiographs and oral and sputum cultures were obtained upon admission to the ICU and were repeated every 48 hours while the patient remained intubated. Oral health was measured according to the Bedside Oral Exam (BOE), and these scores were recorded on the day of enrollment in the trial, the day of extubation, and 48 hours after extubation.

An interim safety analysis was performed upon 47 adult neuroscience ICU patients with an ICP monitor. ICP and CPP were recorded before, during, and after oral care over the first 72 hours of admission. Of 807 ICP and CPP measurements obtained before, during, and after oral care, there were no significant differences in ICP ($P = 0.72$) or CPP ($P = 0.68$) between toothbrushing methods. In the absence of preexisting intracranial hypertension, toothbrushing was safely performed in intubated neuroscience ICU patients.

Oral health deteriorated in both groups, but key differences existed between the deteriorations. In the standard oral care group, the BOE total score and all 8

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categories significantly deteriorated (Friedman Test p<0.001, Bonferroni correction) and did not return to baseline after extubation. Large effect sizes were present at all 3 time points in this group. In the comprehensive oral care group, total BOE deteriorated during intubation (Friedman Test p<0.004) but returned to baseline status after extubation. There was no significant deterioration in the ratings on tongue, mucous membranes, gingiva or teeth over time in the comprehensive oral care group. Oral colonization upon admission was noted in 25% of patients in each protocol. Although there were trends of reduced oral and respiratory nosocomial colonization among those in the comprehensive oral care group, no significant differences were noted between groups. Incidence of VAP was equivalent (p=0.61) for the standard and comprehensive groups at day 6.

Discussion

The comprehensive oral care protocol demonstrated superiority to current published standards for ICU oral care protocols as measured by the BOE. The tongue scraper, power toothbrush, non-foaming toothpaste, and oral moisturizers were found to be the most effective tools for oral hygiene during intubation period as evidenced by BOE item scores of tongue, teeth, gingiva, and mucous membranes. Previously unreported in critical care oral protocols, the tongue scraper was effective in preserving tongue hygiene as noted by the BOE item scores and supported by the reduction in odour compared to the standard protocol (odour was included as a new measurement parameter on the BOE).

Among patients who received comprehensive oral care, there was a trend of a decreased conversion to oral nosocomial colonization. The incidence of VAP, though equivalent in both groups, reflected a decreased trend among patients receiving comprehensive oral care. Because the study was underpowered, larger studies are needed to further investigate the benefits of comprehensive oral care, and further studies are needed to assess the long-term impact of oral hygiene on oral health and patient comfort.

Hospital-wide changes in oral hygiene

The results of this study, combined with other evidence of the benefits of oral care, were the motivation for changes in oral care practices at St. Joseph's Hospital and Medical Center in Phoenix, Arizona. An Oral Health Initiative Committee comprised of experts representing clinical and management areas was established. Members of this multidisciplinary committee reviewed results of the RCT and protocols and ultimately elected to incorporate the BOE and comprehensive oral care protocol in all patient units. The comprehensive oral care protocol was further refined based on BOE scores and subsequently referred to as the Barrow Oral Care Protocol (BOCP).All medical and nursing committees hospital-wide agreed to the implementation of the BOCP.

Using a descriptive case design for implementation and evaluation of oral assessments and oral hygiene, we explored quality improvement data for incidence of VAP and the cost effectiveness of oral hygiene supplies using the expanded range of oral hygiene products. Incidence of VAP and the cost of oral care supplies before and after implementation were compared in the Trauma ICU over a 2-year period.

The incidence of VAP fell significantly from 4.21 to 2.1 per 1000 ventilator days (p=0.04). Average monthly costs for oral care products used in 2011 were $4,000. After implementation of the BOE and BOCP, the average monthly cost in 2012 was $1,453, representing a savings of 65%. Cost-effective, comprehensive oral care appears to help reduce VAP, and the BOE and BOCP remain in place at our institution.

Current practices and future recommendations

Although nurses are responsible for conducting assessments and performing interventions for other body systems, such as hemodynamic monitoring and administration of blood pressure medications, oral health assessments and research-based oral care practices are not routinely performed. Oral assessments are done in dental settings every day, by both dentists and dental hygienists. When dental professionals administer these assessments, they use a wide variety of tools, including mouth mirrors, periodontal probes, loupes, headlights, digital radiography, and cancer screening equipment. Generally, the nurses who perform oral assessments have neither the tools nor the training to do so effectively. Comatose or intubated patients are often unable to indicate whether they are in pain or describe discomfort, and the tubes make it challenging to thoroughly examine the mouth. Additionally, the treatment setting is not conducive to provision of detailed oral care, as the patients are in a bed, not a reclining dental chair. Heavier patients are in a wider bed, which makes it difficult for the nurse to reach the mouth.

Health care professionals who recognize the success of our research and advocate for systemic oral health protocols for hospitalized patients have called attention to oral health and hygiene practices. Some facilities have employed an inpatient registered dental hygienist to assess and perform complex oral hygiene assessments, thereby meeting the demand for cost-effective oral health assessments and reducing the rate of nosocomial infections. Our institution plans to collaborate with local dental hygiene schools to establish student rotations as part of the students' curricula.

Though advancements in oral health have dramatically improved in the United States over the past 25 years, the need for further collaboration among health providers in dentistry, medicine, and allied health care providers is critical.[6] Such collaboration is fundamentally important in health care settings, where the status of oral health has gained heightened awareness to prevent disease.

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Poor oral health literacy: Why nobody understands you

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It's our problem, not theirs

Health literacy has been consistently defined as the degree to which individuals have the capacity to obtain, process, and understand not only the basic health information needed to make appropriate health decisions, but also the services needed to prevent or treat illness.[1] In this paper, we examine the mistaken interpretation of the word "individuals" to be limited almost exclusively to citizens and patients. This misinterpretation may seem logical if we define health literacy as "knowing medical jargon." However, true health literacy reflects a relationship of respect between the citizen and the caregiver in which the caregiver has the responsibility to listen and understand the citizen. The caregiver must also have the "capacity to obtain, process and understand" what the patient says and needs. In addition, as we apply health literacy to the entire communication context of health information, we face a similar confusion. The problem with health pamphlets, fact sheets, and websites is not only the reading level of citizens, but also the ability of the authors to understand to whom they are talking and how they must present information so that it is not only clear, but credible. This paper focuses on the mutuality of health literacy, on the responsibilities and competencies that caregivers and professional health communicators need to foster effective health literacy, and on the new measures of health literacy we need to capture this perspective.

Teetering at the tipping point: US government efforts to promote a health literate society

Health literacy has been identified as a priority area for national action in the United States, first by the Department of Health and Human Services (HHS) as an objective for its *Healthy People 2010* initiative, and again in the Institute of Medicine report *Health literacy: A prescription to end confusion*.[1] The decade that followed the release of these reports saw the achievement of many milestones that marked health literacy's ascendency in both the public and private sectors.[2]

The year 2010 was a banner year for US health literacy policy. First, the Patient Protection and Affordable Care Act (ACA) was passed in March. According to HHS' deputy assistant secretary for health, "Health literacy is in the ACA because health policy makers recognized that activated and informed patients are on the critical path to increasing access to coverage and managing costs—the goals of the ACA. Health literacy is mentioned dozens of times, directly or indirectly, in the ACA because policy makers understand health care cannot be reformed in any meaningful way without health literate patients."[3]

Second, the *National action plan to improve health literacy* was launched in May 2010.[4] The product of a public–private collaboration that puts forth 7 goals, the national action plan includes myriad strategies for achieving those goals and creating a health literate society. This roadmap reflects the current emphasis on the need to tackle system-level changes that make it easier for people to navigate, understand, and use information and services to take care of their health. HHS has not only intellectual leadership in making the conceptual case for health literacy, but has also furthered research, trained professionals, and otherwise encouraged adoption of evidence-based health literacy practices.

Third, the Plain Language Act signed into law in October 2010 made all federal agencies practise what they preach. The law, which is not limited to health care, requires each federal agency to use plain writing in every covered document.

As the decade progresses, health literacy is becoming infused with other health and health care improvement priorities. For example, health literacy is explicitly recognized as an aspect of being culturally competent in HHS' newly enhanced *National standards for culturally and linguistically appropriate services in health and health care*.[5] The US government continues to make an extensive effort to promote a health literate society.

It is our problem and we have some solutions! The Maryland model of oral health literacy

In 2007, the State of Maryland was in the limelight concerning children's dental health. This publicity was a result of the tragic death of Deamonte Driver, a 12-year-old who died from an untreated dental infection. The leadership of the state responded immediately and charged a task force (Dental Action Committee [DAC]) to provide a blueprint for action to address the lack of access to dental care for low-income children. One of the 7 recommendations of the DAC report was for the design and implementation of a statewide unified oral health education program aimed at policy makers, parents, health care providers, and

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the public. Our overarching goal was to decrease dental caries disparities among Maryland's children and youth. The approach is based on the PRECEDE–PROCEED model, a comprehensive approach to planning health initiatives. This is an essential first step towards creating a sustainable multisectorial state program dedicated to improving and promoting oral health literacy, which contributes to the state's capacity to ensure that no more Maryland children succumb to the ravages of dental caries.

Specifically the DAC's objective was to determine what parents, caregivers, and health care professionals know and do about tooth decay and its prevention. In addition, we wanted to know what, if any, communication skills health care providers use on a routine basis, and equally important, know what the public thinks about their health care providers' communication skills.

We collaborated with state medical and dental professional societies to conduct surveys and focus groups of 4 provider groups (dentists, dental hygienists, physicians, and nurse practitioners) to determine what they know and do about preventing dental caries among children 6 years of age and younger. We found that all provider groups could improve their understanding of caries prevention and early detection. We also conducted a phone survey of Maryland adults to determine what they know and do to prevent caries and their opinions regarding the communication skills of their dental providers.[6] To obtain more in-depth information, we conducted 6 focus groups—2 in Spanish and 4 in English—with low-income adults with young children. Collectively, we found adults to be greatly lacking in their understanding of caries prevention. Most assumed that early childhood caries is inevitable and must simply be endured. Partnering with the Office of Oral Health, Department of Health and Mental Hygiene, we also conducted surveys and focus groups with Women, Infants and Children's Programs (WIC) and Head Start directors and staff to help us understand what they know and do about caries prevention.

Based on these findings, we then conducted health literacy environmental scans in 26 of the 32 community-based dental clinics in Maryland.[7] The purpose of these scans was to determine the overall user friendliness of the health facility. Based on the information from our statewide assessment, we identified gaps in knowledge, understanding, and practices regarding caries prevention among the public and all provider groups. To help close these gaps, we created English and Spanish language evidence-based tools to address them. We developed educational interventions for gravid women, parents of young children, and health care provider groups, which we share with others. We also provide in-service training upon request to WIC, Head Start and the Area Health Education Centers. Although our focus is on dental caries prevention and early detection, the model could be used for other content areas.

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Using the best evidence to enhance dental hygiene decision making

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Introduction

An evidence-based approach to health care officially started in the early 1990s with leaders such as Drs. David Sackett and Archie Cochrane, although roots of this movement can be traced to earlier times. This approach has continually been implemented in all areas of health care, including dentistry. The American Dental Association (ADA) definition of evidence-based dentistry can be adapted as "an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence, relating to the patient's oral and medical condition and history, with the dental care professional's clinical expertise and the patient's treatment needs and preferences."[1] This definition includes the 3 critical realms: the science, the clinician's judgement, and the individual patient's needs and preferences.

Using evidence-based decision making (EBD) provides specific and individualized health care that is based on the most robust scientific evidence. Much debate has occurred around the role of each of these realms, but Dr. Sackett described it best when he said, "External clinical evidence can inform, but can never replace, individual clinical expertise." Dr. Victor Montori, another leader in the evidence-based health care movement, gave a clear assessment of the role of research when he stated, "The better the research, the more confident the decision," but he also stated that "Evidence alone is never sufficient to make a clinical decision." The key take-home message is that evidence and science inform, but never replace, clinical decisions.

Learning how to use evidence in making health care decisions is a acquired skill that is perfected over time. As illustrated in Figure 1, there are 5 steps in applying EBD. This paper will review these 5 steps and will offer insights into how to obtain the skills necessary to successfully implement each step.

Step 1: Make the question

This may seem like an easy thing to do, and we have much experience in asking all types of questions. However, developing a strategic clinical question does take skill and practice. The advantages of framing a clinical question are that it helps define exactly what information you are seeking and helps you know when you have found the answer. It also helps to define search terms and develop a successful search strategy.

Figure 1. Five steps for evidence-based decision making

A PICO question format is typically used, where P refers to the population, I refers to the intervention about which we are seeking scientific information, C is the comparison group (usually a placebo or current standard of practice), and O is the outcome being evaluated. Figure 2 provides an example of a PICO question. In this example, the lack of a defined question might lead one to consider a much larger patient population or use a wider pool of outcome

Figure 2. Sample PICO question

For patients with an orthodontic appliance, would the addition of professional fluoride varnish, when compared to home fluoride toothpaste use alone, reduce caries incidence?

P = orthodontic patients
I = professional fluoride varnish plus home fluoride toothpaste
C = home fluoride toothpaste
O = caries incidence

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measures. However, using the PICO question helps us to narrow our search to those patient populations with orthodontics and narrow our outcome measure to caries incidence, which in turn provides framing and focus for our clinical question. More recently, an S has been added to PICO, creating PICOS, in order to focus the question even more. It can be used for the type of study or the setting for which the question is needed.

Step 2: Access the evidence

This part of EBD would undoubtedly be quite a challenge without the capacity to do electronic searches of multiple databases. There are different approaches to searching online for evidence, and this is another skill that is acquired over time. One approach is to seek pre-appraised evidence first. Pre-appraised refers to evidence that has been evaluated and summarized by an individual or organization. The advantage of this approach is that it is typically quicker and provides concise information in a user-friendly format. Examples include evidence-based guidelines and critical summaries of research. Some resources for pre-appraised evidence are free; others require a subscription. Examples are found in Table 1.

A second strategy typically employed if an answer to the PICO(S) question is not identified through searching for pre-appraised evidence is to search databases for systematic reviews (Figure 3) and clinical studies. PubMed (http://www.ncbi.nlm.nih.gov/pubmed) is an open access database with handy multiple online tutorials (http://www.nlm.nih.gov/bsd/disted/pubmed.html). One very useful PubMed feature is the clinical queries search that enables the user to quickly identify both systematic reviews and clinical studies (http://www.ncbi.nlm.nih.gov/pubmed/clinical).

Figure 3. What is a systematic review?[2]

Systematic reviews have increasingly replaced traditional narrative reviews and expert commentaries as a way of summarizing research evidence.

High-quality systematic reviews seek to:

- Identify all relevant published and unpublished evidence
- Select studies or reports for inclusion
- Assess the quality of each study or report
- Synthesize the findings from individual studies or reports in an unbiased way
- Interpret the findings and present a balanced and impartial summary of the findings with due consideration of any flaws in the evidence

The Cochrane Collaboration is another online source of systematic reviews. The Cochrane Collaboration is an independent, non-profit, non-governmental organization consisting of worldwide volunteers. The collaboration was formed to organize medical research information in a systematic way in order to facilitate the choices that health professionals, patients, policy makers, and others face in health interventions according to the principles of evidence-based medicine. They conduct high-quality systematic reviews, and many consider Cochrane systematic reviews to be the gold standard. The Cochrane Oral Health Group (COHG) is 1 of 53 groups around the world, and has responsibility for preparing, maintaining, and disseminating systematic reviews of randomized controlled trials in oral health. The COHG has 1400 members from over 40 countries who contribute in different ways. The COHG always welcomes new members, and increasing the membership of this group is a priority. Increasingly, reviews are conducted on topics relevant to dental hygienists and dental therapists. For more

Table 1. Sources of pre-appraised evidence: guidelines and critical summaries

Organization	Website	Evidence type
American Dental Association's Center for Evidence-Based Dentistry (Free)	http://ebd.ada.org	Evidence-based guidelines Summaries of systematic reviews
Translating Research Into Practice (Free)	http://www.tripdatabase.com/	Evidence-based guidelines Summaries of clinical studies and systematic reviews
Scottish Dental Clinical Effectiveness Programme (Free)	http://SDCEP.org	Evidence-based guidelines
Database of Abstracts of Reviews of Effects (DARE) (Free)	http://www.crd.york.ac.uk/CRDWeb/	Summaries of clinical studies and systematic reviews
National Guideline Clearinghouse (Free)	http://www.guideline.gov	Evidence-based guidelines
Journal of Evidence-based Dental Practice (subscription)	http://www.journals.elsevier.com/journal-of-evidence-based-dental-practice/	Summaries of clinical studies and systematic reviews
Evidence-Based Dentistry journal (subscription)	http://www.nature.com/ebd/index.html	Summaries of clinical studies and systematic reviews

information please email cohg@manchester.ac.uk or visit http://ohg.cochrane.org.

Step 3: Appraising the evidence

Given that not all research is of equal quality, it is important to critically appraise published research to understand each study's strengths and weaknesses. This appraisal entails careful consideration of the study methods, which is typically the least read part of journal articles. It is critical to first understand the study methods and quality before one can begin to consider the significance of the results. This, too, is a skill that is developed over time. Fortunately, there are multiple checklists that can help one consider the important factors to appraise for each study design. Web links to such tools are available through the Resources page of the ADA's EBD website under the title of "Critical Appraisal and Evidence Analysis" (http://ebd.ada.org/en/resources/).

One of the advantages of seeking pre-appraised evidence, as described in the first search strategy above, is that there is no need to conduct a formal critical appraisal because this is included in the critical summary or guideline development process. Furthermore, these documents are developed by individuals with expertise in EBD and critical appraisal.

Step 4: Applying the evidence

Guidelines will provide clinical recommendations, and clinical judgement along with patient preference will influence whether they are adopted. For individual studies, there are 3 primary questions that need to be answered when determining whether evidence should be applied in practice (Table 2). Each has sub-questions that will help you to determine if the evidence is sufficient to enable you to apply it in practice. Answering these questions will help to determine 1) if the study results are trustworthy (Are the results valid?); 2) the anticipated outcome of implementing the intervention (What are the certainty and magnitude of the results?); and 3) if this outcome can be expected with your patients (Can the results be applied to my patient?).

Table 2. Questions to be asked when incorporating evidence into practice

Three primary questions	Sub-questions
1. Are the results valid?	Are the studies well designed and executed? What are the types of studies used?
2. What are the results?	What is the certainty of the effect? What is the magnitude of the effect?
3. Can the results be applied to my patient?	Is the population similar? Is the provider similar? Is the setting similar?

Step 5: Assessing the outcome

One of the aims of EBD is critical thinking. Step 5 is to evaluate the applied evidence in the specific clinical situation. This assessment includes determining which course of action is best and evaluating how well the whole process worked. Did the product or treatment work for this patient in this situation? Was the intended outcome achieved? Did the evaluation or treatment method help this patient? How much time did the process take, and even more important, was the cost efficient? Is the magnitude of the benefit of the additional treatment substantial, and is it worth the extra cost and time?

Conclusion

An evidence-based approach to health care requires combining the most current and comprehensive scientific evidence, the clinician's judgement, and the patient's needs and preferences to make individualized health care decisions. This approach will likely require developing new skills or enhancing existing skills to use evidence in practice both effectively and efficiently. The 5 steps of an evidence-based approach to health care will help any practitioner effectively implement science in practice.

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Overcoming the fear of statistics: Survival skills for researchers

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Introduction

One of the most common complaints I hear from clinician–researchers is that statistics are difficult to understand and apply. Misstatements such as "differences were *highly* significant, with p=0.008" or "our study proved X causes Y" reinforce common misperceptions associated with statistics. These statements illustrate 2 common fallacies. The first is that smaller p values can be interpreted as a larger effect; the second, that a small p value is evidence of "truth." In order to understand why these assumptions are fallacies, it is important to know what the p value represents.

The accepted convention for separating potential explanations (X causes Y) from chance happenings is testing the null hypothesis. One can think of testing the null hypothesis as a "ritualized exercise of devil's advocacy."[1] The null hypothesis is an artificial argument—that any difference between treatment groups is due to chance, assuming that the treatment has no effect. Researchers hope that this likelihood is small. The p value derived from statistical testing is an estimate; that is, the probability, assuming that the intervention is not effective, that treatment groups are different simply due to chance variation. If a small p value (conventionally ≤ 0.05) is obtained, then the researcher rejects the assumption of difference due to chance and accepts the alternative: differences are likely due to the treatment.

Groups can differ simply due to chance. Two common sources that contribute to this are sampling error and measurement error. Sampling error occurs when groups are inherently different by chance. Random assignment can reduce this error, but does not ensure group equivalence with respect to all factors that might influence the outcome. Measurement error can exist depending on how, when, where, and by whom outcomes are measured. Either source of error can introduce doubt as to whether change in the outcome (Y) is solely attributable to the intervention (X). Thus, it is not possible to prove causality. We can, however, estimate the probability (p) that observed differences between groups are based on "chance" using the null hypothesis.

Getting significant differences ($p<0.05$) is influenced by 3 factors: magnitude of effect, sample size, and variation in the data. Because sample size influences p value, a small p cannot be simply equated with large effect size. Results from a study with 1000 subjects will always have a much smaller p value than one with 100 subjects, given the same magnitude of difference between groups. Power of a statistical test—the likelihood of rejecting the null hypothesis when there is a real difference—is influenced by the number of observations/sample size.

Effect size is about actual differences. It can be determined from raw data (e.g., difference between group means) or standardized (raw effect size divided by the standard deviation). It is helpful for researchers to think about raw effect size as the minimally important difference (MID) that is clinically meaningful. The standardized effect size, which takes into account the variance, can be interpreted as a measure of "importance." Thus, it gives an objective estimate of the strength of association between the outcome and intervention/treatment. Common effect size measures include r^2, eta square, odds ratio, and Cohen's d.

Statistical decision making

So, why do clinicians often equate a statistically significant p value with truth about causality? Humans innately have a need for certainty. When individuals feel uncertain or there are multiple cues that need to be considered simultaneously, individuals often rely on one-dimensional rule-based decision making.[2] Such is the case with statistical analysis and interpretation.[3] Several researchers have criticized this "fantasy" of statistical testing as proving effectiveness, and have called for logical interpretation of data along with use of the p value, effect size estimate, and replication of findings.[4,5]

CONSORT (Consolidated Standards of Reporting Trials) Guidelines and Improved CONSORT Guidelines now encourage researchers to provide information about MID when publishing. They also suggest that MID be defined in advance and used as the effect size for designing clinical trials.[6] Despite changes in publication standards and improved statistical techniques available, clinicians and researchers still tend to fear statistics and make rash judgements about the meaningfulness of statistics. Consequently, the remainder of this paper will discuss issues that may help to demystify statistical testing and provide clinician–researchers with realistic strategies for improving the quality of their own research efforts.

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The logic of establishing causality

Establishing the causality between an intervention and outcome requires that 5 tenets be met. First, there must be a logical or biologically plausible relationship between the cause and the outcome. Second, exposure to the cause must precede development of the outcome. Third, there has to be evidence of strength of association. Fourth, and critically relevant to both proper design and statistical testing, is that there has to be a lack of competing explanations for the results. Last, evidence must be replicated. A single study does not provide sufficient evidence to support causality.

Study design is critical to making causal statements. Having a comparison group (or better yet, a control group if possible) is necessary to tease apart whether any observed changes are attributable to the treatment or intervention. While the statistical test (and associated p value) can give us an estimate of chance differences, it alone is insufficient. One must consider why treatment versus comparison groups might (or might not) differ. Some common reasons include:

- Individuals in the respective groups looked similar but differed in subtle ways that were undetectable but important.
- Changes observed over time could be natural occurrences (e.g., aphthous ulcers and healing).
- Measurement was flawed or unequally implemented.
- Study length was insufficient to capture impact over time.
- Not all subjects were available for all observation periods or differentially dropped from the study (missing data).
- There were too few subjects to capture a difference if it existed or there were so many subjects that even a trivial difference would be statistically significant.

Statistical tests as part of a logical argument

One of the most compelling books in print today is *Statistics as Principled Argument*.[1] Abelson argues for use of applied logic and good judgement along with hypothesis testing to make good decisions about study results. Psychologists have shown that people are highly susceptible to confirmation bias. Confirmation bias results when people selectively focus on information that reinforces preexisting ideas, thus resulting in overestimating the influence of systematic factors (like an imposed treatment) and underestimating influence of alternative explanations, including chance. This may cause individuals to conclude that an intervention is effective, especially if there is a p value from a statistical test of ≤ 0.05, without thoughtful consideration of other factors.

Since very few clinical researchers have the depth of understanding that underlies the field of methods and biostatistics, they are likely unaware of how a conceptual model, study design, and measurement can be used to their maximal benefit to answer meaningful research questions. Actively seeking out a consultation with a biostatistician with experience in the broad field of health-related research is one of the most effective ways to overcome a fear of statistics.

Getting a statistical consult

Obtaining a statistical consult during the design phase of a study is one of the best ways to maximize efficiency in the research process. Many institutions have statistical consultation services or individuals who can provide these consults. Find someone at your institution who is knowledgeable with whom you can discuss your project.

Once identified, prepare for the consultation in advance. Be prepared for the questions that the statistician may ask about previous research. In the literature, be attentive to how results may have changed over time. An interesting observation about study results is that effects often decrease over time. Lehrer suggests that "truth wears off" over time because our illusions about the meaningfulness of various research questions declines over time.[7] Being able to articulate this trend will be important for study design and power analysis. Getting the right estimate for sample size initially improves the likelihood of getting meaningful results.

In advance, draft an abstract that summarizes your proposed project using the PICO format.[8]

P (Population): Who is the population being studied?
I (Intervention): What is the intervention or exposure variable?
C (Comparison or Control Group): What is the most appropriate comparison or control group?
O (Primary Outcome Measure): What outcomes are feasible to measure?

A good consultation will usually result in modifying some aspects of your original research plan. So, be prepared to capture recommendations either in writing or audio recording. Clarify issues that are confusing at that time. A good consultant will help to identify potential confounding variables that should be controlled either by design or statistically. Make sure you leave with an understanding of how design, measurement, and statistical analysis fit together. Once you have drafted your proposal, get confirmation from the consultant that you have "gotten it right."

Make sure that you discuss how to set up your data for analysis. The statistical analysis plan, design of the study, capture of confounders, number and type of outcome measures, and statistical software will dictate the appropriate format. Unless you are completely comfortable with statistical software and the analysis plan, do not do this on your own. There is nothing more frustrating than to have all of your data entered, only to find it is not in an analysable format.

Conclusion

Most importantly, leave your apprehension at the door and look at the consultation as a unique opportunity to engage in creative planning. Statistics are wonderful tools, but only if used correctly. Statistical analysis programs manage the computational aspects but do not overcome bad design and incorrect analyses. If you approach the research process just as you would plan a trip to a foreign country, you can avert the fear of statistics and pain of failure.

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Millennials and dental education: Utilizing educational technology for effective teaching

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Millennials arrived on campus in the year 2000 and will continue to be part of the college campus for the next decade. Their unique characteristics, diversity, and expectations for the learning environment are transforming the college classroom and challenging faculty to examine traditional pedagogy as well as the learning environments offered to students.[1] Attitudes, beliefs, and values are influenced by the people, places, and events in our history, and therefore uniquely shape each generation. These influences establish different motivation levels, work ethics, and worldviews that impact teaching and learning. This paper will aid in understanding generational differences and may help dental educators improve their teaching effectiveness.

Millennials have and will continue to influence higher education, first as students, then as faculty. Millennials bring a new generational personality to the college campus, which includes optimism, structure, team orientation, and a confidence that some believe borders on entitlement.[2] Millennials are used to being engaged with adults, and have strong bonds with their parents who throughout their lives have told them they were special and included them in decision making. Consequently, most have the same values as their parents, respect authority, and are rule-followers.[2] Millennials had fewer academic demands in high school than previous generations and, upon arriving on campus, expect the same minimal demands in college. Faculty have found that these students have unrealistically high expectations of success combined with a surprising low level of effort on their part.[3]

Millennials exude confidence and are extremely optimistic. The majority of Millennials are personally happy and excited about their future as they believe they will correct the ills of society.[2] Tangible achievements and rewards are important to them, and they expect praise and encouragement from their college professors, as all of their lives they have heard "good job" for most of what they did. Since the arrival of Millennials on the college campus in 2000, faculty have been trying to figure out how to manage the amount of involvement and feedback these students demand.

Millennials are high achievers and are focused on grades and performance.[4] This generation wants a clear, structured academic path and sees a college education as an expensive consumer good. This mindset translates tuition into a college degree and good grades. In the classroom, students will often dismiss homework as "busy work" when it has no relevance to personal goals. In college, Millennials are finding that self-esteem cannot deliver their expected success, and many are showing signs of stress and anxiety, prompting the rise in academic and mental health resources on today's college campus.

Leisure time is a priority for Millennials. When these students were growing up, they were highly scheduled with traveling sports teams, music lessons, camps, and organized playgroups. As college students, they have less "free time" than any other generation of students due to time commitments to school, sports, social activities, work, and volunteerism. Technology allows Millennials to stay connected and has blurred the lines between work and personal life. They stay in uninterrupted contact with the world around them and, consequently, the workday is no longer 9 to 5, thus motivating Millennials to desire work/school-life balance.[3]

While there is an abundance of information on the traits of Millennials, less has been published on teaching methodology that aligns with the way Millennials learn. Interestingly, many components of Millennials' ideal learning environment—less lecturing, active learning approaches, use of multimedia, collaboration with peers—are some of the same pedagogical approaches that research is showing to be effective.[4,5]

First, because of their highly scheduled childhood, their need for structure carries over into the classroom. The more structured and planned the course, the more secure and satisfied this student will be. This generation prefers to know the facts and does not like ambiguity. A common question of this cohort is "What do I need to know?" Millennial students expect emphasis on core knowledge and skills and expect frequent formative feedback on their performance, as well as frequent review sessions. Frequent formative feedback has shown to improve the learning process, and literature suggests that people learn when they actively monitor their learning and reflect on performance.[5]

In addition to their focus on what information they need to know, Millennial students want to know why they need to know it. Their desire for learning to be relevant and related to their experiences cannot be underestimated.[4]

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However, these students have difficulty seeing the big picture and thinking independently, and will rely on the instructor to make a connection between their lives and course material. Teaching methods emerging from constructivist theory support the way Millennials want to learn, including active learning strategies such as cases, cooperative learning, group projects or skill demonstration. Millennials also desire variety in the classroom and, interestingly, research has demonstrated that people learn best when they receive new materials multiple times but in different ways.[5] Service-learning in education grew out of constructivist theory as well and, when paired with structured reflection, has been demonstrated to improve students' academic, personal, social, and citizenship skills.

Millennials' penchant for connection is manifested in the classroom in several ways. After many years of collaborating at day care, on sports teams, in school and on volunteer projects, Millennials know how and when to work with other people very effectively.[2] Accustomed to teaming up, these students desire collaborative learning in the classroom. Millennial health care students are primed for health care reform, which emphasizes team-based care and interprofessional education. Their desire for connection extends to faculty as well. Having been raised by caring parents and other adults, Millennials want faculty to get to know them, and they care more about how their professors interact with them than about what their professors know.[4]

Technology is perhaps the most distinguishing characteristic of the millennial generation. For this generational cohort, personal computers have always been there and are as ubiquitous and common as a coffee pot. Millennials expect a multimedia-enriched classroom environment. In one study, professors who used multimedia (YouTube, movie clips, etc.) saw better student test scores on quizzes and examinations.[5]

These students expect to communicate with faculty via e-mail and have access to online resources. Faculty will need to serve as a facilitator in order for students to collaborate with each other. It is important for faculty to "frame" the course and supplement student interactions by providing resources and opportunities. Additionally, faculty need to develop a conceptual rationale for incorporating technology into their teaching, identifying how it fits with their philosophy of teaching and learning. In other words, technology should not be used for its own sake but rather only if it enhances teaching and learning.[6]

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Getting your name in print

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The conduct of research and the dissemination of resulting relevant findings create a profession's body of knowledge. For dental hygiene to advance, a cadre of adept researchers must be developed. These researchers must have the skill sets that enable publication of their work. The main goals of this workshop were to successfully instill the self-confidence and impart the knowledge necessary for iterant scientific writers to publish in a peer-reviewed journal. Designed to be interactive, participants applied basic principles of scientific writing and the writing process through self-assessment exercises and individual or group opportunities that allowed attendees to critique and create workable documents. The dual emphases of helping writers write well and write well scientifically were intertwined in group activities.

Scientific writing is a unique approach to sharing information. Several characteristics differentiate it from other styles. Scientific writing must be systematic, as it reflects information that was obtained through a systematic process. While providing the readership with new findings and ideas, scientific writing is expected to reflect an economy of words, a neutral tone, lucidity, and precise wording. The workshop highlighted the need to link thoughts to each other and to present a logical progression of ideas, as well as the methods for emphasizing organization of content and logical flow. For example, a literature review must proceed from the general to the specific to arrive at a focused research question or hypothesis. This same flow of ideas, i.e., from a broad introduction to specificity, should be apparent in each paragraph of a paper. Workshop participants assessed sample papers that required changes in organizational flow. Determining the relevance of inclusions was also examined. Attendees critiqued writing samples and identified superfluous information. Participants self-assessed and modified their own writings to reinforce organization and economy of words.

Scientific writers must address the required components of a research paper and adhere to the guidelines of their publication of choice. Specific elements of research papers most often include the following: title, abstract, introduction/literature review, methodology, discussion, findings, references and appendices, figures, and tables. A scientific, cogent yet attention-grabbing title that reflects the content of the manuscript must be developed. Tips for title creation were delineated, and examples of titles were critiqued and modified. Participants reviewed abstracts and identified whether required parts were included or omitted. How to organize and write the body of the paper, congruent with the paper's abstract, was addressed. We also identified the elements of the methodology section and provided examples of how to group and present results through group activities. The challenges associated with the discussion section and its relationship to the results were discussed. Writers sometimes have a tendency to restate results in discussions and offer discussion points in the results section. Paring down discussions can be challenging in scientific writing, but not all results merit discussion. Moreover, similar findings may be summarized and described in a single paragraph. Researchers often tend to overstate their findings. Limitations associated with sample sizes, research design, and control of extraneous variance must be addressed when findings are discussed.

The formal stages of the writing process were presented. Specific phases include invention (pre-writing), development of a thesis statement, outlining, writing the first draft, revising, and polishing. Since writers process and utilize information differently, their approaches to putting pen to paper differ. Less formalized approaches but useful steps in the writing process include examining the purpose of the paper, how it will be achieved, and brainstorming. Pre-writing may include a random collection of thoughts and ideas that adhere to no particular order. Jotting down or typing random ideas when they enter the writer's mind is a commonly used and helpful way to stimulate thinking.

The workshop emphasized the benefits of outlining, which promotes a hierarchical and systematic approach to writing. To promote order and organization, participants were advised to begin each paragraph with a topic sentence and ensure that paragraph content supports and elucidates introductory sentences. Participants created thesis statements to begin paragraphs and then outlined the subsequent related content. Attendees shared their pre-inventive stages and writing approaches. They discussed ways to improve their processes of writing, and the facilitators and other attendees offered additional suggestions. Other thoughts related to the writing process were shared. Participants were reminded that writing takes time, and editing and re-editing are continual processes; many authors advise taking breaks during the actual writing

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of the paper to clear their minds and enable a return to work with a fresh perspective. Attendees were also advised to seek input from other accomplished writers, researchers, and objective parties during editing and re-editing.

Major grammar and punctuation pitfalls and scientific writing taboos were discussed. Scientific, as opposed to narrative, writing employs no superlatives, is preferably stated in the voice of third person, and uses active, not passive, verbs. Contractions must be avoided and acronyms cannot be used until the proper name for a term has been previously spelled out in the text. Including vocabulary that is difficult to understand in an effort to sound intellectual is discouraged. Flowery prose must always be avoided. Beginning statements with terms such as "there is" or "it is important that" dilute the power of a thought. Subject and verb agreement and parallelism of subjects and possessive pronouns—common grammatical errors—were cited. Participants were advised to be mindful of creating a need to know, beginning with the manuscript title, maintaining an optimal rate to impart information, avoiding ambiguity, and jumping to conclusions (particularly in the discussion and conclusions sections). The workshop also encouraged writers to utilize a thesaurus and dictionary (electronically or hard copy) and to take advantage of spelling and grammar checking software programs. Overreliance on spell check programs was discouraged, as a word may be spelled correctly but still used inaccurately in a sentence.

Knowing the prospective audience helps the writer to decide what information to include in the research report. An article directed towards a narrow audience will have a different perspective from one submitted to a journal that is relevant to a broad range of disciplines. Regardless of the audience, findings and conclusions must be stated clearly with as few words as possible. In addition, referencing content is critical in scientific writing. A fatal flaw and reason for article rejection is plagiarism. Quoted material must be acknowledged. The use of secondary sources is prohibited. Returning to the original reference is required, as the author who first cites the article, i.e., the secondary source, may tweak an original statement inadvertently and that thought could be more distorted in subsequent iterations. A return to an original document ensures that both the original intent of a statement or finding and the details of the citation are accurate. Publishing is not a perfect art so errors can occur. A repetition of the same citation error could indicate the author's use of a secondary source; that is, copying the inaccurate secondary source's reference information. Authors are required to adhere to the referencing guidelines of the publication to which they are submitting. Any questions about guidelines should be directed to the journal of interest.

Finally, workshop attendees received a list of resources to utilize as they develop their writing skills. A key tool for perfecting one's writing skills is reading and studying published work. Published reports, particularly those in peer-reviewed journals, have undergone rigorous reviews so using them as a guide can be advantageous. Publications also can serve as springboards for developing research ideas. Practising writing is another way to develop skills and build self-confidence. To quote Dr. Seuss, "So the writer who breeds more words than he needs is making a chore for the reader who reads." In conclusion, rewriting remains the best form of writing.

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Becoming an effective journal reviewer

Ann Eshenaur Spolarich*, PhD, RDH; **Rebecca S Wilder**§, MS, RDH

Peer review is a time-honoured process that uses editors and experts to evaluate the scientific merit of 1) manuscript submissions to journals; 2) abstracts and papers submitted for consideration for presentation at professional meetings; and 3) grant applications requesting funding for research projects. For journal submissions, the process is used to ensure a level of confidence in the rigour of the research process utilized to conduct a scientific investigation and the accuracy of the study findings and conclusions presented. Papers published in peer-reviewed journals are assumed to have a higher level of quality than those published elsewhere. For non-scientists, peer-reviewed publications remain the "gold standard" as credible, trusted sources of information.[1]

Challenges

Finding individuals to serve on editorial review boards can be challenging for editors. An editorial by William Perrin explored the issues that editors face in finding individuals who will agree to serve as reviewers.[2] A primary difficulty encountered is that often the leading recognized experts in a given field who are best suited to review the paper are "too busy" with their own work, requiring editors to then move down the list of choices to locate individuals who have enough knowledge of the subject matter to review the paper. The worst-case scenario for the editor is having to reach out to reviewers who are not experts in the subject area or not as closely related to the field, increasing the likelihood that the quality of the review will be less than desired.[2] Neither editors nor authors benefit from the outcomes of this process.

Reviewer responsibilities

The primary responsibilities of a reviewer are to inform the editor about whether a manuscript is acceptable for publication and to provide the author with an understanding of how to improve the submission. Reviewers should be able to identify and discuss strengths and weaknesses of a given paper, minimizing not only the time spent searching for minor strengths in a paper that is obviously weak and should be rejected, but also the tendency to obsess over minor weaknesses in a paper that is otherwise strong.[3] The review should be conducted efficiently and returned to the editor promptly to avoid unnecessary delays between time of submission and notification to authors.

Zucker states that reviewers make two common mistakes.[3] First, reviewers often request that authors conduct additional work and/or submit additional data as a contingency for publication. Reviewers should not approach a manuscript review thinking about how they would have conducted the study. A request for additional data should not be made lightly, as it places considerable burden on the authors. It is important to remember that submitted manuscripts represent a body of work that has been completed. Therefore, if the stated conclusions in the paper are not supported by the work described, then the reviewer should recommend to the editor that the paper be rejected. Second, reviewers may fail to consider whether the paper is appropriate for publication based upon how well it aligns with the stated goals and requirements of the journal. A reviewer needs to decide whether a paper that is well-written and novel should be accepted if the paper has not been constructed according to stated guidelines.

Reviewers also should consider the amount of work that will be required by the author to revise the paper to meet posted journal standards.[3] For example, if a manuscript far exceeds the word count allowed by the journal, the reviewer may recommend that the authors either substantially reduce the word count or submit to another publication that will accept longer papers. The reviewer should clearly communicate these concerns to the editor early in the review process in order to come to a consensus on how to advise the author about needed revisions.

Other skills and knowledge are required to become an excellent journal reviewer. The following is a list of important aspects of reviewing for peer-reviewed journals.

1. All reviewers should be familiar with the guidelines to authors. Knowing the suggested word count, format for references, tables, figures, etc. is essential.
2. Respond to the request to review a paper. Reviewers are asked to evaluate papers based on their specific expertise. Editors may have limited numbers of reviewers with the expertise needed for a particular paper. If reviewers fail to respond, it delays the entire process for the authors and the editorial staff. Even responding with a "No" will help the process move forward.

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3. Start the review process from an optimistic point of view. Many reviewers find ways to reject a paper, expecting authors to convince them otherwise. Good reviews help authors to improve their work even if their papers are not accepted for publication. Reviews that "tear a paper apart" are not useful to the editor, author or reputation of the journal. The review should provide a balance between positive feedback and critical assessment of what needs to be accomplished to improve the paper. The best reviews provide critical commentary with concrete recommendations
4. Provide reviews that are tactful, constructive, and as professional as possible. Wording such as "Who cares?", "This sentence makes no sense," "I disagree with this statement," and "This is bad" can be restated so the author does not become defensive and overlook the valuable insight of the reviewer. One might wish to approach every review as if it were a graduate student who needs to be mentored. In addition, be a role model of good writing by providing reviews that are free of typographic and spelling errors.
5. Most reviewer evaluation forms have a section where reviewers can provide confidential comments to the editor. Do not make substantive points about a paper unless those comments also are shared with the authors. It is frustrating to editors if the confidential comments are more crucial than what will be shared with the authors. It also can place the editor in an awkward position if the decision regarding the manuscript does not coincide with the review.
6. Reviews need to be prioritized. It should be clear what are priority areas for revisions and what are suggested changes to improve the manuscript. In addition, justify statements with references and logical arguments.[4] Even if the reviewer recommends that the paper be rejected, a thorough review with some encouragement and advice will help the author improve future research and writing efforts.
7. Submit the review to the editor on time. If the situation changes and more time is needed, communicate with the editor to ensure a timely review process for the authors.
8. After the first reviews are submitted to the authors, resist the temptation to add additional requests in subsequent reviews that are not related to the original revisions. Authors become frustrated if they have responded to all of the recommended revisions only to have others added in the second or third round.

Other considerations

Serving as a reviewer is an expectation of all scientific professionals, and this responsibility should be included in job descriptions for faculty and as a requirement for tenure.[2] It also is an honour and privilege to contribute to the profession by supporting and improving the peer-review process. However, it is becoming increasingly difficult to serve as a reviewer, as fields of study are becoming more specialized, scientific technology is increasingly complex, and research projects cross multiple disciplines. For interdisciplinary projects, it is not realistic to expect 2 or 3 people to have expertise in all aspects of the project. When a reviewer is asked to look at a paper that is outside of his or her expertise, the nature of the question asked by the reviewer changes from "Is this paper a significant contribution to the literature?" to "Is there anything about this paper that makes me feel uncomfortable?"[5] While the reviewer is expected to detect notable design flaws in a paper, it may not be easy to do so if the reviewer has not engaged in a similar type of work or if the reviewer is unaware of subtleties, such as cultural differences or variances due to study setting, that might be inherently important to project design and related outcomes.

Further compounding these challenges is the notion that faculty feel increasingly pressured to publish and, in response, choose to "split" their work across multiple papers, submitting pieces of the same study to several journals with the hope of improving the odds of getting a paper accepted for publication. The increased number of submissions and the finite number of available reviewers overloads the peer-review system. When there are fewer reviewers available to look at a paper, the process of review is delayed, limiting the dissemination of new knowledge in a timely manner.[5]

To entice more individuals to participate in peer review, individuals need to find a balance between the demands of the typical academic workload and the time needed to serve in this capacity. Some have examined how best to reward the efforts of those who dedicate their time and talents as reviewers, especially for those who consistently provide thoughtful, comprehensive, and quality reviews. If serving as a reviewer becomes a stated expectation for faculty promotion and tenure, then a method to measure and document performance is required to help ensure that participation will "count" as a scholarly activity among the metrics used to determine eligibility for academic advancement. Finally, new software systems used to track manuscript submissions and corresponding documentation can be used to archive reviews, which can be used to train reviewers and evaluate reviewer performance over time.[6,7]

Conclusions

Serving as a reviewer for a peer-reviewed scientific publication can be a challenging yet rewarding experience.

Professionals seeking an appointment as a reviewer or membership on an editorial review board must be willing to dedicate time and expertise and be willing to be constantly educated about how to become a better reviewer. Conducting reviews in a positive manner with a spirit of professionalism will assist in encouraging and mentoring the future investigators in the field.

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Successfully navigating the human subjects approval process

MaryAnn Cugini, MHP, RDH

In order to successfully navigate the human subject approval process in clinical or behavioural research, one needs a good understanding of the ethical principles guiding the conduct of research involving human subjects. Federal and international codes and guidelines frame the context of ethical research. These codes and guidelines include The Nuremberg Code (1949),[1] the Declaration of Helsinki (1964-2000),[2] The Belmont Report (1979),[3] Council for International Organizations of Medical Sciences (CIOMS) and World Health Organization (WHO) International Guidelines (1993, 2002),[4] and the International Conference on Harmonization: Good Clinical Practice Guidance (ICH/GCP, EU, 1996).

There are 3 ethical principles that guide all research involving human subjects: beneficence, justice, and respect for persons.[3,4]

- *Beneficence* refers to the ethical obligation to maximize benefits and minimize harm. In effect "do no harm." Assessment of risk falls under this principle. Risk in this context is defined as the probability that certain harm will occur to subjects from participation in research. It is the obligation of investigators to minimize this potential by selecting optimal study designs and interventions for their research.
- *Justice* is the ethical obligation to treat each person (population) equitably and equally. In this principle, the benefits and burdens or risks of research to participants and populations should be distributed fairly among diverse populations. Justice protects vulnerable populations from exploitation and protects of the rights and welfare of vulnerable persons.
- *Respect for Persons* incorporates 2 ethical considerations: respect for autonomy and protection for persons with reduced autonomy. Autonomy refers to a person's ability to make sound decisions. In research, an autonomous person must be able to consider the potential harms and benefits, analyse the risks associated with the proposed research, and make a decision in his or her own best interest. This autonomy includes the ability to read and understand the informed consent document.

In 2000, Emanuel, Wendler, and Grady proposed a framework of 7 ethical principles for clinical research studies, believing that informed consent is not sufficient to ensure ethical research.[5] Expanding on the 3 basic principles described above, this framework adds the principles of social or scientific value, meaning that some enhancement of health or knowledge must be derived from the research, and scientific validity, meaning that the proposed research has a rigorous scientific methodology including statistical tests that produce reliable and valid data.

In the US, the Office for Human Research Protection (OHRP) in the Department of Health and Human Services (HHS) provides leadership and structure for overseeing the rights and welfare of subjects participating in research conducted or supported by the HHS. These guidelines and policies are published in the Code of Federal Regulations (CFR) 45 CFR part 46. The Food and Drug Administration (FDA) regulates human subjects in clinical investigations involving drugs, biological products, and medical devices. FDA regulations are published in 21 CFR parts 50, 56, 312, and 812, covering not only protection of human subjects, but also regulations for Institutional Review Boards (IRB) and other areas in the review process.

Most academic institutions have ethics or human subjects committees that review projects involving the participation of human subjects as research subjects for both behavioural and interventional studies. Independent, central IRBs also exist to serve those companies or investigators not affiliated with an academic or medical institution. IRBs such as the Western Institutional Review Board (www.wirb.com) and the New England Institutional Review Board (www.neirb.com) may review pharmaceutical or clinical protocols for studies conducted in private practice.

Is it research? A first step in determining the need for IRB review is to decide if in fact the proposed project is research and then if it is research involving humans. The US OHRP (www.ohrp.gov) provides a series of decision trees to assist investigators in understanding human subject regulations (http://www.hhs.gov/ohrp/policy/checklists/index.html). These decision trees list the categories under which a research project may be exempt from IRB review and are a good resource for the investigator in planning for IRB review. Exempt categories for research can include

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research involving educational tests, survey procedures or observation of public behaviour, and research involving the collection or study of existing data, documents, records or pathological or diagnostic specimens. A primary reason for the exemption is that the subjects involved in the research cannot be identified, meaning there are no personal identifiers that can link the data to the research subject. IRB submission is still required and final determination of exemption is decided by the IRB; in some institutions this determination is made by the Scientific Review Officer.

It is the responsibility of the IRB to review non-exempt research proposals prior to any human involvement in the research. An IRB has the authority to approve, require modifications or disapprove all research activities. (§45 CFR 46.109)

- *Approval:* If the IRB has approved the research involving human subjects, the research may commence once all other organizational and/or local approvals have been secured. IRB approval is granted for a limited period of time, not exceeding one year, which is noted in the approval notification letter.
- *Requires Modification(s):* If the IRB requires modifications to secure approval, the notification letter will outline specific revisions to the human research protocol and/or study materials, e.g., consent form. Human research may not commence until the IRB grants final approval. If the Principal Investigator accepts the required modifications, she or he should submit the revised materials to the IRB within the timeframe specified. If all requested modifications are made, the IRB will issue a final approval notification letter after which time the human research can begin.
- *Deferral/Disapproval:* If the IRB defers or disapproves the human research, the IRB will provide a statement of the reasons for this decision. Deferral or Disapproval means that the human research, as proposed in the submission, cannot be approved and the IRB was unable to articulate specific modifications that, if made, would allow the human research to be approved. In most cases, if the IRB's reasons for the deferral or disapproval are addressed in a modification, the human research can be approved. In all cases, the Principal Investigator has the right to address his or her concerns to the IRB directly at an IRB meeting and/or in writing.

One of the major areas assessed by the IRB when reviewing a research protocol is the potential risk to the subjects from their participation. As mentioned previously, when discussing the ethical principle of beneficence, it is incumbent on the investigator to minimize potential risk. Some research will by its nature involve more than minimal risk. In this instance, a risk/benefit analysis is presented to the IRB to assist the review process. A second focus of IRB review is the informed consent document. This document is assessed to ensure that it contains the elements for consent as determined by the regulations and ethical guidelines: purpose of the study, risks and benefits associated with participation, alternatives to participation, confidentiality, compensation, a statement of the right to refuse participation at any time without penalty, and a person to contact if they have questions about their participation or the research. In addition, the consent form should be written in such a manner that it is understandable by a person who can read at the 8th grade level in their native language.

Human Subject Protection Training serves as the initial guidance for new investigators conducting research involving human subjects. Institutions provide this training, and there are online courses available as well. Documentation of Human Subject Protection Training by the investigator and those involved in the project is needed for submission to the IRB. This training provides the investigator with a basic understanding of the current regulatory and ethical information. Topics include the basics of IRB regulations and the review process, assessing risk to participants, avoiding group harms, conflicts of interest, and cultural competence. Also included is information on FDA-regulated research, genetic research, HIPAA-regulated research, informed consent, international research, Internet research, records-based research, research in schools, research with protected populations, and research with vulnerable subjects, unanticipated problems and reporting, and students in research. Web-based training can be found on the National Institutes of Health (https://phrp.nihtraining.com) and private educational websites such as the Collaborative Institutional Training Initiative (CITI) at the University of Miami (www.citiprogram.org).

Often considered daunting, obtaining review from an IRB for research involving human subjects can be a collaborative effort. The IRB can provide guidance and direction to the investigator, allowing her or him to conduct valuable research with the subject's welfare and well-being at the forefront.

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Data management 101: How to construct and maintain a usable dataset

R Curtis Bay, PhD

We advance our understanding of the human condition by asking questions. In dentistry, these questions are best answered through formulation of hypotheses that allow us to test the validity (truthiness) of one possible answer against others. Simply put, "This new treatment is better than what we have always used" or it is not.

Clinical questions arise naturally in the practice of clinical dentistry. Frequently, they are based on the desire to use the best available practices and procedures to optimize care for patients. Answers to clinical questions are readily available in the numerous dental journals and online content that have proliferated over the past few decades using an evidence-based approach to dentistry. Much of the evidence is trustworthy. Much of it is not. The best and most trustworthy evidence is investigator-initiated; that is, arising from clinical practice and initiated by those who seek a truthful answer, untainted by financial interest. Of course, trustworthy research is the product of sound scientific methodology. Fundamental to sound methodology is the construction of a consistent and replicable plan for data acquisition, recordation, and analysis.

This paper focusses on the basic requirements for designing, constructing, and maintaining a dataset collected in the course of conducting a research study. The nature of data and how data serve the purpose of research, including the various types or "qualities" of data that may be collected, are also discussed. Some types of data (interval and ratio-level) are more informative than others (ordinal and nominal data). It is almost always best to collect the most informative type of data that can practicably be collected. Data can always be "dumbed down" by recoding, but it is very hard to "smarten-up" data once it has been collected.

Statisticians tend to like numbers and information that comes in the form of numbers. Statistical software programs are designed to analyse numbers. This session shared methods to codify information in order to make datasets more amenable to statistical analysis. Examples included Male as "1"; Female as "2"; Amalgam as "1"; Composite as "2"; Glass Ionomer as "3."

Very importantly, the discussion during the session included strategies about how best to communicate with the project statistician. Researchers should initiate communication with a statistician before and after data collection forms are designed; before these forms are used; after data entry has started and before it is completed; during the statistical analysis; and after it is finished. An open line of communication with the statistician will help to ease frustration and avoid headaches for all parties involved in the process.

Along with the data, the researcher should present the statistician with a "data map," or "dictionary" indicating explicitly what each variable is, the scale on which it was collected, and what the data elements mean. Specifically, what does a "1" mean in an Excel column labeled "Gender"? A "3" which is intended to represent an ordered category (3 out of 5 on a preference scale) will be treated very differently from a "3" reflecting a nominal category (e.g., glass ionomer). The researcher should formally document the meaning associated with each number in a written form: Word and Excel work well. It is poor form to hand a statistician handwritten notes with multiple deletions and corrections or to convey this information orally. Doing so may result in forgotten or lost communication, and the potential downgrade in priority of the project.

Find out early on if the analysis planned for the dataset requires a "wide" or "long" format. These are very different, and converting one to the other may be tedious. Simple, one-observation-per-subject datasets are straightforward: one line per subject, column headings in the first row. If the analyst is planning a mixed-effects treatment of the data, repeated measures on each subject are typically best treated in a one-observation-per-row format, with a unique identifier for each subject repeated across rows (a "long" format). However, some analyses (e.g., repeated measures ANOVA) require that all information, across all observations for a single subject, be entered in one row: a "wide" format.

In a "long" dataset, one or more variables must be included indicating how the multiple rows for one subject differ from one another. If row 1 is for a baseline visit, row 2 is the first follow-up, and row 3, end-of-trial, then a column must be created to convey this information. It might be labeled "Visit." This information, of course, must be included in the data map.

Each cell in a spreadsheet can include only one piece of information. If the subject indicates that he is White, African American, and Hispanic, this requires 3 columns in the spreadsheet. The statistical software, on import of the spreadsheet, will interpret a cell entry of "1 2 5" as text,

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rather than a series of numbers. If a subject is asked to list the years in which he has had restorative dental work performed, and he lists 5 years, this requires 5 columns in the spreadsheet. Worst are the "check all that apply" formatted questions. A separate column must be included for every possible response. An endorsement of a category equals "1"; a non-endorsement should be coded as "0."

Missing data should be explicitly coded as such; not with the word "missing," but with a numeric value that could not possibly be valid for a given variable. As an example, "99" entered as a value for a Likert-type variable scored 1 to 7 is an invalid entry, and must be flagged as "missing" by the analyst. Once "99" is defined as "missing," the statistical software will ignore that particular observation in subsequent analyses. Missing values should appear in the data map so that the analyst can define them as such before beginning the analysis. Again, do not type "missing" into a column that is defined as a numeric field. The data will be imported as text, rather than numeric, and will require conversion before the analysis proceeds.

Having analysed data for over 2,000 projects during 12 years at an academic medical centre, and another 10 years at a dental, medical, and ancillary health sciences university, I issue this plea: CHECK AND CLEAN YOUR DATA BEFORE GIVING IT TO YOUR ANALYST!

I have re-run hundreds of analyses because the researcher failed to check his data before giving it to me. The analysis is completed; the output is sent to the researcher; we meet to go over the results. "Whoops! Those should be '7s,' not '6s.'" Or, "Those values aren't possible for that variable." "Sorry, I should have checked my data more carefully. Would you mind re-running all of these analyses after fixing my mistakes?" Ask your analyst to run a set of *descriptive* statistics on the dataset, including means, standard deviations, frequencies, minima and maxima so that the numbers can be reviewed before the actual analysis begins.

And, as an aside, in spite of the fact that the popular press insists upon making "data" singular, as in "The data shows that...," the word "data" is not singular, but plural. The singular form is "datum." When communicating with a statistician, nothing will mark you as unsophisticated as readily as asking him or her "what the data shows." Asking what the data "show" will immediately convey that you are "adept" with numbers, which will gain the statistician's respect and admiration.

In addition to a discussion of the fundamentals of data preparation, advantages and disadvantages of using databases rather than spreadsheets to capture research data were explored during the session. Database software offers the potential for more security than software conventionally used for spreadsheets, and is highly customizable. It also requires considerably more skill to navigate, especially during the setup phase. In the case of complex datasets, with one-to-many relationships and/or highly sensitive content, databases may be worth the extra effort.

The session included a discussion of Internet-based data collection systems, such as SurveyMonkey®, Qualtrics, and REDCap™ (Research Electronic Data Capture), noting the highlights and lowlights of each. Finally, a quick overview of Microsoft® Excel (spreadsheet), SPSS (statistical software), and Microsoft® Access (database) was provided, with a demonstration of how each may be used for research data collection and analysis.

POSTER SESSION: TOPICS AND PRESENTERS

Access to care

Dental hygienist attitudes concerning willingness to volunteer care for the underserved population
Lynn A Marsh, EdD, RDH
Farmingdale State College, USA

University of Maryland School of Dentistry, dental hygiene students and interprofessional education in HIV: Involvement in the Institute of Human Virology's JACQUES Initiative (JI), University of Maryland School of Medicine
Marion C Manski, MS, RDH; Sheryl E Syme, MS, RDH; Jacquelyn L Fried, MS, RDH; Alexandra Reitz, BS; Valli Meeks, DDS, MS, RDH; Sharon L Varlotta, MS, RDH
University of Maryland, USA

The association between early childhood caries (ECC), feeding practices, and an established dental home
Erin A Kierce, BA, RDH[1]; Linda Boyd, RD, EdD, RDH[1]; Lori Rainchuso, MS, RDH[1]; Carole A Palmer, EdD, RD, LDN[2]; Andrew Rothman, MS, EIT[3]
[1]Forsyth School of Dental Hygiene, MCPHS University, [2]Tufts University School of Dental Medicine and Friedman School of Nutrition Science and Policy, [3]MCPHS University, USA

Snapshot of dental hygiene diversity trends
Andrea L Beall, MA, RDH; Rosemary D Hays, MS, RDH; Lisa B Stefanou, MPH, RDH; Cheryl M Westphal Theile, EdD, RDH
New York University College of Dentistry, USA

Geographic comparisons of Washington state non-traumatic dental complaint emergency department patients
Jacqueline A Juhl, MSDH candidate, RDH; Ellen J Rogo, PhD; JoAnn Gurenlian, PhD, RDH
Idaho State University, USA

Gender differences in masticatory difficulty in elderly Koreans
Yeun-Ju Kim, BA, RDH[1]; Won-Gyun Chung, DDS, PhD[1]; Yang-Hee An, RN, HCNS, PhD[2]; Chun-Bae Kim, MD, MPH, PhD[3]; Nam-Hee Kim, MPH, PhD, RDH[1]
[1]Department of Dental Hygiene, [2]Department of Nursing Science, [3]Department of Preventive Medicine, Yonsei University, Korea

Attitudes, behaviours, and needs of team dentists
Lesley A McGovern, BS, MS candidate, RDH; Ann E Spolarich, PhD, RDH
Herman Ostrow School of Dentistry, University of Southern California, USA

Basic science

Comparative anti-gingivitis efficacy of oscillation-rotation electric toothbrush versus a manual toothbrush
Andrea Johnson, BS, RDH[1]; Malgorzata A Klukowska, DDS, PhD[1]; Neresh C Sharma, DDS, MS[2]; Julie M Grender, PhD[1]; Erin Conde, BS[1]; Pam Cunningham, BA[1]; Jimmy G Qaqish, BA[2]
[1]Procter & Gamble, USA; [2]Bio-Sci Research Canada, Ltd, Canada

Effects of aromatase inhibitors on alveolar bone loss among postmenopausal women with breast cancer
Iwonka T Eagle, BSDH, RDH; Erika Benavides, DDS, MS; Robert M Eber, DDS, MS; Marita R Inglehart, PhD; Catherine H Van Poznak, MD; L Susan Taichman, MPH, PhD, RDH
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Gingival abrasion and recession in manual and power brush users
B Jordan, MS, RDH; NAM Rosema; J Grender, PhD; E Van Der Sluijs; SC Supranoto; GA Van Der Weijden
Procter & Gamble Company, USA

Meta-analysis of oral safety data for 0.454% stannous fluoride sodium hexametaphosphate dentifrice
Rebecca VanHorn, BA, RDH; Tao He, DMD, PhD; Matthew L Barker, PhD; Melanie C Miner, BS; Ghebre Tzeghai, PhD; Robert W Gerlach, DDS, MPH
Procter & Gamble, USA

Clinical dental hygiene practice

Views of dental providers on primary care coordination
Shirley Birenz, MS, RDH; Mary E Northridge, MPH, PhD; Danni Gomes, BS, RDH; Cynthia Golembeski, MPH; Ariel Port, DMD; Janet Mark, MA; Donna Shelley, MD, MPH; Stefanie L Russell, DDS, MPH
New York University College of Dentistry, USA

Gingival bleeding and oral hygiene of women with von Willebrand Disease
Stefanie Marx, BSDH, RDH; Jill Bashutski, DDS, MS; Karen Ridley, MS, RDH; Mark Snyder, DDS; L Susan Taichman, MS, MPH, PhD, RDH
University of Michigan, USA

Diabetes detection: A new intraoral screening approach in the dental setting
Lindsey Cohen Vine[1]; Joanna Pitynski[1]; Rosemary Hays, MS, RDH[1]; Dianne Sefo, BA, RDH[1]; Mary T Rosedale, PhD, PMHNP-BC[2]; Shiela M Strauss, BS, MA, PhD[2]
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The frequency of dietary advice provision in a student dental hygiene clinic: A retrospective cross-sectional study
Johanna Franki, BOH, BHSc(Hons); Melanie J Hayes, BOH, BHSc(Hons), PhD; Jane A Taylor, BDS, MScDent, PhD
The University of Newcastle, Australia

Education

Formative and summative clinical assessment: The student perspective
Linda D Boyd, RD, EdD, RDH; Kristeen R Perry, MSDH, RDH
Forsyth School of Dental Hygiene, MCPHS University, USA

A pilot study to determine impact of germ simulation on standard precaution compliance in dental hygiene students
Susan L Tolle, BSDH, MS; Joyce M Flores, MS, RDH; Leslie A Mallory, BSDH, MS; Vivienne A Parodi, RN, DSN
Old Dominion University, USA

An analysis of faculty perceptions on assessment methods utilized to evaluate student competency in dental hygiene
Kristeen R Perry, MSDH, RDH; Linda D Boyd, RD, EdD, RDH; Debra November-Rider, MSDH, RDH; Heather Brown, MPH, RDH
Forsyth School of Dental Hygiene, MCPHS University, USA

A survey of clinical faculty calibration in dental hygiene programs
Nichole L Dicke, MS, RDH[1]; Kathleen O Hodges, MS, RDH[2]; Ellen J Rogo, PhD, RDH[2]; Beverly J Hewett, RN, PhD[2]
[1]Indiana University-Purdue University, [2]Idaho State University, USA

A faculty development program to enhance dental hygiene distance education: A pilot study
Vicki J Dodge, EP, MS, RDH; Denise M Bowen, MS, RDH; Kristin H Calley, MS, RDH; Teri Peterson, EdD
Idaho State University, USA

Using multiple mini interviews to identify noncognitive attributes for dental hygiene admissions
Jacqueline J Freudenthal, MHE, RDH
Idaho State University, USA

Relevance of a workshop to prepare for dental hygiene clinical boards
Marie R Paulis, MSDH, RDH
University of Bridgeport, USA

A comparison of associate and bachelor degree-seeking students on self-perceptions of senior dental hygiene students as health educators
Deborah L Dotson, PhD, RDH
East Tennessee State University, USA

Dental hygienists' perception of preparation and use for ultrasonic instrumentation
Joanna Asadoorian, PhD, RDH[1]; Dani Botbyl, RDH[2]; Marilyn J Goulding, MOS, RDH[3]
[1]University of Manitoba, [2]Dentsply Canada Ltd., [3]Niagara College, Canada

Teaching dental hygiene students to utilize the logic model for community outreach programs
Karen M Portillo, MS, RDH; Ellen Rogo, PhD, RDH
Idaho State University, USA

The effects of a legislative advocacy project on dental hygiene students' knowledge, values, and actions
Leciel K Bono, BS, RDH-ER[1]; Ellen J Rogo, PhD, RDH[1]; Kathleen Hodges, MS, RDH[1]; Teri Peterson, EdD[2]
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Dental hygiene undergraduate student specialty practicum clinic: Medical and dental complexity of clients
Lindsay Marshall, RDH; Rachel Haberstock; Sharon Compton, PhD, RDH; Minn Yoon, PhD
University of Alberta, Canada

Local anesthesia training model improves confidence and reduces anxiety in students
Anjum Shah, BSDH, MS, RDH; Tammy K Swecker, BSDH, MEd, RDH; Joan M Pellegrini, MS, PhD, RDH; Al M Best, PhD
Virginia Commonwealth University School of Dentistry, USA

An integrated approach in teaching microbiology to dental hygiene students
Laura Mueller-Joseph, EdD, RDH; Robert Elgart, PhD
State University of New York at Farmingdale, USA

Enhanced learning during the dental hygiene process of care
Cynthia Howard, MS, RDH; Andrea Beal, MS, RDH; Shirley Birenz, MS, RDH; Cheryl Westphal Theile, EdD, RDH; Robert Davidson, DDS, PhD
NYU College of Dentistry, USA

Online course evaluations: Program directors' and students' knowledge, beliefs, and practices of online course evaluations from 100% online dental hygiene education
JoAnn M Marshall, CDA, MSDH, RDH
Fones School of Dental Hygiene, University of Bridgeport, USA

Health behaviours

Systematic review of medical providers' knowledge and attitude towards oral health screenings for children
Denise M Claiborne, BSDH, MS, PhD candidate; Deanne Shuman, BSDH, MS, PhD
Old Dominion University, USA

Motivational interviewing: Assessment of dental hygiene students' perceptions of importance in using and confidence in applying
Angela J Mills, BSDH, RDH; Wendy E Kerschbaum, MA, MPH, RDH; Philip S Richards, DDS, MS; Gail A Czarnecki, DDS; Anne E Gwozdek, BA, MA, RDH
University of Michigan, USA

The role of technologies in promoting periodontal health
Mário R Araújo, MPsych, RDH; Cristina A Godinho, MA; Maria-João Alvarez, PhD
Universidade de Lisboa, Portugal

Health literacy/Cultural competency

Avatar-mediated practice scenarios to evaluate cross-cultural knowledge and understanding
Tara Newcomb, MS, RDH; Joyce Flores, MS, RDH; Amy Adcock, PhD; Brett Cook, MS; Laurie Craigen, PhD, LPC
Old Dominion University, USA

Occupational health

Radiographic imaging for disaster victim identification (DVI) in dental hygiene
Ann M Bruhn, BSDH, MS; Tara L Newcomb, BSDH, MS
Old Dominion University, USA

Musculoskeletal disorders: Does operator positioning or use of ergonomic devices matter?
Beckie M Barry MEd, RDH[1]; Ann E Spolarich, PhD, RDH[2]
[1]University of Mississippi Medical Center, [2]University of Southern California, USA

Dental radiographic prescribing practices: Survey of Illinois dental hygienists
Kathleen B Muzzin, MS, RDH[1]; Diane J Flint, DDS, MS[1]; Emet Schneiderman, PhD[1]; Frieda A Pickett, RDH, MS[2]
[1]Texas A&M University, Baylor College of Dentistry, [2]Idaho State University, USA

Technology

Efficacy of Total Mouthwash compared to Pro-Health and placebo mouthwash
B Stewart[1]; M Morrison[1]; J Miller[1]; J Chung, DMD, MPH[1]; S Pilch[1]; AR Elias-Boneta[2]; R Ahmed[2]
[1]Colgate–Palmolive Technology Center, USA; [2]University of Puerto Rico School of Dental Medicine, Puerto Rico

Clinical investigation of whitening efficacy on Colgate optic white dentifrice
AR Elias-Boneta[1]; LR Mateo[2]; E Delgado, DDS, MSc[3]; YP Zhang[3]; S Miller[3]
[1]Dental Research Associates, Inc., Puerto Rico; [2]LRM Statistical Consulting, LLC, USA; [3]Colgate–Palmolive Technology Center, USA

Efficacy of Total Mouthwash compared to Listerine and placebo mouthwash
P Chaknis[1]; J Miller[1]; M Morrison, PhD[1]; S Pilch[1]; B Stewart[1]; AR Elias-Boneta[2]; R Ahmed[2]
[1]Colgate–Palmolive Technology Center, USA; [2]University of Puerto Rico School of Dentistry, Puerto Rico[2]

In vitro stain prevention efficacy of commercially available whitening dentifrices
H Strotman, MS; VP Maloney; S Chopra
Colgate–Palmolive Technology Center, USA

ORAL FREE PAPERS: TOPICS AND PRESENTERS

Access to care

Effects of power toothbrushing on caregiver compliance and oral and systemic inflammation in a nursing home population
Salme E Lavigne, MSDH, PhD candidate, RDH; Malcolm B Doupe, PhD; Anthony M Iacopino, DMD, PhD; Salah Mahmud, MD, PhD; Lawrence Elliott, MD, MSc
University of Manitoba, Canada

Transforming the culture of oral care in long-term care
Mary F Bertone, BScDH, RDH
University of Manitoba, Canada

Oral cancer awareness among community-dwelling senior citizens in Illinois
Ewa Posorski, MS, RDH[1]; Linda Boyd, RD, EdD, RDH[2]; Lori J Giblin, MS, RDH[2]; Lisa Welch, BS, MSDH, RDH[3]
[1]Harper College School of Dental Hygiene, [2]Forsyth School of Dental Hygiene, MCPHS University, [3]Dixie State University, USA

The integration of dental hygienists as part of the primary healthcare team: A strategic analysis of the barriers to direct dental service delivery by federally qualified healthcare facilties
Trisha M Johnson, MHA, RDH
University of Southern Indiana, USA

Oral health knowledge of eating disorder treatment providers
Lisa Bennett Johnson, MSDH, RDH; Linda D Boyd, RD, EdD, RDH; Lori Rainchuso, MS, RDH
Forsyth School of Dental Hygiene, MCPHS University, USA

A comparison of dental hygienists' and dentists' clinical and telehealth screening for dental caries in urban children
Susan J Daniel, PhD, RDH
Old Dominion University, USA

Basic science

Identification and characterization of novel human papillomaviruses in oral cancers
Juliet Dang, PhD candidate, MS, RDH[1]; Nancy B Kiviat, MD[1]; Qinghua Feng, PhD[1]; Stephen Hawes, PhD[1]; Greg Bruce, PhD[2]
[1]University of Washington, [2]Seattle Children's Research Institute, USA

Clinical dental hygiene practice

Exploring dental hygiene clinical decision making: A mixed methods study of potential organizational explanations
Joanna Asadoorian, PhD, RDH[1]; Evelyn L Forget, PhD[1]; Mahmoud Torabi, PhD[1]; Lesley F Degner, RN, PhD, FCAHS[1]; Joan Grace, PhD[2]
[1]University of Manitoba, [2]University of Winnipeg, Canada

Efficacy of novel brush on paste "MI Paste Plus One Step"
Annette Scheive, MS, RDH[1]; Linda Belllisario, BS, RDH[1]; Gina Durkin[1]; Sayako Hotta, PhC, DH[2]; Takuya Sato[2]; Yoko Ishihara[2]; Tomohiro Kumagai[2]
[1]GC America, USA; [2]GC Corporation, Japan

An in vitro comparison of the effects of various airpolishing powders on enamel and selected esthetic restorative materials
Caren M Barnes, MS, RDH; David A Covey, DDS, MS; Hidehiko Watanabe, DDS, MS
University of Nebraska Medical Center College of Dentistry, USA

Utilization of an American Diabetes Association adopted diabetes risk survey to identify patients at increased risk for type 2 diabetes mellitus in asymptomatic patients
Lori J Giblin, MS, RDH; Lori Rainchuso, MS, RDH
Forsyth School of Dental Hygiene, MCPHS University, USA

Capability of a dental hygienist to perform a clinical oral diagnosis in various settings: A multilevel analysis
Kelly T Williams, CDA, MSDH, RDH; Joyce M Flores, MSDH, RDH
Old Dominion University, USA

Soft-rubber-interdental-cleaner compared to an interdental brush on plaque/gingivitis/gingival abrasion
DE Slot, MSc, RDH; D Ekkelboom, BOH, RDH; E Van Der Sluijs, BOH, RDH; SC Supranoto, BOH, RDH; GA Van Der Weijden, PhD
Academic Centre for Dentistry Amsterdam, The Netherlands

Effect of chemotherapeutic agents and mechanical tongue cleaning on morning bad breath
Eveline Van Der Sluijs, BOH, RDH; Dagmar E Slot, MSc, RDH; Sam C Supranoto, BOH, RDH; Fridus A Van Der Weijden, PhD
Academic Centre for Dentistry Amsterdam, The Netherlands

Oral and/or peri-oral piercings are not without risks!
Nienke L Hennequin-Hoenderdos, BOH, CRC, RDH; Dagmar E Slot, MSc, RDH; Fridus A Van Der Weijden, PhD
Academic Centre for Dentistry Amsterdam, The Netherlands

Education

Linking dental hygiene admissions criteria to licensure examination pass rates
Tammy R Sanderson, MSDH, RDH[1]; Marcia H Lorentzen, MSEd, EdD, RDH[2]
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An evaluation of the effects of blended learning pedagogy on student learning outcomes
Luisa Nappo-Dattoma, RD, EdD, RDH
Farmingdale State College, USA

Factors associated with clinical skill remediation in dental hygiene education programs
Donna F Wood, MS, RDH[1]; Tanya V Mitchell, MS, RDH[2]; Lorie A Holt, MS, RDH[2]; Bonnie G Branson, PhD, RDH[2]
[1]University of Oklahoma, [2]University of Missouri–Kansas City, USA

Current issues of community dental hygiene practice education in Korea
Nam-Hee Kim, MPH, PhD, RDH[1]; Yang-Keum Han, MD, RDH[2]; Young-Kyung Kim, MPH, RDH[3]; Hyun-Ju Lim, MPH, PhD, RDH[4]; Yang-Ok Kown, MPH, PhD, RDH[5]; Han-Mi Kim, BA, RDH[6]; Yeun-Ju Kim, BA, RDH[1]; Jeong-Ran Park, PhD, RDH[7]
[1]Wonju College of Medicine, Yonsei University, [2]Daejeon Health Sciences College, [3]Chungcheong University, [4]Dongju College, [5]Sasang-gu Public Health Center, [6]Hoengseong-gun Public Health Center, [7]Baek seok University, Korea

E-model of online learning communities
Ellen J Rogo, PhD, RDH; Karen M Portillo, MS, RDH
Idaho State University, USA

Assessing the cultural competence/faculty development needs among Florida's allied dental faculty
Linda S Behar-Horenstein, PhD[1]; Frank A Catalanotto, DMD[1]; Cyndi W Garvan, PhD[2]; Yu Su, MEd candidate[3]; Xiaoying Feng, doctoral student[3]
[1]College of Dentistry, [2]College of Nursing, [3]College of Education, University of Florida, USA

The impact of clinicians' interpersonal skills: Differences between dentally anxious and non-anxious patients
Laura J Dempster, MSc, PhD, RDH
University of Toronto, Canada

Guiding dental hygiene students in creating employment e-portfolios that can help hygienists find jobs
Sharon L Mossman, EdD, RDH
Delaware Technical Community College, USA

Theory analysis of the dental hygiene human needs model
Laura L MacDonald, BScD(DH), MEd
University of Manitoba, Canada

Dental hygiene student practicum experiences in a hospital-based dental clinic
Minn N Yoon, PhD; Sharon M Compton, PhD, RDH
University of Alberta, Canada

Health behaviours

Association between cigarette and electronic cigarette use and perceptions of risks in urban high school males: A pilot cross-sectional study
Elizabeth T Couch, MS, RDH; Benjamin W Chaffee, DDS, MPH, PhD; Stuart A Gansky, DrPH; Gwen Essex, MS, EdD, RDH; Margaret M Walsh, MS, MA, EdD, RDH
University of California, San Francisco, USA

Brush off! Promoting oral hygiene behaviours with a game
Joyce M Flores, MS, RDH[1]; Traci Leong, PhD[2]; Stella Lourenco, PhD[2]; Dov Jacobson[3]; Jesse Jacobson[3]; Stephanie Chergi[3]; RL Jacobson, DDS[3]
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Health literacy/Cultural competency

Cultural competence curriculum: Are we there yet?
Cheryl M Westphal Theile, EdD, RDH
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Racial/ethnic, cultural, and linguistic diversity among the dental hygiene students
Anna Matthews, MS, RDH; Susan Davide, MS, MSEd, RDH; Anty Lam, MPH, RDH
New York City College of Technology, City University of New York

Iatro-compliance: An unintended consequence of excessive autonomy in long-term care facilities
Melanie V Taverna, MSDH, RDH; Carol Nguyen, MS, RDH; Rebecca Wright, MS, RDH; James W Tysinger, PhD; Helen M Sorenson, MA, RT
University of Texas Health Science Center at San Antonio, USA

Occupational health

The effect of stainless steel vs silicone dental instrument handles on hand strength and comfort
Melanie J Hayes, BOH, BHSc(Hons), PhD
The University of Melbourne, Australia

Technology

Teledentistry-assisted affiliated practice dental hygiene
Fred F Summerfelt, AP, MEd, RDH
Northern Arizona University, USA

PlasmaDent: Advances in plasma medicine provides promise for applications in dentistry
Gayle B McCombs, MS, RDH
Old Dominion University, USA