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Competencies for Canadian baccalaureate dental hygiene education: A Delphi study

An investigation into toothbrush wear related to months of use among university students

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EDITORIALS

Preventive professionalism

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1 Delaurenti M, et al. An Evaluation of Two Toothbrushes on Plaque and Gingivitis. Journal of Dental Research. 2012, 91(Special Issue B):522.
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The *Canadian Journal of Dental Hygiene* is the official peer-reviewed publication of the Canadian Dental Hygienists Association (CDHA). Now published in February, June, and October, the journal invites submissions of original research, literature reviews, case studies, and short communications of scientific and professional interest to dental hygienists and other oral health professionals. Bilingual *Guidelines for Authors* are available at www.cdha.ca/cjdh.

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1. Jeganathan S, Payne JA, Thean HP. Denture stomatitis in an elderly edentulous Asian population. *J Oral Rehabil*. 1997;24(6):468–472. **2**. Emami E, de Grandmont P, Rompré PH, et al. Favoring trauma as an etiological factor in denture stomatitis. *J Dent Res*.2008;87(5):440–444. **3**. Barbeau J, Seguin J, Goulet JP, et al. Reassessing the presence of *Candida albicans* in denture-related stomatitis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2003;95(1):51–59. **4**. Arendorf TM, Walker DM. Oral candida populations in health and disease. *Br Dent J*. 1979;147(10):267–272. **5**. Compagnoni Ma, Souza RF, Marra J, et al. Relationship between Candida and nocturnal denture wear: quantitative study. *J Oral Rehabil*. 2007;34(8):600–605. **6**. GSK data on file, 2011. (Polident CSS)

Preventive professionalism

Rae McFarlane, MEd, RDH

Rae McFarlane

As a member of the inquiry committee for the College of Dental Hygienists of British Columbia (CDHBC), I see the complaints that are received by CDHBC. They come from a wide variety of sources including clients, dental hygienists, dentists, employers, and insurance companies. These complaints almost always contain a breach in professionalism made by a dental hygienist. And almost every situation that is contained in a complaint is one that could have been prevented. I would like to share what I have learned from my experiences on the CDHBC inquiry committee and offer suggestions on how to ensure that all registrants adhere to their regulations and bylaws, practice standards, and codes of ethics so that infractions do not occur. Forewarned is forearmed. We are a profession steeped in prevention; we can extend that prevention to our own dental hygiene practice. It's a measure I like to call "preventive professionalism."

First, some background: dental hygiene has been regulated since it became a recognized health profession in Canada in the 1950s. Regulatory colleges are mandated to ensure that the public is protected against impaired, unethical or unauthorized practice. Originally, dental hygienists in Canada were regulated either by a regulatory board that also governed dentists or by a provincial or territorial government. Further advancements in our profession saw dental hygiene move towards self-regulation. One by one, provincial governments entrusted members of the dental hygiene profession to be responsible for their own regulation under the umbrella of their *Health Professions Act*. Today, all provinces except PEI have a regulatory body, or college, of dental hygiene.

In British Columbia, the privilege of self-regulation has allowed us to set our own rules through the CDHBC Regulations and Bylaws to ensure safe and ethical dental hygiene practice. The accompanying responsibilities include establishing, monitoring, and enforcing the Practice Standards and Code of Ethics for registrants, as well as investigating complaints. Every province's college has an investigatory or inquiry committee (sometimes doubling as a discipline committee) for the purpose of investigating complaints against registrants. The committee determines if professional misconduct has occurred and applies the appropriate penalty where necessary in order to protect the public and uphold the integrity and credibility of the profession.

I have found that most infractions can be categorized under one of the following descriptions: unauthorized practice; bylaw violations: lapsed insurance; unprofessional behaviour; implied versus informed consent; lack of documentation; improper billing; and marketing violations.

BREACHES IN PROFESSIONALISM

Unauthorized practice

By far the most common complaint received by the CDHBC pertains to a registrant's failure to renew his or her licence to practise by the deadline. To the public, this violation means that the dental hygienist is practising illegally, and the penalty can be severe. It is entirely avoidable if you remember to keep your contact information up to date with the college. In fact, it is a bylaw requirement to do so. You may be telling the truth when you say, "No one notified me of the renewal date" or "The email went in the junk file" or "I didn't read the email because I get so many these days," but the violation still exists and the registrant is still responsible for ensuring that he or she holds a valid licence to practise. Remember to keep your contact information up to date so that you don't miss important email reminders about renewal deadlines. Update your profile on your regulatory body's website or make a phone call, and renew by the deadline. It can save you a trip to the inquiry committee.

Another type of unauthorized practice is when care is provided by an individual who has never been registered by the College and/or does not have the appropriate education. We have never had to face this circumstance at the CDHBC inquiry committee, but it is incumbent on all of us to ensure that only those individuals who are registered by their provincial college are providing care to the public.

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Bylaw violation: Lapsed insurance

In accordance with CDHBC bylaws all registrants in practising registration categories must possess professional negligence insurance in order for their registration as a dental hygienist to be valid. Every year registrants who do not have this coverage are referred to the inquiry committee. Legally, this contravention creates a serious risk to public protection. The confusion comes about because association membership years and renewal dates (for example, in BC it is March 1 to February 28) do not always coincide with insurance coverage years (typically January 1 to December 31). These conflicting dates sometimes result in a gap in coverage. Take a moment to check your profile on your provincial college website to verify that the insurance confirmation has been received, then contact your insurance providers or college if necessary.

Unprofessional behaviour

Unfortunately, inquiry commissions are sometimes called upon to investigate complaints of unprofessional behaviour. These complaints usually relate to tone of voice, physical demeanor, angry threats or lack of integrity in personal communications; usually they come from other dental hygienists, employers, clients, and even from staff at the College itself. One case concerned a handwritten note containing inappropriate, angry words that had been left on the employer's desk. In another case, a dental hygiene registrant was offensive to the registrar and staff over the phone and through emails. This public display of discourtesy reflects negatively on the profession of dental hygiene and is most definitely cause for reprimand. Although the provincial and national dental hygiene codes of ethics may seem overly simple or obvious in their content, they do contain guidelines to keep you mindful of the way you are perceived in the workforce.

All conversation, whether face-to-face, through email or on social media, needs to be made in an ethical and professional manner. Be aware that confidentiality, conflict of interest, and professionalism can be breached inadvertently through social media. We all know by now that Facebook isn't private at all. Make a point of reflecting on what you post (photos or text) before you click the submit button. You are always a dental hygienist in the public eye!

Implied versus informed consent

Do you realize that, by law, you must have informed consent before treating a client? We often assume that, if a client is sitting in our chair, he or she agrees to our intervention. In other words, their presence implies consent. This assumption is true to some extent. This consent is in play when collecting assessment data for your dental hygiene diagnosis and treatment plan within the Assessment, Dental Hygiene Diagnosis, Planning, Implementation and Evaluation (ADPIE) process of care. However, such consent excludes the taking of radiographs and other higher risk assessment procedures, which require informed consent. Informed consent is given by the client voluntarily after the development and presentation of your dental hygiene diagnosis and treatment plan, and must be documented. A signature is not always required as proof that you have discussed the client's oral and overall health, the risks associated with care, and the risks of not receiving treatment. Usually a simple notation will suffice. However, if you are at all concerned about the client's level of understanding of the care to be provided, then a signature is recommended.

Even more critical is obtaining appropriate consent for the treatment of minors and clients in care facilities. In these cases, you must share the assessment and treatment plan with the guardian who is responsible for providing consent. The facility's admittance policy may not necessarily include consent for oral health care. Consult your provincial Act to determine the best course of action. For example, in BC it is called *The Infants Act*.

Lack of documentation

Inadequate documentation rears its ugly head every time an investigation occurs where a chart audit is requested. And more often than not, the investigation does include a review of the charts. Forgetting to record appropriate and accurate information can get you into a great deal of trouble when using electronic documentation. As a precaution you should implement unique user IDs and passwords for all who access the office software system. In one memorable case, it was not possible to prove who had tampered with the records, which put everyone's credibility at risk, including the dental hygienist. Make it a practice to go through each pertinent practice standard that involves documentation (for the CDHBC there are five) and develop a checklist to ensure that all areas of required documentation are in your charts. Many colleges offer webinars to encourage and instruct dental hygienists on how to improve documentation.

Improper billing

The College's regulatory mandate also includes practice standards related to billing. I have witnessed several cases of improper billing over the years. One thing that clients often submit complaints about is being charged too much money. Sometimes they are simply complaining about the high cost of health care, but on other occasions they do have legitimate concerns over improper billing practices. Be sure the client has given informed consent, not only for the treatment to be performed but also for the billing for the treatment. A client's treatment is based on assessed needs, not on what is covered by insurance companies. Clients don't always understand that. In addition, they should not be billed for services that were not provided. We recently closed a case in which a client was billed by an independent practitioner for procedures not performed. For absolute clarity, and for the client's sake, document

in the chart the actual treatment related to the dental hygiene process of care—not just the billing codes. It's also important to periodically review your scope of practice. For example, night guards are routinely billed to insurance companies, but in BC they are not within the scope of dental hygiene practice—only sports guards are.

Marketing violations

The colleges regulate marketing practices, which fall under the area of ethical and truthful information about dental hygiene services. One common issue is the use of misleading words in the title of an advertisement (such as a newspaper ad) for a dental hygiene independent practice, implying that it is a dental practice. Sometimes a catchy name can have unintended consequences. Advertising must be targeted to attract the appropriate client. Another infringement occurs in the malpractice of dental diagnosis. Each province's regulatory college has its own marketing interpretation guideline for consultation. When advertising by social media, you need to consult government privacy legislation.

CONCLUSION

How can dental hygienists practice preventive professionalism? First, understand the importance and accompanying responsibilities of self-regulation. Second, become familiar with your provincial college's bylaws, practice standards, scope of practice, and code of ethics (see the resource list on page 50), and consult provincial legislation. Third, stay connected to your profession and keep current with trends and technology. A variety of organizations and groups offer continuing education opportunities that will allow you to stay informed about new trends and research as well as new legislative rulings. Look into networking opportunities to connect with peers, mentors, and leaders. Networking with other professionals gives you the ability to dialogue about your experiences as well as hear how colleagues are handling some of the same issues that you face. As the saying goes, "knowledge is power." If you know what to do, then you also know what not to do. Professionalism is a state of mind; it takes thought and awareness. Think it and you will be it.

IN THIS ISSUE

This issue of the journal highlights topics of vital importance to the dental hygiene profession. **Susanne Sunell, Joanna Asadoorian, Cynthia Gadbury-Amyot**, and **Heather Biggar** present the results of a Delphi study that was conducted to establish the required competencies for Canadian baccalaureate dental hygiene education (p. 57). Given the diversity of entry-to-practice educational models across Canada, the range of postsecondary organizations involved, and changing regulatory legislation, competencies that could be adopted nationwide for baccalaureate dental hygiene programs are long overdue. This original research article constitutes part 1 of the analysis of the Delphi study; part 2 will be published in October (Volume 49, Number 3). In addition, **Mandy Hayre** outlines in her editorial the necessary qualities and skills for dental hygienists who are interested in pursuing a career as educators in the 21st century (p. 51).

We are also pleased to present a research article by **Kalyan Chakravarthy Gundavarapu, Srinivas Sulugodu Ramachandra**, and **Daniel Devaprakash Dickist**, who explore toothbrush wear related to months of use among university students (p. 74). In addition, **Juliet Dang, Nancy B Kiviat**, and **Qinghua Feng** investigate the prevalence of HPV16 and 18 within a dental student clinic setting in their short communication (p. 79). Finally, **Corinne Story** offers a unique perspective on the implications of interprofessional collaboration for the advancement of the profession (p. 85).

RESOURCES

1. Canadian Dental Hygienists Association. Dental hygiene regulation: A comparison [online]. Ottawa: CDHA; 2013 [accessed 20 March 2015]. Available from: http://www.cdha.ca/pdfs/profession/regulatorycomparisoncharts_final.pdf
2. Canadian Dental Hygienists Association. Dental hygienists' code of ethics [online]. Ottawa: CDHA; 2012 [accessed 20 March 2015]. Available from: http://www.cdha.ca/pdfs/Profession/Resources/Code_of_Ethics_EN_web.pdf
3. Canadian Dental Hygienists Association (CDHA), Federation of Dental Hygiene Regulatory Authorities (FDHRA), Commission on Dental Accreditation of Canada (CDAC). National Dental Hygiene Certification Board (NDHCB) and dental hygiene educators. Entry-to-practice competencies and standards for Canadian dental hygienists [online]. Ottawa: CDHA; 2010 [accessed 20 March 2015]. Available from: www.cdha.ca/pdfs/Competencies_and_Standards.pdf
4. College of Audiologists and Speech Language Pathologists of Ontario. Pause before you post: Social media awareness for regulated health professionals [E-Learning module]. Toronto: CASLPO [accessed 20 March 2015]. Available from: https://members.caslpo.com/public/elearning/socialmedia/player.html
5. College of Dental Hygienists of BC. CDHBC regulation and bylaws [online]. Victoria: CDHBC; 2013 [accessed 20 March 2015]. Available from: http://www.cdhbc.com/Practice-Resources/Regulation-and-Bylaws.aspx
6. College of Dental Hygienists of BC. CDHBC Code of Ethics [online]. Victoria: CDHBC; 2013 [accessed 20 March 2015]. Available from: http://www.cdhbc.com/Practice-Resources/Code-of-Ethics.aspx
7. College of Dental Hygienists of BC. Standards and Policies. Victoria: CDHBC; 2015 [accessed 20 March 2015]. Available from: http://www.cdhbc.com/Practice-Resources/Practice-Standards/Standards-and-Policies.aspx
8. Gholami-Kordkheili F, Wild V, Strech D. The impact of social media on medical professionalism: A systematic qualitative review of challenges and opportunities. *J Med Internet Res*. 2013;15(8);e184.
9. Government of British Columbia. Human Rights Code, RSBC 1996, Chapter 210 [online]. Victoria: Queen's Printer; 1996 [accessed 20 March 2015]. Available from: http://www.bclaws.ca/Recon/document/ID/freeside/00_96210_01
10. Government of British Columbia. Personal Information Protection Act, SBC 2003, Chapter 63 [online]. Victoria: Queen's Printer; 2003 [accessed 20 March 2015]. Available from: http://www.bclaws.ca/Recon/document/ID/freeside/00_03063_01

Thinking about a career in dental hygiene education?

Mandy Hayre, DipDH, BDSc, PID, MEd

When I reflect on the history of dental hygiene education in Canada, I see many changes. The most significant, to my mind, is that we now expect much more of our educators than we did in the early years when dental hygiene programs began to proliferate across the country. Having spoken to many seasoned faculty members about their pathway to education, I have heard most of them discuss the relatively short list of qualifications and experience required of them at the time they entered the teaching profession. These requirements ranged from some clinical experience to a combination of clinical experience and advanced education. Most of these senior educators went on to obtain advanced academic credentials after they began teaching, while learning about being a teacher "on the job."

Mandy Hayre
CDHA President/Présidente de l'ACHD

Dental hygiene education has changed dramatically over the years. From its early beginnings of training technicians to remove calculus, the teaching of dental hygiene has evolved to include a complex range of activities under a broadened scope of practice.

Dental hygienists often ask me how they can make the transition into teaching. It is a complicated query to answer because there are so many factors to consider. To respond to the question, we need to reflect on where the profession is today and where we envision it to be in the future. Educators are often seen as visionary leaders of the profession who are able to see the "big picture." Dental hygiene may change in ways we haven't yet imagined. For example, the profession may be involved in interdisciplinary activities with other health care professions in new places of work using new scopes of practice or technologies. The ability to envision future opportunities and embrace the changes that will bring concepts to fruition demands certain qualities in an educator.

Teachers are role models and therefore need to exemplify excellence for the new generation of dental hygienists. With our profession's growth have come regulatory changes, an increase in competencies, complex

Vous envisagez une carrière en enseignement de l'hygiène dentaire ?

Lorsque je songe à l'histoire de l'enseignement de l'hygiène dentaire au Canada, je constate que le domaine a beaucoup évolué. Nos attentes envers les enseignants sont beaucoup plus élevées maintenant que dans les premières années, au moment où les programmes d'hygiène dentaire se sont multipliés à travers le pays et selon moi, ces attentes font partie des changements significatifs qui ont modulé la profession. Après avoir discuté avec plusieurs membres de la faculté au sujet de leur cheminement éducationnel, la plupart d'entre eux m'ont parlé du nombre relativement limité de compétences et d'expérience professionnelle qu'ils devaient avoir au moment où ils ont commencé à enseigner. Les exigences d'embauche allaient d'un peu d'expérience clinique à une combinaison d'expérience clinique et de formation avancée. Après avoir commencé à enseigner, la plupart des enseignants expérimentés ont poursuivi leurs études et ont reçu des attestations d'études avancées, tout en apprenant « sur le tas » à être enseignant.

La formation en hygiène dentaire a radicalement changé au fil des ans. Depuis ses tout débuts, lorsqu'il s'agissait de former des techniciens spécialisés à enlever le tartre, l'enseignement de l'hygiène dentaire a évolué de façon à inclure une gamme complexe d'interventions dans le cadre d'un champ d'activités plus vaste.

Les hygiénistes dentaires me demandent souvent comment ils peuvent passer à l'enseignement. Voilà une question complexe, car il faut prendre en compte plusieurs facteurs. La réponse à cette question nous oblige à réfléchir à la situation actuelle de la profession et à la position que nous voulons qu'elle occupe dans le futur.

Les enseignants sont souvent perçus comme les leaders visionnaires de la profession; ceux qui ont la capacité d'avoir une vue d'ensemble. L'hygiène dentaire pourrait évoluer à un point que nous n'avons pas encore imaginé, en participant, par exemple, à des activités interdisciplinaires et en collaborant avec d'autres professionnels de la santé, dans des milieux de travail inédits, en adoptant de nouveaux champs d'activités ou des technologies novatrices. Les enseignants doivent démontrer certaines qualités pour envisager les occasions futures et faire place aux changements qui concrétiseront les concepts.

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access-to-care and advocacy issues, interdisciplinary care models, and community linkage opportunities, as well as new and emerging models for independent practice. We need educators with an equally expanded skill set to provide the depth and breadth of education we expect in our programs.

Another area of consideration is the growing diversity of institutions of higher education. We now enjoy a mix of schools that includes research universities, community colleges, private institutions, and technical schools. These different types of schools, each with a different focus, may require specific skills. For example, a research university expects educators to have a track record of publications in peer-reviewed journals as well as a commitment to undertake research.

If you feel as passionate as I do about dental hygiene education, I encourage you to consider the rewarding career of educator. To help you make the transition to teaching, I have made a list of desired qualities to help you begin to build your portfolio in a meaningful way:

1. *Experience*: Variety in clinical practice areas, such as general and periodontal practices, independent practice, community health or interdisciplinary care, is beneficial. Previous teaching experience is also advantageous whether it is clinical, didactic, in continuing education or in another health discipline such as dental assisting.
2. *Education*: Credentials beyond the dental hygiene diploma are essential. A minimum of a baccalaureate in education or a related field is now the norm. While the bachelor's degree is the expectation for part-time clinical instruction, graduate-level credentials (master's or doctoral degrees) are expected for full-time faculty members or to secure a leadership position in a dental hygiene program (e.g., department head).
3. *Professional service*: Serving on local, provincial or national associations, the Commission on Dental Accreditation of Canada (CDAC), National Dental Hygiene Certification Board (NDHCB), interdisciplinary health teams or community initiatives is important. Such activities engage dental hygienists in the issues facing our profession; and build essential skills in education, leadership, advocacy, and public service.
4. *Volunteer work*: This can take many forms and can be directly or indirectly related to our profession. Giving of your personal time for causes that have no tangible personal gain shows a level of commitment to worthy causes or advocacy that is valued in educators. It also helps to role model these altruistic activities to students.
5. *Passion for the profession*: Interest and enthusiasm can be expressed through participation in activities such as volunteering or lobbying government for

Les enseignants servent de modèles et par conséquent doivent incarner l'excellence face à la nouvelle génération d'hygiénistes dentaires. Le développement de la profession s'est poursuivi de pair avec les changements réglementaires, l'élargissement des compétences, l'accès aux soins et aux questions liées au plaidoyer qui sont plus complexes, les modèles de soins interdisciplinaires et les occasions de réseautage dans la collectivité, tout en composant avec l'émergence de modèles novateurs en matière d'exercice indépendant. Nous avons besoin d'enseignants qui possèdent un vaste éventail de compétences afin de donner à la formation l'ampleur et la profondeur à laquelle nous nous attendons dans nos programmes.

Une autre question qu'il faut examiner tient à la diversité croissante des établissements qui offrent de l'enseignement supérieur. Nous jouissons actuellement d'une gamme d'établissements qui comprend les universités de recherche, les collèges communautaires, les établissements privés et les écoles techniques. Ces différents types d'établissements reposent tous sur des thèmes qui leur sont propres et qui requièrent possiblement des compétences spécifiques. Par exemple, une université de recherche s'attend à ce que les enseignants aient un dossier de candidature qui comprend des publications dans des revues à comité de lecture ainsi qu'un engagement à effectuer des recherches.

Si vous êtes passionné par l'enseignement de l'hygiène dentaire autant que je le suis, je vous invite à considérer l'enrichissante carrière qu'est l'enseignement. J'ai préparé une liste de qualités recherchées pour vous aider à préparer votre transition vers l'enseignement et à monter un portfolio efficace.

1. *Expérience* : Posséder de l'expérience clinique en milieux variés est bénéfique, tels qu'en pratique générale et en parodontie, en pratique autonome, en santé communautaire ou en soins interdisciplinaires. Il est avantageux d'avoir de l'expérience en enseignement, qu'elle soit en clinique, en didactique, en éducation permanente ou dans une autre discipline liée à la santé, comme en assistance dentaire.
2. *Scolarité* : Des attestations d'études au-delà du diplôme en hygiène dentaire sont essentielles. Un baccalauréat en enseignement ou dans un domaine connexe est maintenant la norme. Bien que le baccalauréat soit exigé pour l'enseignement à temps partiel en clinique, il va de soi que les membres de la faculté qui enseignent à temps plein ou ceux qui cherchent à sécuriser un poste de leadership dans un programme d'hygiène dentaire (p. ex. directeur de département) doivent avoir fait des études supérieures (une maîtrise ou un doctorat).
3. *Services professionnels* : Il est important d'occuper des postes au sein d'associations locales, provinciales ou nationales, de siéger aux comités de la Commission de l'agrément dentaire du Canada (CADC), du Bureau national de la certification en hygiène dentaire (BNCHD) ou d'équipes qui offrent des services de santé interdisciplinaires ou de participer à des projets communautaires. Les

legislative changes. Passion is related to a dental hygienist's attitude and is noteworthy because love for the profession is evident in everything you do. Teaching is not a 9-to-5 job; it is a lifestyle that demands a deeper commitment of time, resources, lifelong learning, and self. I believe that only someone with a profound and sustaining love of our profession can embrace the demands of a successful teaching career.

6. *Pedagogical expertise*: Educators should be fully fluent in the pedagogy of teaching; increasingly, the use of educational and social media technology is advantageous. Teaching-related skills are essential, as is proficiency with professionally related technologies, such as digital radiography or computerized charting.
7. *Ability to motivate and inspire*: There is an expectation that we are educating and empowering the next generation as opposed to simply training technicians. Accordingly, educators need to fully understand and embrace the idea that dental hygiene is a health care profession equal to other professions in the field of primary care provision.
8. *Adaptability*: Educators need to be able to embrace change and continue to seek out new paradigms in order for dental hygiene programs to play a leading role in directing and advancing the profession. Educators must also be cognizant that innovation and change should be grounded in current research and best practices.
9. *High ethical standards*: Educators embody ethical practice and set the example for students. Therefore, it is important to be familiar with the Code of Ethics, national competencies, CDAC guidelines, NDHCB requirements, and related health and education policies. Be ready to know what documents you need to refer to for guidance in procedure decisions.
10. *Strong written and verbal communication skills*: Communication is key to participating as a team player while remaining an independent thinker and visionary about our profession. Having the ability to hear different perspectives and work through disagreements in a respectful manner is essential.
11. *Respect for diversity*: Recognizing and understanding diversity in its many forms is important. Just as you need to adapt your clinical practice to meet the needs of students, clients, and colleagues who are physically or mentally challenged, you also need to be mindful of social and cultural differences in all interactions with others.
12. *Basic research experience*: A solid background in evidence-based practice and decision making is essential. Being familiar with current research

activités de cette nature incitent les hygiénistes dentaires à s'engager face aux enjeux de la profession, donc, à acquérir des compétences essentielles en enseignement, en leadership, en plaidoyer et en service public.

4. *Bénévolat* : Cette activité peut prendre plusieurs formes et peut être liée directement ou indirectement à notre profession. Donner de son temps pour des raisons qui n'offrent aucun gain personnel tangible fait preuve d'un engagement face à diverses causes méritoires et à la défense des droits, et cette qualité est recherchée chez les enseignants. Participer à ces activités altruistes permet aussi de servir de modèle auprès des étudiants.
5. *Passion pour la profession* : L'intérêt et l'enthousiasme face à la profession peuvent se manifester par la participation à des activités, comme faire du bénévolat ou exercer des pressions auprès du gouvernement en vue de modifications législatives. La passion est liée à l'état d'esprit d'un hygiéniste dentaire et elle est digne de mention, car aimer sa profession se reflète dans tout ce que vous faites. L'enseignement n'est pas un emploi de 9 à 5; il s'agit d'un style de vie qui demande un profond engagement en matière de temps, de ressources, d'acquisition continue du savoir, autant que personnel. Je suis d'avis que seules les personnes ayant un amour profond et durable envers la profession peuvent accepter les exigences propres à une carrière enrichissante en enseignement.
6. *Expertise pédagogique* : Les enseignants doivent avoir l'entière maîtrise des méthodes d'enseignement; l'utilisation de la technologie liée aux médias éducatifs et sociaux est un atout de plus en plus reconnu. Les bonnes compétences liées à l'enseignement sont essentielles et aussi importantes que celles en matière de maîtrise de la technologie liée à la profession, telles que la radiographie digitale ou la consignation aux dossiers informatisés.
7. *Capacité à motiver et à inspirer les autres* : Nous sommes appelés à éduquer et à responsabiliser la prochaine génération d'hygiénistes dentaires, plutôt qu'à simplement former des techniciens. Par conséquent, les enseignants doivent pleinement comprendre et adopter l'idée que l'hygiène dentaire est une profession de la santé au même titre que les autres professions liées aux soins de santé primaires.
8. *Adaptabilité* : Les enseignants doivent pouvoir accepter le changement et être à la recherche de nouveaux paradigmes afin que les programmes d'hygiène dentaire jouent un rôle prépondérant dans l'orientation et l'avancement de la profession. Les enseignants doivent aussi être conscients que l'innovation et le changement devraient être fondés sur les recherches actuelles et les meilleures pratiques.
9. *Normes d'éthiques élevées* : Les enseignants sont les représentants de la pratique sur le plan de

through reading professional journals and learning more about research methodology will benefit your professional practice and expand your academic knowledge.

13. *Commitment to personal development*: Learning is lifelong; educators need to commit to critical self-assessment to guide personal professional development appropriate to the role of the educator.

While this list of skills and qualities can seem daunting, please remember that you do not need all of these to enter the teaching profession. Start with what interests you and what you can accommodate in your lifestyle. Then build your portfolio step by step, and your efforts may lead to you the educational position you are seeking, at the institution of your choice.

Teaching is the profession that creates all others.

—Anonymous

l'éthique et donnent l'exemple aux étudiants. Par conséquent, il est important de bien connaître le code de déontologie, les compétences nationales, les lignes directrices de la CADC, les exigences du BNCHD et les politiques pertinentes et liées à la santé et à l'éducation. Sachez quels documents consulter pour vous guider en matière de procédures et de décisions.

10. *Solides compétences en matière de communication écrite et verbale* : La communication est primordiale lorsqu'il s'agit de travailler en équipe tout en demeurant indépendant d'esprit et visionnaire à l'égard de notre profession. Il est essentiel d'être capable d'entendre les différents points de vue et de pouvoir travailler au-delà des désaccords d'une manière respectueuse.
11. *Respect de la diversité* : Il est important de reconnaître et de comprendre la diversité sous toutes ses formes. Vous devez adapter votre pratique clinique aux besoins des étudiants, des clients et des collègues aux prises avec des difficultés physiques ou mentales, tout autant qu'il est important d'être attentif aux différences sociales et culturelles lors de vos échanges avec autrui.
12. *Expérience de base en recherche* : Une solide expérience de pratique fondée sur des données probantes et des aptitudes exceptionnelles en prise de décision est essentielle. Être au courant des recherches actuelles grâce à la lecture de journaux professionnels et s'instruire davantage au sujet de la méthodologie de la recherche seront profitable à votre pratique professionnelle et vous permettront d'élargir vos connaissances scolaires.
13. *Engagement en matière de perfectionnement personnel* : L'acquisition de connaissances se poursuit tout au long de la vie et les enseignants doivent s'engager à l'auto-évaluation critique afin que le perfectionnement personnel et professionnel s'aligne adéquatement avec le rôle d'enseignant.

Bien que cette liste de compétences et de qualités puisse sembler intimidante, veuillez vous rappeler que vous n'avez pas besoin de toutes ces compétences pour commencer à exercer la profession d'enseignant. Commencez par ce qui vous intéresse et ce que vous pouvez intégrer à votre style de vie. Montez ensuite votre portfolio étape par étape et vos efforts vous guideront peut-être vers le poste d'enseignant que vous convoitez, et ce, à l'établissement de votre choix.

La profession d'enseignant est à la base de toutes les autres.

— Anonyme

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Competencies for Canadian baccalaureate dental hygiene education: A Delphi study, Part 1

Susanne Sunell*, EdD; **Joanna Asadoorian**[§], PhD; **Cynthia C Gadbury-Amyot**[†], EdD; **Heather C Biggar**[Δ], BDSc(DH), MSc

ABSTRACT

Background: The Canadian Dental Hygienists Association and Dental Hygiene Educators Canada created learning outcomes for baccalaureate education in the early 2000s. However, further development to inform members of the profession, other professionals, and the public as to what they can expect from baccalaureate dental hygiene graduates was deemed necessary. **Purpose:** The aim of this study was to identify the competencies that Canadian dental hygienists need at the fourth-year baccalaureate level to promote and support the oral health of the public. **Methods:** An online, 3-round Delphi study was conducted from fall 2012 until spring 2014. Respondents were asked to rate the importance, relevance, and realistic characteristics of domain competencies and their sub-competencies. Open-ended questions were included to augment the ratings. A 70% consensus level was selected for inclusion of the competencies. **Results:** Twenty-four Canadian dental hygienists who met the inclusion criteria were invited to participate in the study; 10 completed Round 3 representing a 42% response rate. Round 1 started with 14 domain competencies supported by 120 sub-competencies. This number was reduced by Round 3 to 13 domain competencies and 98 sub-competencies. Several domain headings were identical to the national entry-to-practice domains: professionalism, coordination, advocacy, health promotion, oral health education, and clinical therapy. The domains of collaboration and communication were uncoupled and articulated as separate entities, and new domains were added: research use, leadership, policy use, disease prevention, and knowledge of discipline. **Discussion and Conclusion:** Consensus was achieved on a diverse number of domain competencies and sub-competencies; many are similar to the competencies from diploma education but expressed to a higher level. Others highlight the importance of discipline knowledge, research use, policy use, and leadership. These competencies have the potential of being valuable for accreditation, national examination as well as educational purposes; they may serve as a catalyst for strengthening baccalaureate dental hygiene education.

RÉSUMÉ

Contexte : Au début des années 2000, l'Association canadienne des hygiénistes dentaires et Éducateurs en hygiène dentaire Canada ont élaboré des résultats d'apprentissage pour la formation menant au baccalauréat. Cependant, une mise en valeur a été jugée nécessaire afin d'informer les membres de la profession, d'autres professionnels et le public des attentes à l'égard des diplômés de programmes de baccalauréat en hygiène dentaire. **Objectif :** Cette étude a été effectuée pour cerner les compétences requises des hygiénistes dentaires canadiens titulaires d'un baccalauréat de 4 ans afin qu'ils puissent promouvoir et appuyer la santé buccale du public. **Méthodes :** Une étude Delphi exécutée sur 3 tours a été menée en ligne de l'automne 2012 au printemps 2014. Les participants devaient évaluer l'importance, la pertinence et les caractéristiques réalistes des domaines de compétences et des sous-compétences liées à ces domaines. Des questions ouvertes étaient intégrées au questionnaire afin d'augmenter les cotes. La décision d'inclure des compétences reposait sur un consensus de 70 %. **Résultats :** Vingt-quatre hygiénistes dentaires canadiens qui ont satisfait aux critères d'inclusion ont été invités à participer à l'étude et dix personnes ont complété le troisième tour, ce qui correspond à un taux de réponse de 42 %. Le premier tour a débuté avec 14 domaines de compétences appuyés par 120 sous-compétences. Au troisième tour, il ne restait que 13 domaines de compétences et 98 sous-compétences. Plusieurs titres de domaines étaient identiques aux domaines de compétences d'entrée en pratique nationale : professionnalisme, coordination, plaidoyer, promotion de la santé, éducation en matière de santé buccodentaire et thérapie clinique. Les domaines touchant la collaboration et la communication ont été séparés et présentés comme des entités distinctes, et de nouveaux domaines ont été ajoutés : utilisation de la recherche, leadership, mise en pratique des politiques, prévention des maladies, et connaissance de la discipline. **Discussion et conclusion :** Un consensus s'est dégagé sur un certain nombre de domaines de compétences et de sous-compétences; plusieurs des compétences sont similaires à celles de la formation menant au diplôme collégial, mais elles sont exprimées à un niveau supérieur. D'autres mettent l'accent sur l'importance de la connaissance de la discipline, l'utilisation de la recherche, la mise en pratique des politiques et le leadership. Ces compétences peuvent être utiles aux fins d'accréditation, d'examen national et de formation; elles peuvent servir de catalyseur en vue de renforcer le baccalauréat en hygiène dentaire.

Key words: baccalaureate degree, competencies, Delphi technique, dental hygiene education, dental hygienists

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INTRODUCTION

The first Canadian dental hygiene competencies were developed in the mid-1980s to support the work of the Canadian Dental Association's Council on Education and Accreditation.[1] The competencies in this era were largely technical in nature, and the dental hygiene versions were no exception; they focused on clinical therapy. Since that time competencies have evolved to capture more clearly the full scope of dental hygiene practice including cognitive abilities.

The outcomes-based education movement originated in the public school system, with the goal of exploring the abilities needed by graduates to integrate into society.[2] In the 1990s this movement merged with the accountability focus in postsecondary education, which directed attention to the identification of graduate outcomes and the integration of authentic assessments that more closely reflected practice experiences.[3] This direction was embraced by many governments in Canada[4,5] and internationally;[6,7] these policy shifts that occur almost simultaneously in various jurisdictions are an example of "policy borrowing"[8] or "policy learning."[9]

The outcomes of education had often been presented in terms of intentions but they were now being stated as evaluated abilities demonstrated by graduates. While a plethora of terms were used to define these outcomes[10] (e.g., core competencies, learning outcomes, essential skills), they all described the "knowledge, skills, and attitudes"[3] expected of graduates and necessary for the practice of a profession. "Competencies" tended to be the term used in vocational and career technical areas, while "learning outcomes" were discussed in professional and academic areas. While some authors explained these concepts as dichotomous,[11] the proposed differences between them often disappeared at the implementation level.[3] Indeed, the terms that define educational outcomes are best understood on a continuum ranging from specific to general statements, with competencies tending to express outcomes in more specific terms. Regardless of the term applied, discussions about the outcomes of learning now focus on complex abilities that are multidimensional as opposed to simple, unitary constructs.

In 1993, the Association of Canadian Faculties of Dentistry (ACFD) held a strategic planning session directed towards national dental hygiene and dental assisting educational standards.[12] The recommendations arising from this session prompted the Canadian Dental Hygienists Association (CDHA) to advance dental hygiene education. In 1998, CDHA developed a policy framework for dental hygiene education,[13] followed by the establishment of the Task Force on Dental Hygiene Education in 2000 whose mandate was to articulate learning outcomes for diploma, baccalaureate, master's, and doctoral credentials.[14]

In 2000 CDHA asked Dental Hygiene Educators Canada (DHEC) to validate the learning outcomes generated by the CDHA Task Force. In response, DHEC implemented a 3-phase study of CDHA's proposed diploma and baccalaureate learning outcomes. First, a national online survey of dental hygiene educators was conducted. Second, an email Delphi study that included respondents who were identified as dental hygiene experts by provincial organizations was carried out. Third, a feedback loop was developed for Canadian dental hygiene program directors.[15] CDHA and DHEC used the learning outcomes terminology to align with the policy directions in postsecondary education in the 1990s,[1] which resulted in broad, general statements that some educators found to provide little practical direction. These learning outcomes were also viewed as belonging to a specific organization; they were available in 2004 but were never fully integrated into the work of other national organizations.

In 2006 DHEC initiated discussions among national dental hygiene organizations to support the revision of the diploma and baccalaureate learning outcomes.[16] The discussions involved the following organizations, listed in alphabetical order:

- Canadian Dental Hygienists Association (CDHA)
- Commission on Dental Accreditation of Canada (CDAC)
- Dental Hygiene Educators Canada (DHEC)
- Federation of Dental Hygiene Regulatory Authorities (FDHRA)
- National Dental Hygiene Certification Board (NDHCB)

During the initial meeting at CDHA's national conference in Edmonton, the group decided to form a national consortium to guide the development of national competencies for the dental hygiene profession; each organization present was included in the consortium. It was decided to use the language of competencies to align with the current trend in the health professions.[17,18] In this article the wording reflects the terms used by the organizations that generated specific documents; the term "abilities"[3] is used as a generic expression encompassing both learning outcomes and competencies.

The consortium members made a deliberate decision to avoid discussions of credentials and program length in an effort to establish foundational competencies for the profession given the perceived erosion of dental hygiene education with the influx of multiple players into the delivery of programs.[1] A 3-phase study was initiated commencing with a workshop involving 21 key dental hygiene informants who generated draft competencies in February 2007; these competencies were then used as the basis for a national online survey of CDHA members in fall 2007 followed by regional focus groups in spring 2008.[16] The resulting entry-to-practice competencies published in 2008 were described by some as being beyond the diploma level while others felt that the competencies

reflected the acquired skills of current diploma graduates accurately. Despite these diverse views, the competencies were integrated into educational programs, accreditation requirements, the national examination blueprint as well as regulatory practice standards published in 2010.[19]

Discussions about baccalaureate competencies had been limited by the focus on entry-to-practice competencies; however, they were not forgotten. CDHA's Education Advisory Committee lobbied for work in this area and, in 2012, CDHA created an advisory committee to guide the articulation of these competencies. The need for such a standard was seen as increasingly important given the diverse educational models across Canada and changing regulatory legislation. Degree competencies were deemed important as a quality assurance element to inform members of the profession, other professionals, and the public as to what they could expect from baccalaureate dental hygiene graduates.

The literature on the abilities associated with dental hygiene baccalaureate education is sparse;[14,15,20-22] it includes the previously mentioned organizational documents but few research studies. To obtain further evidence for the development of a national competency profile for baccalaureate dental hygiene education, CDHA supported the implementation of a study designed to identify the competencies that were needed by dental hygiene baccalaureate graduates. The following research question guided this study: What are the competencies that dental hygienists need at the fourth-year baccalaureate level to promote and support the oral health of the public in the 21st century?

METHODOLOGY

The Delphi approach provides a structured group communication process to support decision making in the health professions. Such an approach has been used to gain consensus from people deemed to be experts in a field on a wide range of health questions including competency profiles.[23-25] The Delphi approach was selected for this research project given its ability to provide anonymity of responses, thus helping to minimize the "group think" or "bandwagon effect"[23] that often comes with face-to-face meetings. It also has the advantage of reducing barriers related to time and geographic distance. Multiple iterations are believed to produce more valid judgements as participants have the time to reconsider their positions and also gain peer input.[23-26] However, the Delphi approach also has limitations in that it tends to be time consuming for respondents and researchers alike.

CDHA provided financial support for this study, which was organized as a collaborative research project involving the members of CDHA's Advisory Committee for the Development of a Baccalaureate Dental Hygiene Competency Framework. Ethics approval was obtained through the University of Manitoba Research Ethics Board.

The membership of the advisory committee included baccalaureate dental hygiene program directors, regulatory representatives from provinces with a baccalaureate program, representatives from CDAC and the Canadian Association of Public Health Dentistry (CAPHD), as well as 2 American educators with experience in both baccalaureate and master's level dental hygiene education. One committee member was hired as the project consultant, and the committee members conducted their work through teleconferences (n=6), emails, and a one-day meeting after the completion of Round 3. They were involved in the development of the instruments used in each round and the analysis of the results after every round. The work of this committee extended beyond the Delphi study; it also included the development of the final competency framework for 4-year baccalaureate programs. This article will present the findings from the Delphi study.

To address the research question, which was to identify the competencies that Canadian dental hygienists need at the fourth-year baccalaureate level, it was necessary to establish the boundaries between diploma, baccalaureate, and master's level education. The focus of the Delphi study was specific to the competencies for fourth-year baccalaureate education. Respondents were informed that the current national entry-to-practice competencies[16] would be integrated into the profile once the fourth-year competencies had been identified. This integration was important given that most of the Canadian programs are baccalaureate degree completion programs with only one being a 4-year entry-to-practice program. See www.cdha.ca/schoolsPrograms for the listing of baccalaureate programs in Canada.

The study involved a purposeful sample of Canadian dental hygienists who are recognized as experts in the profession. An instrument developed and validated through discriminant analysis by Bradley et al.[27] in the area of dietetics was adapted to generate the following inclusion criteria:

- Holds a position that involves at least 2 roles that are complex and diverse in terms of responsibilities and functions
- Holds a master's degree or higher
- Has 8 years or more of practice experience
- Has given one professional presentation, published one scholarly piece or received one award in the past 3 years
- Has a network of multiple and diverse professional contacts including 2 contacts beyond the organization of employment

In June 2013, CDHA distributed an email invitation to its members asking them to express their interest in participating in the study through a brief SurveyMonkey survey about their professional background. The 24 respondents who met the inclusion criteria were invited to participate in the study.

The competency profile for the first round of the Delphi was developed from a review of the literature[24] in health sciences including international, national, and provincial resources with a focus on peer-reviewed literature[17,18,20-22,28-48] as well as gray literature from governmental[49-61] and health-related organizations.[62-85] Special attention was paid to the issues of client/patient safety and better health outcomes.[86-99] The literature pertaining to generic abilities[57-60] associated with postsecondary education at a national and provincial level also informed the development of the draft competency profile.

The draft document for the Delphi study was structurally aligned with the national entry-to-practice competencies.[16,19] It included generic domain headings, many of which are used in health professional curricula;[17,18] they were clustered under the following 3 main headings:

- knowledge of the discipline competency (to direct attention to the foundational knowledge that underpins all of the competencies)
- core competencies (to reflect their interprofessional nature)
- dental hygiene service competencies (to focus on the specialized services provided by dental hygienists)

The domain headings were supported by a broad, general competency statement to provide clarity (Table 1). These general competency statements were then augmented by more detailed competency statements—postulated to be more specific to fourth-year baccalaureate dental hygiene education—under each domain heading. These descriptive layers will be referred to as the "domains" (the general heading), "domain competencies" for the overarching competency statement, and the "sub-competencies" (the more detailed competencies under each domain). The draft domain competencies and associated sub-competency clusters for the first round of the study were vetted by the CDHA Advisory Committee to support content validity.

A pilot phase was conducted for Round 1 (June to July 2013) with directors of dental hygiene baccalaureate degree programs in the United States (n=4) using SurveyMonkey. All rounds of the Delphi were subsequently conducted using this methodology. Feedback from the pilot phase resulted in editorial changes to improve clarity.

In Round 1 (August 26 to September 30, 2013) the respondents were asked to rate the importance, relevance, and realistic characteristics of each domain competency and its sub-competencies using a 4-point rating scale plus a "do not know" option. The rating scale, adapted from Forrest and Spolarich,[100] ranged from very important/relevant/realistic to not important/relevant/realistic. The survey included open-ended questions that asked respondents to explain their rating and provide recommendations for

Table 1. Domain competencies for baccalaureate dental hygiene education

Domain heading	Domain competencies
Knowledge of discipline competency	**1. Integration of knowledge of discipline:** Incorporate foundational knowledge in behavioural, social, and biological sciences into practice decisions to generate evidence-based autonomous judgements.
Core competencies	**2. Professionalism:** Demonstrate self-management and self-regulation within oral health and interprofessional settings within the parameters of relevant legislation, codes of ethics, and practice standards. **3. Communication:** Interact effectively with individuals and groups to facilitate the gathering, integrating, and conveying of information in multiple forms. **4. Collaboration:** Work effectively with others to address the oral health needs of individuals, groups, communities, and populations with a view to improving overall well-being. **5. Coordination:** Organize oral health services by bringing together the contributions of diverse individuals to manage the oral health needs and outcomes of individuals, groups, communities, and populations. **6. Research use:** Use scientific information to support evidence- and theory-based autonomous judgements and services. **7. Leadership:** Facilitate change and innovation in diverse practice environments to support and promote the well-being of individuals, groups, communities, and populations.
Dental hygiene service competencies	**8. Health promotion activities, initiatives, and programs:** Assess, diagnose, plan, implement, and evaluate health promotion services for individuals, groups, communities, and populations. **9. Disease prevention activities, initiatives, and programs:** Apply knowledge of oral, general, and behavioural sciences to minimize the occurrence of oral disease and to foster the competence of clients to achieve oral health. **10. Oral health education:** Support clients in the exploration of their values and beliefs, and the acquisition of knowledge, skills, and self-care habits related to oral health and well-being. **11. Advocacy:** Support social issues, policies, and individuals, groups, communities, and populations to reduce inequities in oral health status and increase access to oral health services. **12. Policy use:** Work with policies to improve and protect the oral and general health status of the public. **13. Clinical therapy:** Manage therapeutic and ongoing supportive services for clients, including those with medically complex needs, through the life stages.

changes, including additions and deletions. The results of Round 1 were reviewed by the advisory committee, and the recommendations, based on unanimous consensus, were included in the next round of the study. This collaborative analysis methodology continued throughout all rounds of the study.

In Round 2 (November 1 to December 2, 2013) the respondents were asked to rate the realistic nature of the ability statements using the same type of scale as used in Round 1. The question was refined to focus specifically on the "realistic" characteristic, as respondents had scored the importance and relevance highly, but questioned the realistic nature of some abilities. A further question asked respondents to identify how confident they were in their responses using a 4-point scale ranging from very confident to not confident at all; this question was included to provide insights into the validity[23] of the data in the other questions. Similar open-ended questions as in Round 1 were included in Round 2.

In Round 3 (January 20 to February 17, 2014) the respondents were asked to accept, edit or reject each ability statement in which consensus had not yet been achieved; in cases where respondents selected the edit or reject option, they were asked to provide suggestions and the associated rationale for their rating. Respondents were also asked to provide further comments about the consensus-achieved domain competencies and the sub-competencies. The same open-ended questions as in previous rounds were included.

The feedback from the study participants was integrated into the rounds of the Delphi as they were implemented, with ongoing analysis and input from the CDHA Advisory Committee. The aim was to reduce redundancies, promote clarity of wording, ensure realistic verb choices, and identify gaps. The participants received text information and percentage scores for the domain and sub-competency statements, which provided what Keeney and Hasson[24] describe as "basic but meaningful information" for their decision making. Each round also included a reminder email sent about 10 days prior to the closure of the survey.

The consensus level employed in Delphi studies commonly ranges from 51% to 80%[23,26] depending on the research question posed and resources available, with 70% being a common benchmark.[23] Hence, a 70% consensus level was pre-selected as the criterion for final inclusion of abilities. Statistical analysis included the exploration of frequency data, and thematic analysis was conducted to investigate common views and areas of divergence in the written comments. The competencies for which consensus was achieved were reviewed by the CDHA Advisory Committee for face validity.

RESULTS

The Delphi data are being presented in 2 separate but related articles. This article, Part 1, focuses on the consensus-achieved domain competencies and sub-competencies for the fourth year arising from the Delphi study; these data help to define the boundary between baccalaureate and master's abilities. Part 2 will focus on the identification of substantive differences between diploma and baccalaureate education to clarify the boundary between those 2 credentials.

Three hundred and seventy CDHA members expressed an interest in participating in the study through the completion of the online survey. Twenty-four met the inclusion criteria and were invited to participate. Sixteen respondents (66%) started the study and eleven (46%) completed Round 1. All respondents who provided data in Round 1 were invited to Round 2. Of the 16 invitees, 12 individuals (50%) started Round 2 and 9 (39%) completed it. The twelve respondents who provided data in Round 2 were then invited to participate in Round 3 of the study. Ten respondents of the original twenty-four started and completed the survey, representing a 42% response rate for Round 3.

The majority of respondents had over 24 years of practice experience (Table 2); this was expected given their expert status. There was consistent representation of respondents working in private practice, postsecondary education, research, and administration in all rounds. Public health was represented in Rounds 1 and 2, but not in Round 3; however, the CDHA Advisory Committee did include a representative from CAPHD. While there was no representation from hospital/agency/facility practice in Rounds 1 and 2, there was a respondent from this setting in Round 3. These data suggest that there were some shifts in practice settings during the study.

All professional roles were represented in all rounds of the study (Table 2). The majority of respondents held a master's degree; one respondent had a doctorate. Given the few Canadian dental hygienists with doctoral degrees and the fact that 3 Canadian members of the CDHA Advisory Committee held doctorates, this profile was expected.

Seven of the eight provinces with dental hygiene programs were represented in the original group invited. Respondents from 6 provinces participated in the study; the invited experts from Alberta did not participate but the program director from the University of Alberta was a member of the CDHA Advisory Committee. See www.cdha.ca/schoolsPrograms for the listing of all accredited Canadian dental hygiene programs.

The domain headings were selected from national and international[48,50,62,66,67,84] literature and were shaped to integrate with interprofessional[17,18,27,55,65] and dental hygiene competency documents.[6,7,39,52,58,70,71] The associated domain competencies were generated from the same literature and adapted shaped to the dental hygiene profession (Table 1).

Five domain competencies were initially added: research use, systematic inquiry, leadership, policy use, and integration of knowledge. Rather than having a

Table 2. Characteristics of invited sample and respondents who completed the Delphi

Respondent characteristics	Invited sample (n=24)	Round 1 respondents (n=11)	Round 2 respondents (n=9)	Round 3 respondents (n=10)
Years in practice (with each respondent having ≥ 8 years of practice)				
Between 8 and 16 years	4	0	1	2
Between 17 and 24 years	6	2	2	1
Over 24 years	14	9	6	7
Primary practice area				
Private practice	1	0	1	1
Public health practice	2	1	1	0
Hospital/facility/agency practice	0	0	0	1*
Postsecondary education – educator	8	2	1	1
Postsecondary education – researcher and educator	8	5	4	3
Administration	2	3	2	3
Other	3			1
Secondary practice area				
Private practice	9	2	3	3
Public health practice	0	0	1*	0
Hospital/facility/agency practice	2	0	0	0
Postsecondary education – educator	4	1	2	2
Postsecondary education – researcher and educator	2	2	0	0
Administration	3	1	0	1
Not applicable	4	5	3	3
Other	0	1	0	1
**There appear to have been some shifts in practice settings during study.*				
Professional role positions (with each respondent having 2 or more positions)				
Educator (with students)	23	10	7	5
Presenter	22	8	8	7
Evaluator	19	7	5	6
Implementer of programs/services	18	7	6	4
Clinician	17	4	5	4
Consultant	17	7	4	4
Researcher	16	9	6	3
Creator of programs/services	16	5	6	4
Administrator/manager	16	6	5	6
Highest level of education (master's level or higher required)				
Master's degree	22	10	8	9
Doctoral degree	2	1	1	1
Primary province of practice				
Alberta	4	0	0	0
British Columbia	7	2	3	3
Manitoba	2	1	1	1
Nova Scotia	2	1	1	1
Ontario	6	4	3	3
Québec	2	2	1	1
Saskatchewan	1	1	0	1

separate domain for critical thinking, the concept was incorporated into the sub-competencies in all domains. It was then also augmented by the concept of research use, systematic inquiry, and integration of knowledge which directs attention to evidence-based practice.

The systematic inquiry domain was developed to bridge the gap between research "use" and the abilities required to "conduct" research, the latter being commonly associated with graduate education. A leadership domain competency was created given its current existence in baccalaureate[52,66] and master's[72,99] education. A policy use domain competency was developed for the same reason.[52,66,72,73,79,99,102]

In Round 1 all of the domain competencies were rated as important, relevant, and realistic with a range from 75% to 94% (Table 3). While the systematic inquiry domain was rated at 94%, many of the competencies in the domain were described as being ''too lofty'' for baccalaureate education. Respondents also found it challenging to differentiate between the systematic inquiry and the research use domain.

The following quotes are representative of these views:

What does "research use" and "systematic inquiry" mean?

Table 3. Rounds 1 and 2 data related to domain competency ratings

Domain competencies	Round 1 (n=16) Important/relevant/realistic			Round 2 (n=12) Relevant		
	Very important/ (very relevant/ very realistic)	Important/ (relevant/ realistic)	Total	Very relevant	Relevant	Total
Knowledge of the discipline competency						
Integration of knowledge of the discipline	75% (12)	19% (3)	94% (15)	67% (8)	25% (3)	92% (11)
Core competencies						
Professionalism	69% (11)	25% (4)	94% (15)	100% (12)	0%	100% (12)
Communication	81% (13)	13% (2)	94% (15)	92% (11)	8% (1)	100% (12)
Collaboration	75% (12)	19% (3)	94% (15)	83% (10)	17% (2)	100% (12)
Coordination	38% (6)	38% (6)	76% (12)	42% (5)	42% (5)	83% (10)
Research use	63% (10)	25% (4)	88% (14)	83% (10)	17% (2)	100% (12)
Systematic inquiry	69% (11)	25% (4)	94% (15)	Domain was deleted after Round 2		
Leadership	50% (8)	25% (4)	75% (12)	100% (12)	0%	100% (12)
Dental hygiene service competencies						
Health promotion activities, initiatives, and programs	75% (12)	19% (3)	94% (15)	100% (12)	0%	100% (12)
Disease prevention activities, initiatives, and programs	88% (14)	6% (1)	94% (15)	83% (10)	17% (2)	100% (12)
Oral health education	62% (10)	25% (4)	87% (14)	58% (7)	42% (5)	100% (12)
Advocacy	69% (11)	25% (4)	94% (15)	33% (4)	58% (7)	92% (11)
Policy use	44% (7)	38% (6)	82% (13)	58% (7)	33% (4)	92% (11)
Clinical therapy	81% (13)	13% (2)	94% (15)	100% (12)	0%	100% (12)

I see all of these abilities as far beyond the realistic expectations of a BScDH. These are Master's, and more realistically, PhD outcome abilities.

The recommendation to amalgamate the 2 domains was implemented in Round 2. The systematic inquiry domain was deleted and the sub-competencies were amalgamated into the research use domain. In Round 2, consensus (ranging from 83% to 100%) was achieved on all of the domain competencies indicating that they were found to be relevant for baccalaureate dental hygiene education (Table 3).

The 3 Delphi rounds resulted in consensus on the following domain headings and competencies:

Knowledge of discipline:
- Integration of knowledge of discipline

Core competencies:
- Professionalism
- Communication
- Collaboration
- Coordination
- Research use
- Leadership

Dental hygiene service competencies:
- Health promotion activities, initiatives, and programs
- Disease prevention activities, initiatives, and programs
- Oral health education
- Advocacy
- Policy use
- Clinical therapy

The draft sub-competencies used in Round 1 included 120 statements organized into 14 domain competencies (Table 4). Two additional sub-competencies were introduced in Round 2: one in the collaboration and one in the oral health education domains. During the course of the study, the number of sub-competencies was reduced to 98 in the consensus-achieved profile. The greatest reductions occurred in research use, advocacy, and policy use, with the research use domain having the most dramatic change when considering the amalgamated abilities from the systematic inquiry domain. The reductions were based on redundancies, competencies already being met in diploma education, and competencies deemed more appropriate for graduate programs.

Table 4. Number of sub-competency statements in each round and the consensus-achieved results

Domains	Number of sub-competencies in domain			
	Round 1	Round 2	Round 3	Consensus achieved
Knowledge of the discipline competency				
Integration of knowledge of the discipline (n=5)	5	5	5	**5**
Core competencies				
Professionalism	6	6	6	**6**
Communication	8	8	7	**7**
Collaboration	8	9[a]	9	**9**
Coordination	9	9	9	**8**
Research use	12	12	12	**11**
Systematic inquiry[b]	11	-	-	**-**
Leadership	9	9	9	**9**
Dental hygiene service competencies				
Health promotion activities, initiatives, and programs	10	9	9	**8**
Disease prevention activities, initiatives, and programs	7	7	7	**7**
Oral health education	9	9 a	9	**8**
Advocacy	8	8	8	**6**
Policy use	9	9	7	**5**
Clinical therapy	9	9	9	**9**
Total	**120**	**110**	**106**	**98**

[a]One new competency was added to this domain in Round 2.
[b]Round 1 included an additional domain (systematic inquiry); these competencies were amalgamated into the research use domain.

The following quotes provide examples of these views:

This ability statement should be entry-to-practice standard for a graduate dental hygienist whether from a diploma or degree program.

These are wonderful domains and abilities but perhaps a little onerous to accomplish [in baccalaureate programs].

These seem redundant and already incorporated in the above statements.

During Round 1 respondents were asked to rate the importance, relevance, and realistic nature of each sub-competency statement (eTables A-M, available at www.cdha.ca/pdfs/Profession/Journal/sunell_eTables.pdf). The resulting ratings were high: 93% (n=112) of the items were rated at 80% or higher, with 6% (n=7) rated at 73%. Only 2 items (2%) were not within the 70% consensus range. While respondents indicated that they believed the sub-competencies to be important and relevant, they often questioned how realistic they were. The following comments reflect these views:

Kudos to you for capturing a multitude of very important and extensive list of abilities that aren't even touched upon in a diploma program.

Important, but not so realistic for lower levels of education [baccalaureate degree].

Although I identified the abilities in [Policy Use] as very important, they may not be very realistic at the baccalaureate level.

To gain more meaningful data, the question in Round 2 focused solely on the realistic nature of the sub-competencies, which resulted in generally lower ratings (eTables A-M, available at www.cdha.ca/pdfs/Profession/Journal/sunell_eTables.pdf). The sub-competencies in these tables are presented in descending order based on Round 2 data; those that achieved consensus in Round 3 are located towards the end of each table.

The scores in only 9 items increased from Round 1 to Round 2, which was likely influenced by changes in the verbs. At the end of Round 2, consensus had been achieved in 70 sub-competencies while 36 sub-competencies remained below the 70% level. Of those 36 sub-competencies, 27 achieved consensus in Round 3.

The most numerous changes pertained to verb choices; these changes helped to define the boundary between baccalaureate and master's level abilities. The following examples illustrate this feedback:

These abilities are more realistically posed... "support" is a good verb choice.

"Analyze" is too lofty.

Change "Collect data about policies..." to "Work with others to collect data about policies."

While consensus was achieved on 98 sub-competencies, respondents expressed a range of views. The following quotations highlight some of those issues:

Leadership is a domain that is lofty for a BScDH program.

In our changing health care system - leadership, innovation and change management are becoming extremely important.

Not sure to what extent or depth [Research Use #1-6] can be learned, applied, demonstrated in baccalaureate education.

This [Communication domain] does not seem to be that different from the 2-year degree I graduated with.

Contributing effectively within oral health and interprofessional groups and settings depends on MANY factors. Contributing at all would be a more realistic goal, or perhaps "contributing positively."

The diversity of views provided rich data for shaping and refining the sub-competencies over the 3 rounds of the study.

Respondents were also asked to rate their confidence in their responses regarding the realistic question. All of the ratings were 70% or above, suggesting that they felt comfortable with their views.

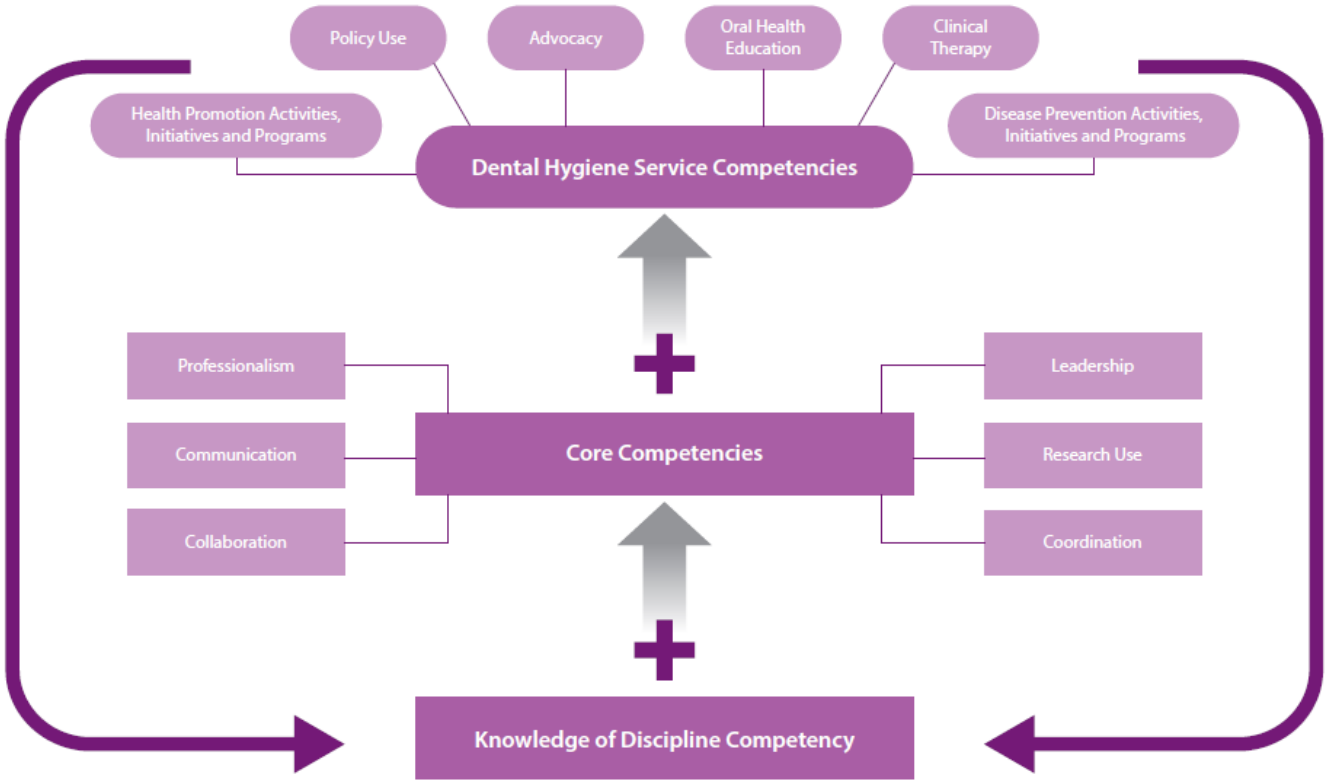
DISCUSSION

The overall profile of the study participants indicates that they had a wide range of professional roles and experiences in diverse practice settings. Their background suggests that they possessed the knowledge and experience to contribute to the discussions of baccalaureate dental hygiene education.

Consensus was achieved on a diverse number of domain competencies and sub-competencies. Figure 1 presents a schematic of the 13 domains organized under the 3 headings of knowledge of the discipline, and core and dental hygiene service competency areas. Overlapping areas exist between the domains as is common in frameworks; for example, advocacy, policy use, and education are pillars of health promotion while many aspects of disease prevention overlap with both health promotion and clinical therapy. However, each domain highlights and emphasizes important yet interconnected sub-competencies for baccalaureate dental hygiene education in the 21st century.

Many of the domain headings are identical to the ones generated during the development of the *National Dental Hygiene Competencies for Entry-to-Practice*.[16] This result was expected as the headings in that document were also grounded in the literature on interprofessional education.[17,18] However, some differences emerged between

Figure 1. Canadian competencies for baccalaureate dental hygiene programs



Source: Canadian Dental Hygienists Association. *Canadian competencies for baccalaureate dental hygiene programs.* Ottawa: CDHA; 2015. Reprinted with permission from CDHA.

this and the entry-to-practice[16] profile. In this current profile, collaboration and communication are articulated as separate domains in order to provide a greater focus on abilities to support interprofessional collaboration and to emphasize the effective flow of information within groups and organizations given the relationship of these abilities to client safety and better health outcomes.[51,52,101]

Many of the sub-competencies in the systematic inquiry domain did not achieve consensus as they were viewed as more appropriate for master's level education. However, the remaining ones were integrated within the research use domain that now represents the bridge to graduate studies given that a systematic analysis of the literature is the first step when a research question is explored. The integration of some abilities pertaining to systematic inquiry acknowledges the continuum of learning from diploma to graduate studies.

The study results confirmed the growing importance of leadership and policy use, both of which are supported by the Public Health Agency of Canada[52] and the Association of Canadian Faculties of Dentistry[66] in their competencies for the public health sector. These 2 domain competencies were viewed as another bridge between baccalaureate and master's level education. See Table 5 for some examples of wording used in domain headings associated with different credentials in the health professions.

Schrecker[103] highlights the reality that health professionals continue to explore health promotion mainly through the development of personal skills. He suggests that the discourse on the pillars of health promotion shifts dramatically during the implementation of policy, with the result that policies often focus solely on personal lifestyle behaviours in isolation from the social determinants of health and the other pillars of health promotion. Several Delphi respondents expressed the view that some of the health promotion, policy use, and leadership sub-competencies were more appropriate for graduate studies. The fact that these themes are integral to graduate studies is not disputed; the challenge is to define the foundational abilities that are appropriate for baccalaureate dental hygiene education. The results of this study provide further knowledge from which to explore the boundary between baccalaureate and master's level education in these areas.

Issues pertaining to safety and better oral health outcomes are threaded throughout the sub-competencies in various domains. Historically, safety issues were

Table 5. Examples of domain themes across credentials from national and international literature

Domain themes	Canadian dental hygiene ETP themes[a]	Educational programs: Baccalaureate themes	Educational programs: Master's[b] themes
Knowledge of the discipline	--	Public health sciences[52,66] Basic and dental sciences[31]	Public health sciences[52,66]
Professionalism	✓	Professionalism[15,17,67,50]	Professionalism[17,18,72,85]
Communication	✓	Communication[15,17,28,50,52,66,67] Information management[59]	Health informatics and technology[72]
Collaboration	✓	Collaboration[15,17,50, 52,66,67]	Interprofessional collaboration[58,72,85]
Coordination	✓	Coordination[17,67] Practice management[15] Systems-based practice[37,50] Supervision competence[28]	Program administration[72] Management of oral health care delivery[71] Practice management[85]
Research use	Critical thinking	Research use[67,81] Evidence-based practice[15,37,50] Scholarship for evidence-based practice[59]	Scholarly inquiry and research[58, 72] Translational research[71] Clinical scholarship[85] Evidence-based practice[85]
Leadership	--	Leadership[50,52,66,67,80,81] Leadership and systems thinking skills[65]	Leadership[72]
Health promotion	✓	Health promotion[15,28,52,66,67,80,84]	Health promotion[72,85] Program development and administration[58]
Disease prevention	✓	Disease prevention[15,52,66,67]	Disease prevention[72]
Health education	✓	Health education[15,52,66,67]	Health education[72]
Advocacy	✓	Advocacy[15,52,66,67,80,]	Advocacy[72,85]
Policy use	--	Policy use[67] ADPIE for policy[52,66] Policy development[65,81] Health care policy[59]	Health care policy[58,85] Health care policy & advocacy[71] Health policy & management[72]
Clinical therapy	✓	Clinical therapy[15, ,67] Patient-centred care[50] Direct care	Patient care[71] Provision of primary care[85] Case management[85]

[a]Dental Hygiene Educators Canada, Canadian Dental Hygienists Association, National Dental Hygiene Certification Board, Commission on Dental Accreditation of Canada, Federation of Dental Hygiene Regulatory Authorities. *National dental hygiene competencies for entry-to-practice: release* 3. Ottawa (ON): Authors; 2008.
[b]This is not to suggest that these are the only themes in master's level education.

limited to abilities surrounding acute care;[104] that is, clinical therapy in an oral health context. In the Delphi results the threads of safety now occur in 8 domains to reflect the impact of communication, coordination, collaboration, research use, leadership, health promotion, disease prevention, and clinical therapy on client safety and better health outcomes.[55,75,82,89,90,93,94] The concepts are sometimes expressed explicitly, as in the communication and leadership domains, or framed around phrases such as "to protect and further the oral health status of the public" (see eTable F, available at www.cdha.ca/pdfs/Profession/Journal/sunell_eTables.pdf#page=06) or "management of incidents, outbreaks and emergencies" by health professionals (see eTable H, available at www.cdha.ca/pdfs/Profession/Journal/sunell_eTables.pdf#page=08). While these discussions have occurred in medicine and nursing for many years, they are only now becoming a focus in oral health literature.[86,105]

The sub-competency related to the management of incidents, outbreaks, and emergencies prompted diverse comments. This sub-competency represents an emerging trend involving the deployment of health care providers to assist in various types of disasters.[106,107] For example, through the collaborative efforts of people involved in disaster relief, changes were made to the Illinois Public Act 49-409 recognizing Dental Emergency Responders.[106] The Act includes both dentists and dental hygienists; it recognizes the potential contribution of these oral health

professionals in providing basic triage care, airway care, inoculations (injections), drug dispensing, and care for the walking well—those who are not injured but still need guidance with evacuation from the scene.

Each domain competency includes sub-competencies that have been identified as important, relevant, and realistic for fourth-year dental hygiene baccalaureate education; some were rated higher than others, but all achieved a 70% or higher consensus level. The data were analysed to explore possible themes present in the 89% to 100% range, but none emerged.

The Delphi results align well with 2 Canadian studies whose respondents included graduates of Canadian baccalaureate dental hygiene degree programs.[20,22] The participants in the Kanji et al.[20] study talked about the outcomes of dental hygiene education involving an increased knowledge base as well as increased abilities related to critical thinking, making evidence-based decisions, and being able to provide more comprehensive care. Similarly, the respondents in the Sunell et al. study[22] identified a greater knowledge base in addition to increased abilities in cognitive areas such as critical thinking, problem solving, research use, and autonomous decision making as outcomes of baccalaureate dental hygiene education. The participants in both studies had entered practice with a diploma in dental hygiene and subsequently earned a baccalaureate degree in dental hygiene so they had the background with which to explore differences in their practices based on their educational pathway.

The consensus-achieved sub-competencies align well with the expectations articulated in the *Ministerial Statement on Quality Assurance of Degree Education in Canada*.[57] The criteria in this document have been operationalized through provincial documents used for the approval of new degrees.[58,59] The ministerial statement indicates that baccalaureate degrees are required to support learners in acquiring the following:

- depth and breadth of knowledge in a particular field of study
- knowledge of research methodologies
- ability to apply discipline specific knowledge
- ability to communicate at an academic level
- awareness of the limitations of knowledge
- autonomy and professional capacity[57]

The depth and breadth of knowledge and the ability to apply it are articulated in the knowledge of the discipline as well as the research use domain. The research use domain addresses issues surrounding methodology and assessment of knowledge for evidence-based decisions. Abilities related to professional capacity and autonomy are threaded throughout the domains, with a particular emphasis on the professionalism, collaboration and coordination, as well as all the domains in the dental hygiene services cluster.

Limitations

The study included a call for experts through a CDHA email broadcast to support participation given the substantial time commitment involved. Peer-reviewed criteria[27] were used to reduce the bias of expert selection,[24,] but the selection process may still have been a source of error.[23-26] Of the 370 submissions of interest, only 62 had a master's degree or higher. Thirty-five of these were eliminated as they had not presented by invitation, authored or been recognized through an award in the past 3 years. Three of the remaining twenty-seven respondents had no networks within their organization or external to it in the past 3 years other than their membership to CDHA. They had not been involved in the profession at a local, provincial or national level for the past 3 years.

Even though the 24 invited participants had self-selected as experts and submitted an expression of interest, many did not follow through on that expression, thus resulting in a low response rate. However, another group of experts, members of the CDHA Advisory Committee who met the inclusion criteria (n=10), generated the initial competencies that supported the Delphi study and they continued the collaborative analysis involving a rigorous review of each round over a 2-year period. The involvement of the advisory experts helped to offset the low response rate that is not unique to our study. Other Delphi studies have involved similar response rates, as in Lock[109] (n=10) and Franklin[110] (n=13). As Keeney and Hasson[24] suggest, there is no "magic formula" to guide the selection of experts or how many experts to include. Such decisions often rely on funding and inclusion criteria that in our study identified the neophyte characteristic of the dental hygiene profession in Canada.

It is also important to understand that the development of consensus does not imply the "rightness" of the competency profile.[24,26] Another group might have reached a different consensus. However, the iterative and reflective process does provide an outcome that is worthy of consideration and future debate; it helps to broaden our knowledge of dental hygiene education.

CONCLUSION

The Delphi study has laid the foundation for the articulation of abilities that express the essence of baccalaureate dental hygiene education. The study was grounded in the previous work conducted by ACFD, DHEC, CDHA, and CAPHD. However, it is unique in its emphasis on baccalaureate abilities.

The abilities identified in this study focus on the fourth-year of baccalaureate education. They highlight the importance of integrating knowledge, research use, policy use, advocacy, health promotion, disease prevention, and leadership while also supporting the continued enhancement of communication, collaboration, coordination, oral health education, clinical therapy, and professionalism.

These competencies have the potential of being valuable for accreditation, national examination as well as educational purposes. From an educational perspective they provide a standard against which current curricula can be measured and could support curriculum design activities within existing and future programs as well as continuing education initiatives. From a regulatory perspective they could help to define educational requirements for registration as our profession advances. They could also be used to inform future applicants to dental hygiene programs as to what they could expect within the program, as well as supporting students currently enrolled in baccalaureate programs. In addition, they provide a basis for discussion of expectations between graduates and other professionals upon graduation. The competencies may become a catalyst for strengthening baccalaureate dental hygiene education. The CDHA Advisory Committee for this project has already used the Delphi results to formulate a stand-alone document[111] of national competencies for 4-year baccalaureate dental hygiene education.

The profile does not answer all of our questions, but it helps to deepen our understanding of baccalaureate dental hygiene education. We can now continue to develop this understanding by assessing the domain and sub-competencies in practice to support our learners and our profession.

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DUALITY OF INTEREST STATEMENTS

Susanne Sunell: In addition to serving as a representative of the Canadian Association of Public Health Dentistry on the Canadian Dental Hygienists Association (CDHA)'s Advisory Committee for this project, I was paid by CDHA as a consultant for the design, implementation, and analysis of the Delphi study. My remuneration also included payment for the writing of this manuscript and partial payment for the development of a second manuscript that is pending publication.

Joanna Asadoorian: I am currently working on contract with the Canadian Dental Hygienists Association and am involved in various volunteer positions with CDHA.

REFERENCES

1. Sunell S, Richardson F, Udahl B, Jamieson L, Landry D. National competencies for dental hygiene entry-to-practice. *Can J Dent Hyg.* 2008;42(1):27–36.
2. Spady WG. Choosing outcomes of significance. *Educ Leadersh.* 1994;51(6): 18–22.
3. Sunell S. Learning outcomes for British Columbia colleges and university colleges [dissertation]. Vancouver (BC): University of British Columbia; 2003.
4. Ontario Ministry of Colleges and Universities. *Vision 2000: Quality and opportunity.* Toronto (ON): Author; 1990.
5. British Columbia Ministry of Education, Skills and Training. *Charting a new course: A strategic plan for the future of British Columbia's college, institutes and agency system.* Victoria (BC): Author; 1996.
6. Hodgson A, Spours K, Savory C. *Improving the 'use' and 'exchange' value of key skills.* London: University of London, Institute of Education; 2001.
7. New Zealand Qualifications Authority. Essential skills and generic skills in the national qualifications framework. Opinion papers. (ERIC Document Reproduction Services No. Ed. 367 835). Wellington, New Zealand: NZQA; 1994.
8. Halpin D, Troyna B. The politics of education policy borrowing. *Comp Educ Rev.* 1995;31(3):303–10.
9. Dale R. Specifying globalization effects on national policy: A focus on the mechanism. *J Educ Policy.* 1999;14(1):1–17.
10. Wilson CD, Miles CL, Backer R L, Schoenberger RL. *Learning outcomes for the 21st century: Report of a community college study.* Mission Viejo (CA): League for Innovation in the Community College, The Pew Charitable Trusts; 2000.
11. Shipley CD. Learning outcomes: Another bandwagon or a strategic instrument for reform? *College Q.* 1994;1(4).
12. Sunell S, Cavanagh S, Paquin M. *Strategic planning session for dental assisting and dental hygiene educational standards.* Vancouver (BC): Association of Canadian Faculties of Dentistry; March 1993.

13. Canadian Dental Hygienists Association (CDHA). Policy framework for dental hygiene education. *Probe.* 1998;32(3):105–7.
14. Canadian Dental Hygienists Association (CDHA). T*ask force on dental hygiene education: Report to Canadian Dental Hygienists Association Board of Directors.* Ottawa (ON): CDHA; 2000.
15. Sunell S, Wilson M, Landry D. *Learning outcomes in Canadian dental hygiene education: DHEC/EHDC Report.* Edmonton (AB): DHEC/EHDC; 2004.
16. Dental Hygiene Educators Canada, Canadian Dental Hygienists Association, National Dental Hygiene Certification Board, Commission on Dental Accreditation of Canada, Federation of Dental Hygiene Regulatory Authorities. *National dental hygiene competencies for entry-to-practice: release 3.* Ottawa (ON): Authors; 2008.
17. Verma S, Paterson M, Medves J. Core competencies for health care professionals: What medicine, nursing, occupational therapy and physiotherapy share. *J Allied Health.* 2006;35(2):109–15.
18. Verma S, Broers T, Paterson M, Schroder C, Medves JM, Morrison C. Core competencies: the next generation. *J Allied Health.* 2009;38(1):47–53.
19. Canadian Dental Hygienists Association (CDHA), Federation of Dental Hygiene Regulatory Authorities (FDHRA), Commission on Dental Accreditation of Canada (CDAC), National Dental Hygiene Certification Board (NDHCB). *Entry-to-practice competencies and standards for Canadian dental hygienists.* Ottawa (ON): CDHA, FDHRA, CDAC, NDHCB; January 2010.
20. Kanji Z, Sunell S, Boschma G, Imai P, Craig BJ. Outcomes of dental hygiene baccalaureate degree education in Canada. *J Dent Educ.* 2011;75:31–20.
21. Dickinson C, Beatty F, Marshall D. A pilot study: Are dental hygienists in Texas ready for the elderly population explosion. *Int J Dent Hyg.* 2012;10:128–37.
22. Sunell S, McFarlane RDD, Biggar HC. Differences between diploma and baccalaureate dental hygiene education: A quantitative perspective. *Can J Dent Hyg.* 2013;47(3):109–21.
23. Cramer CK, Klasser GD, Epstein JB, Sheps SB. The Delphi process in dental research. *J Evid Based Dent Pract.* 2008 Dec;8(4):211–20.
24. Keeney S, Hasson F, McKenna H. Consulting the oracle: Ten lessons from using the Delphi technique in nursing research. *J Adv Nurs.* 2006;53(2):205–12.
25. Lindberg M, Lundström-Landegren K, Lidén S. Holm U. Competencies for practice in renal care: A national Delphi study. *J Ren Care.* 2012;38(2):69–75.
26. Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *J Adv Nurs.* 2000;32(4):1008–1015.
27. Bradley RT, Young WY, Ebbs P, Martin J. Characteristics of advanced level dietetics practice: A model and empirical results. *J Am Diet Assoc.* 1993;93(2):196–202.
28. Utley-Smith Q. 5 competencies needed by new baccalaureate graduates. *Nurs Educ Perspect.* 2004;25(4):166–70.
29. Newell ME. Patients of the future: A survey of school nurse competencies with implications for nurse executives in the acute care setting. *Nurs Adm Q.* 2013;37(3):254–65.
30. Mouradian WE, Huebner CE. Future directions in leadership training of MCH professionals: Cross-cutting MCH leadership competencies. *Matern Child Health J.* 2007;11(3):211–18.
31. Blitz P, Hovius M. Towards the international curriculum standards. *Int J Dent Hyg.* 2003;1:57–61.
32. Kumm S, Godfrey N, Martin D, Tucci M, Muenks M, Spaeth T. Baccalaureate outcomes met by associate degree nursing programs. *Nurse Educ.* 2014;39(5):216–20.
33. Silka CR, Stombaugh HA, Horton J, Daniels R. Nursing research in a nonacademic health system: Measuring knowledge, attitudes, and behaviors. *J Nurs Adm.* 2012;42(7-8):386–92.
34. Fisher M. Comparison of professional value development among pre-licensure nursing students in associate degree, diploma, and bachelor of science in nursing programs. *Nurs Educ Perspect.* 2014;35(1):37–42.
35. Pawlak RP, Scott ES, Murphy LS. Crossing our quality chasm: Continuing the case for graduate preparation of nurse managers and leaders. *J Nurs Adm.* 2013;43(12):627–29.
36. Choi J, Zucker DM. Self-assessment of nursing informatics competencies for doctor of nursing practice students. *J Prof Nurs.* 2013;29(6):381–87.
37. Hunter K, McGonigle D, Hebda T. The integration of informatics content in baccalaureate and graduate nursing education: a status report. *Nurse Educ.* 2013;38(3):110–13.
38. Kase N, Muller D. Competencies as the basis for reformed premedical education; the case for an unrestricted liberal arts collegiate education [abstract]. *Pharos Alpha Omega Alpha Honor Med Soc.* 2012;75(1):32–40.
39. Mauro AMP, Hickey MT, McCabe DE, Emerson EA. Attaining baccalaureate competencies for nursing care of older adults through curriculum innovation. *Nurs Educ Perspect.* 2012;33(3):187–90.
40. Thistlethwaite JE, Forman D, Matthews LR, Rogers GD, Steketee C, Yassine T. Competencies and frameworks for interprofessional education: a comparative analysis. *Acad Med.* 2014;89(6):869–75.
41. Mueller C, Burger S, Rader J, Carter D. Nurse competencies for person-directed care in nursing homes. *Geriatr Nurs.* 2013;34(2):101–104.
42. Sportsman S, Poster E, Curl ED, Waller P, Hooper J. Differentiated essential competencies: a view from practice. *J Nurs Adm.* 2012;42(1):58–63.
43. Long KA. The institute of medicine report health professions education: a bridge to quality. *Policy Polit Nurs Pract.* 2003;4(4):259–62.
44. Lawrence HP, Leake JL. The US Surgeon General's report on oral health in America: A Canadian perspective. *J Can Dent Assoc.* 2001;67(10):1–10.
45. Thornhill J, Dault M, Clements D. Ready, set … collaborate? The evidence says "go," so what's slowing adoption of inter-professional collaboration in primary healthcare? *Healthc Q.* 2008;11(2):14–16.
46. Belkhodja O, Amara N, Landry R, Ouimet M. The extent and organizational determinants of research utilization in Canadian health services organizations. *Sci Commun.* 2007;28(3):377–417.
47. Guerra NG, Bradshaw CP. Linking the prevention of problem behaviors and positive youth development: Core competencies for positive youth development and risk prevention. *New Dir Child Adolesc Dev.* Winter 2008;122:1–17.
48. Pines EW, Rauschhuber ML, Cook JD, Norgan GH, Canchola L, Richardson C, Jones ME. Enhancing resilience, empowerment, and conflict management among baccalaureate students: Outcomes of a pilot study. *Nurse Educ.* 2014;39(2):85–90.

49. Romanow RJ. *Building on values:* The future of health care in Canada. Ottawa (ON): Commission on the Future of Health Care in Canada; 2002 [accessed 2014 Aug 04]. Available from: http://www.cbc.ca/healthcare/final_report.pdf

50. Massachusetts Department of Higher Education Nurse of the Future Competencies Committee. Creativity and connections. Boston (MA): Massachusetts Department of Higher Education; 2010 [accessed 2014 July 20]. Available from: http://www.mass.edu/currentinit/documents/NursingCoreCompetencies.pdf

51. Public Health Agency of Canada (PHAC), Canadian Public Health Association (CPHA). *Moving ahead, together: Launch of a national dialogue on public health and sustainable development in Canada.* Workshop summary report. Ottawa (ON): PHAC/CPHA; 2007.

52. Public Health Agency of Canada (PHAC). *Core competencies for public health in Canada: release 1.0.* Ottawa: PHAC; 2008 [accessed 2012 May 24]. Available from: http://www.phac-aspc.gc.ca/php-psp/ccph-cesp/about_cc-apropos_ce-eng.php

53. US Department of Health and Human Services. *Oral health in America: A report of the Surgeon General. Rockville* (MD): US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000.

54. Public Health Agency of Canada. *Chief Public Health Officer's report on the state of public health in Canada, 2008.* Addressing health inequalities. Ottawa (ON): Minister of Health; 2008.

55. Federal, Provincial and Territorial Dental Directors. *A Canadian oral health strategy.* Ottawa (ON): Federal, Provincial and Territorial Dental Directors; 2005.

56. Health Disparities Task Group of the Federal/Provincial/Territorial Advisory Committee on Population Health and Health Security. *Reducing health disparities—roles of the health sector: discussion paper.* Ottawa (ON): Public Health Agency of Canada; 2005.

57. Council of Ministers of Education, Canada. *Ministerial statement on quality assurance of degree education in Canada.* Ottawa (ON): CMEC; 2007 [accessed 2012 Sept 26]. Available from: www.cicic.ca/docs/cmec/Qa-statement-2007.en.pdf

58. Council of Ontario Universities. *Ensuring the value of university degrees in Ontario: A guide to learning outcomes, degree level expectations and the quality assurance process in Ontario.* 2011 [accessed 2014 May 24]. Available from: http://www.cou.on.ca/publications/reports/pdfs/ensuring-the-value-of-university-degrees-in-ontari

59. British Columbia Ministry of Advanced Education. Degree program criteria and guidelines. [accessed 2014 March 15]. Available from: http://www.aved.gov.bc.ca/degree-authorization/public/degree-program-criteria.htm

60. Skolnik ML. College baccalaureate degree approval processes in other jurisdictions. Toronto (ON): Colleges Ontario; 2013 [accessed 2014 August 8]. Available from: http://www.collegesontario.org/research/DegreeGranting/College_Baccalaureate_Degree_Approval_Processes_in_Other_Jurisdictions.pdf

61. Department of Health in England. Public health skills and career framework: *Multidisciplinary/multi-agency/multi-professional. April 2009* [accessed 2014 Feb 12]. Available from: http://www.skillsforhealth.org.uk/component/docman/doc_view/1869-public-health-skills-career-framework-03-2009.html

62. Morris TL, Hancock DR. Institute of Medicine core competencies as a foundation for nursing program evaluation. *Nurs Educ Perspect.* 2013;34(1):29–33.

63. American Academy of Nursing Psychiatric Mental Health Substance Abuse Expert Panel. Essential psychiatric, mental health and substance use competencies for the registered nurse. *Arch Psychiatr Nurs.* 2012;26(2):80–110.

64. American Association of Colleges of Nursing. Recommended baccalaureate competencies and curricular guidelines for nursing care of older adults. Washington (DC): Author; 2010 [accessed 2014 March 4]. Available from: http://www.aacn.nche.edu/geriatric-nursing/aacn_gerocompetencies.pdf

65. Petersen PE. The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Program. *Community Dent Oral Epidemiol.* 2003;31(Suppl1):3–24.

66. Canadian Association of Public Health Dentistry (CAPHD). *Discipline competencies for dental public health.* Edmonton (AB): CAPHD; 2008 [accessed 2014 May 24]. Available from: http://www.caphd.ca/sites/default/files/pdf/DisciplineCompetenciesVersion4_March31.pdf

67. University of British Columbia. *UBC dental hygiene program competencies document – Version 1.3.* Vancouver (BC): UBC; 2011.

68. Commission on Dental Accreditation of Canada (CDAC). *Accreditation requirements for dental hygiene programs.* Ottawa (ON): CDAC; 2001 (updated 2011) [accessed 2014 May 24]. Available from: http://www.cda-adc.ca/en/cda/cdac/accreditation/index.asp

69. Canadian Interprofessional Health Collaborative. *A national interprofessional competency framework.* Vancouver (BC): Author; 2010 [accessed 2014 May 26]. Available from: http://www.cihc.ca/files/CIHC_IPCompetencies_Feb1210.pdf

70. College & Association of Registered Nurses of Alberta. *Entry-to-practice competencies for the registered nursing profession, 2014* [accessed 2014 Feb 12]. Available from: http://www.nurses.ab.ca/Carna-Admin/Uploads/Entry_to_Practice_Competencies.pdf

71. Greiner AC, Knebel E. Health professions education: A bridge to quality. Washington (DC): Institute of Medicine, Committee on the Health Professions Education Summit, National Academic Press; 2003 [accessed 2014 July 14]. Available from: http://www.nap.edu/download.php?record_id=10681

72. American Dental Educators Association, American Dental Hygienists Association. *Core competencies for graduate dental hygiene education.* Chicago: Authors; 2011 [accessed 2012 Sept 12]. Available from: http://www.adea.org/uploadedFiles/ADEA/Content_Conversion_Final/about_adea/governance/ADEA_Core_Competencies_for_Graduate_Dental_Hygiene_Education.pdf

73. American Association of Colleges of Nursing. *The essentials of baccalaureate education for professional nursing practice.* 2008 [accessed 2014 Feb 12]. Available from: www.aacn.nche.edu/education-resources/baccessentials08.pdf

74. Commission on the Social Determinants of Health. *Closing the gap in a generation: Health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health.* Geneva: World Health Organization; 2008 [accessed 2014 May 25]. Available from: http://whqlibdoc.who.int/publications/2008/9789241563703_eng.pdf?ua=1

75. World Health Organization (WHO). *A safer future: Global public health security in the 21st century.* Geneva: WHO; 2007 [accessed 2014 May 26]. Available from: http://www.who.int/whr/2007/whr07_en.pdf?ua=1

76. Cowpe J, Plasschaert A, Harzer W, Vinkka-Puhakka H, Walmsley AD. Profile and competences for the graduating European dentists—update 2009. *Eur J Dent Educ.* 2010;14:193–202.

77. American Association of Colleges of Nursing. Public health: *Recommended baccalaureate competencies and curricular guidelines for public health nursing.* September 2013 [accessed 2014 May 26]. Available from: http://www.aacn.nche.edu/education-resources/BSN-Curriculum-Guide.pdf

78. Quad Council of Public Health Nursing Organizations. *Quad Council competencies for public health Nurses.* Summer 2011 [accessed 2014 May 26]. Available from: http://www.resourcenter.net/images/ACHNE/Files/QuadCouncilCompetenciesForPublicHealthNurses_Summer2011.pdf

79. Interprofessional Education Collaborative Expert Panel. *Core competencies for interprofessional collaborative practice: Report of an expert panel.* Washington (DC): Interprofessional Education Collaborative; 2011 [accessed 2014 May 26]. Available from: http://www.aacn.nche.edu/education-resources/ipecreport.pdf

80. International Union for Health Promotion (IUHP), Society for Public Health Education (SOPHIE). *Towards domains of core competency for building capacity in health promotion: The Galway consensus conference statement.* June 2008 [accessed 2014 May 26]. Available from: http://www.iuhpe.org/images/IUHPE/Advocacy/Galway_Consensus_Statement.pdf

81. World Health Organization. *Bangkok charter for health promotion in a globalized world.* Geneva: WHO; 2005 [accessed 2014 May 26]. Available from: http://www.who.int/healthpromotion/conferences/6gchp/bangkok_charter/en/

82. World Health Organization. *Preparing a health care workforce for the 21st century: The challenge of chronic conditions.* Geneva: WHO Non-communicable Disease and Mental Health Cluster, Chronic Disease and Health Promotion Department; 2005 [accessed 2014 May 26]. Available from: http://whqlibdoc.who.int/publications/2005/9241562803.pdf

83. National Physiotherapy Advisory Group. *Essential competency profile for physiotherapists in Canada.* 2010 [accessed 2014 May 26]. Available from: http://www.peicpt.com/content/page/front_news/id/23/Essential-Competency-Profile-for-Physiotherapists-in-Canada.html

84. American Dental Educators Association, American Dental Hygienists Association. *Competencies for entry into the dental hygiene profession.* Chicago: ADEA/ADHA; 2003 [accessed 2014 May 26]. Available from: www.adea.org

85. American Dental Hygienists Association. *Competencies for advanced dental hygiene practitioner.* Chicago: Author; 2008 [accessed 2014 May 26]. Available from: http://www.newenglandruralhealth.org/activities/items/oralhealth/FitzpatrickADHP09.pdf

86. Ramoni R, Walji MF, Tavares A, White J, Tokede O, Vaderhobli R, Kalenderian E. Open wide: Looking into the safety culture of dental school clinics. *J Dent Educ.* 2014;78(5):745–56.

87. Braithwaite J, Westbrook MT, Travaglia JF, Iedema R, Mallock NA, Long D, Nugus P, Forsyth R, Jorm C, Pawsey M. Are health systems changing in support of patient safety? A multi-methods evaluation of education, attitudes and practice. *Int J Health Care* Qual Assur. 2007;20(7):585–601.

88. Ginsburg LR, Chuang YT, Berta WB, Norton PG, Ng P, Tregunno D, Richardson J. The relationship between organizational leadership for safety and learning from patient safety events. *Health Serv Res.* 2010;45(3):607–32.

89. Hellings J, Schrooten W, Klazinga N, Vleugels A. Challenging patient safety culture: survey results. *Int J Health Care Qual Assur.* 2007;20(7):620–32.

90. Golemboski K, Otto CN. Morris S. Using performance tasks employing IOM patient safety competencies to introduce quality improvement processes in medical laboratory science education. *Clin Lab Sci.* 2013;26(4):205–11.

91. Stevenson L, McRae C, Mughal W. Moving to a culture of safety in community home health care. *J Health Serv Res Policy.* 2008;13(1):20–4.

92. Lau DT, Scandrett KG, Jarzebowski M, Holman K, Emanuel L. Health-related safety: A framework to address barriers to aging in place. *Gerontologist.* 2007;47(6):830–37.

93. Ponte PR, Connor M, DeMarco R, Price J. Linking patient and family-centered care and patient safety: The next leap. *Nurs Econ.* 2004;22(4):211–15.

94. Kilbridge PM, Classen DC. The informatics opportunities at the intersection of patient safety and clinical informatics. *J Am Med Inform Assoc.* 2008;15(4):397–407.

95. Ramadas K, Arrossi S, Thara S, Thomas G, Jissa V, Fayette JM, Mathew B, Sankaranarayanan R. Which socio-demographic factors are associated with participation in oral cancer screening in the developing world? Results from a population-based screening project in India. *Cancer Detect Prev.* 2008;32:109–115.

96. Feng X, Bobay K, Weiss M. Patient safety culture in nursing: A dimensional concept analysis. *J Adv Nurs.* 2008;63(3):310–19.

97. El-Jardali F, Sheikh F, Garcia NA, Jamal D, Abdo A. Patient safety culture in a large teaching hospital in Riyadh: Baseline assessment, comparative analysis and opportunities for improvement. *BMC Health Serv Res.* 2014;14:122.

98. World Alliance for Patient Safety. *Summary of the evidence on patient safety: Implications for research.* Geneva: World Health Organization; 2008 [accessed 2014 May 26] Available from: http://whqlibdoc.who.int/publications/2008/9789241596541_eng.pdf

99. Calhoun JG, Ramiah K, McGean Weist E, Shortell S. Development of a core competency model for the Master of Public Health degree. *Am J Public Health.* 2008;98(9):1598–1607.

100. Forrest JL, Spolarich AE. A Delphi study to update the American dental hygienists' national dental hygiene research agenda. *J Dent Hyg.* 2009;83(1):1–19.

101. MCH Leadership Competencies Workgroup. Maternal and child health leadership competencies: version 3. [accessed 2014 May 26]. Available from: http://leadership.mchtraining.net/mchlc_docs/mch_leadership_comp_3-0.pdf

102. Wold JL, Williams A, Spencer L, Jakeway C, McCombs J. Teaching the public health core competency of policy development to baccalaureate student nurses. *Fam Community Health.* 2004;27(4):308–15.

103. Schrecker T. Beyond 'run, knit and relax': Can health promotion in Canada advance the social determinants of health. *Healthc Policy.* 2013;9(Special Issue):48–58.

104. Stevenson L, McRae C, Mughal W. Moving to a culture of safety in community home health care. *J Health Serv Res Policy.* 2008;13(1):20–24.

105. Canadian Dental Hygienists Association. *Pathways to support the oral health of Canadians: The CDHA dental hygiene education agenda.* Ottawa: CDHA; 2009 [accessed 2014 August 20]. Available from: http://www.cdha.ca/pdfs/Profession/Policy/EducationAgenda.pdf

106. Colvard MD, Mampiris LN, Cordell GA, James J, Guay A, Lee M, Stokes CM, Scott G. The dental emergency responder. JADA. 2006;137:468–73.

107. Ferguson DA, Sweet DJ, Craig BJ. Forensic dentistry and dental hygiene: How can the dental hygienists contribute? *Can J Dent Hyg.* 2008;42(4):203–11.

108. The Council on Linkages Between Academia and Public Health Practice. Core competencies for public health professionals. 2010 [accessed 2012 October 9]. Available from: http://www.phf.org/resourcestools/pages/core_public_health_competencies.aspx

109. Lock LR. Selecting examinable nursing core competencies: A Delphi project. *Int Nurs Rev.* 2011;58(3):347–53.

110. Franklin EA. Greenhouse facility management experts' identification of competencies and teaching methods to support secondary agricultural education instructors: A modified Delphi study. *J Agric Educ.* 2011;52(4):150–61.

111. Canadian Dental Hygienists Association. *Canadian competencies for baccalaureate dental hygiene programs.* Ottawa: CDHA; 2015.

An investigation into toothbrush wear related to months of use among university students

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ABSTRACT

Background: Toothbrushes should be replaced every 3 to 4 months as older brushes lose their plaque removal ability. Older brushes may not be able to remove plaque from pits and fissures seen on the occlusal surfaces of the teeth or from the proximal areas between the teeth. The purpose of this study is to evaluate the wear seen on used toothbrushes (UTB) and the relation of wear with regards to the period of toothbrush use. **Material and methods:** UTB were collected from university students studying courses in arts and sciences faculties, excluding health sciences faculties, during an oral health awareness campaign conducted by the Faculty of Dentistry. A validated questionnaire was used to collect descriptive data regarding toothbrushing habits. Two calibrated examiners scored the UTB according to the Rawls et al. index. Authors also examined different types of toothbrushes and the cleanliness of the toothbrush handles. **Results:** The findings of the study show that 58.0% of the UTB were in good condition for optimal plaque removal (scores 0 and 1), whereas the remaining 42% were not in suitable condition for optimal plaque removal (scores 2 and 3). The UTB measured with Rawls et al.'s index were used for 2.7, 4.5, 5.9, and 7.0 months (mean number of months), respectively. **Conclusion:** Many factors, in addition to period of use, come into play with regards to the splaying of toothbrush bristles. Dental professionals should educate their clients about and reinforce the need to replace toothbrushes after 3 to 4 months of use or after significant wear of the bristles, whichever comes first.

RÉSUMÉ

Contexte : Il est conseillé de remplacer les brosses à dents tous les 3 à 4 mois, car les vieilles brosses perdent leur capacité d'éliminer la plaque. Les vieilles brosses à dents sont moins susceptibles d'éliminer la plaque dentaire située dans les régions proximales ou dans les puits et fissures des surfaces occlusales. L'objectif de la présente étude consiste à évaluer l'usure décelée sur les vieilles brosses à dents (VBD) et à examiner le lien entre l'usure des poils et la période d'utilisation de la brosse à dents. **Matériel et méthodes :** Lors d'une campagne de sensibilisation à la santé buccale menée par la faculté de dentisterie, les VBD ont été recueillies auprès des étudiants universitaires suivant des cours à la faculté des arts et des sciences, à l'exception de la faculté des sciences de la santé. Un questionnaire validé a servi à la collecte de données descriptives en matière d'habitudes de brossage de dents. Deux examinateurs spécialement formés à l'étalonnage ont évalué les VBD selon l'indice de Rawls et coll. Les auteurs ont aussi examiné les différents types de brosses à dents ainsi que la propreté de leurs manches. **Résultats :** Les résultats de l'étude montrent que 58 % des VBD étaient en bon état pour éliminer la plaque de façon optimale (scores de 0 et 1), alors que les autres 42 % n'étaient pas dans un état convenable pour éliminer la plaque de façon optimale (scores de 2 et 3). Les VBD qui ont été évaluées selon l'indice de Rawls et coll. avaient été utilisées respectivement pendant 2,7, 4,5, 5,9 et 7 mois (nombre moyen de mois). **Conclusion :** L'évasement des poils d'une brosse à dents peut être causé par de nombreux facteurs, autres que la période d'utilisation. Il est important que les professionnels du domaine dentaire soulignent à leurs clients l'importance de remplacer leurs brosses à dents après 3 à 4 mois d'utilisation ou lorsque l'usure des poils est significative, selon la première éventualité.

Key words: adults, charcoal-coated brush, renewal/replacement, toothbrush wear

INTRODUCTION

Toothbrushes serve as the main aids for mechanical plaque removal from the labial/facial, lingual/palatal, and occlusal surfaces of the teeth.[1] Brushing technique and the condition of the toothbrush serve as the major determinants for the efficacy of plaque removal by the toothbrush.[1] Conforti et al. conducted a study wherein worn and new, manual and powered toothbrushes were compared for their plaque removing efficacy.[2] The results showed that worn toothbrushes had significantly less ability to remove plaque, especially from the proximal areas.[2] The ability of worn toothbrushes to clean pits and fissures on the occlusal surfaces of the teeth is reduced. While the American Dental Association (ADA) recommends that toothbrushes be replaced every 3 to 4 months,[3,4] this time period may not be practically applicable to every individual, because the amount of force used, pattern,

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Table 1. Toothbrush bristle wear index proposed by Rawls et al., and effectiveness of plaque removal based on the scores

Score	Appearance of toothbrush	Effectiveness
0	It is impossible to state if the toothbrush was used or not	In suitable condition for optimal plaque removal
1	The bristles of the toothbrush seem to be separated within some tufts	
2	Most tufts are separated, many cover other tufts and present a large number of curved and inclined bristles	**Not** in suitable condition for optimal plaque removal
3	Most tufts are covered by other bristles and bristles are folded and tipped	

duration of brushing, and socio-economic factors vary from individual to individual. The ADA advises individuals to check for any sort of wear on the bristles and replace them more frequently if needed.[3] As bristles of the brush fray and wear with use, the cleaning effectiveness of the brush decreases. The purpose of this study was to analyse the correlation between toothbrush bristle wear and period of time of toothbrush use among university students.

MATERIAL AND METHODS

This study was approved by the Institutional Ethics Committee of SEGi University (Selangor, Malaysia). UTB were collected from participants during an oral health awareness campaign "Smile campaign 2014" organized by the Faculty of Dentistry. Participants were university students pursuing courses in mass communication, education, business administration, information technology, and engineering. Students pursuing courses in medicine, dentistry, and allied health sciences were excluded from the study. The UTB were collected as part of the oral health awareness campaign wherein new tooth brushes were distributed to the participants in exchange for their old UTB. Descriptive data regarding the toothbrushing habits were collected through a validated questionnaire which included questions regarding the frequency and duration of brushing sessions per day, and period of use of current toothbrush in months. Those UTB from participants who indicated that they were brushing once daily and those who were brushing twice daily irregularly were excluded from the study. A total of 121 UTB, used twice daily for a period of around 2 minutes by the participants, were included in the study. Two examiners were calibrated for scoring UTB wear according to the Rawls et al. index.[5] Based on this index, a score of 0 is given when it is impossible to determine if the toothbrush was used or not; score 1, when the bristles of the toothbrush seem to be separated within some tufts; score 2, when most tufts are separated, many cover other tufts, and present a large number of curved and inclined bristles; and score 3, when most of tufts are covered by other bristles and bristles are folded and tipped. Toothbrushes with scores of 0 and 1 are in suitable condition for optimal plaque removal, whereas those with scores of 2 and 3 are not suitable for optimal plaque removal. Table 1 outlines the scoring criteria and inferences about the toothbrush wear index given by Rawls et al. A representative image of the UTB according to the scores of the Rawls et al. index is shown in Figure 1.

The 2 examiners scored 121 UTB independently, and weighted kappa score values were calculated. A satisfactory kappa score of 0.86 was obtained for interexaminer agreement. The examiners re-examined the UTB that were differently scored and agreed upon a single score for each UTB. Later they re-examined the UTB and agreed upon one criterion to plot the data against the number of months of usage of toothbrush. Both examiners were blinded with regards to the information of period of use of each toothbrush when scoring the UTB wear according to the Rawls et al. index. Table 2 summarizes the weighted kappa scores for the 2 examiners SSR and KCG.

The examiners also assessed the cleanliness of the UTB handles, as it relates to the general attitude towards and importance accorded to oral hygiene aids. UTB handles and bristle bases were scored from 0 to 3 based on the presence of visible dirt (i.e., toothpaste deposits, food particles, other hard deposits) as shown in Table 3. A representative image of the UTB handles according to which scoring was carried out is shown in Figure 2.

Figure 1. Representative image of used toothbrushes scored according the Rawls et al. index

Table 2. Interexaminer Kappa scores for 2 calibrated examiners

	Examiner KCG				
Examiner SSR	0	1	2	3	
0	17	1	0	0	18 (14.9%)
1	1	42	4	0	47 (38.8%)
2	0	9	30	2	41 (33.9%)
3	0	0	0	15	15 (12.4%)
	18	52	34	17	121
	-14.90%	-43.00%	-28.10%	-14.00%	

Weighted Kappa=0.856; Standard error=0.035; 95% CI=0.788 to 0.924

RESULTS

In total, 121 UTB were included in the study to assess the wear seen on the bristles. Examiners found that 37.2% of UTB bristles were angulated, whereas 62.8% of UTB bristles were straight. Among the UTB, 14.9% were scored at 0 (it is impossible to state if the toothbrush was used or not), 43.0% were scored at 1 (the bristles seem to be separated within some tufts), 28.1% were scored at 2 (most tufts are separated, many cover other tufts and present a large number of curved and inclined bristles), 14.0% were scored at 3 (most tufts are covered by others and bristles are folded and tipped).The reliability of the 2 examiners (weighted kappa) who graded all of the UTB independently based on visual examination ranged from 0.79 to 0.92, which can be considered as a good interexaminer agreement. Duration of use of toothbrushes reported by participants is tabulated across the Rawls et al. index in Table 4. (Detailed tabulation of frequency and percentages against the Rawls et al. index is also provided). Of the 121 UTB that were examined, 42 (34.7%) were used for 3 months, and usage ranged from 1 to 9 months. The mean numbers of months for which the UTB were used, based on the Rawls et al. index score 0–3, are 2.7, 4.5, 5.9, and 7.0 months, respectively. Toothbrush bristle wear increased with the increase in mean number of months of toothbrush use. So, a direct relationship was observed between mean number of months of toothbrush use and scores of the Rawls et al. index.

The cleanliness of the UTB handle was also scored in our study. Out of 121 UTB, 65.0% were scored as having a clean handle and acceptable hygiene, 26.4% had visible dirt on less than one-third of the handle, 6.6% had visible dirt on more than one-third and less than two-thirds of the handles. A very small portion of the UTB had more than two-thirds of the handle covered with visible dirt. The presence of deposits at the base of the tufts was also assessed. Out of 121 UTB, 57.0% had toothpaste deposits, food particles, and other hard deposits at the base of the bristles.

Figure 2. Representative image of the used toothbrush handles scored for cleanliness of the handles

DISCUSSION

The bristles of toothbrushes should be in good condition (Score 0 and 1 on the Rawls et al. index) for optimal removal of plaque from the pits and fissures as well as from interproximal surfaces of the teeth. The findings of this study show that 58.0% of the UTB were in good condition for optimal plaque removal (scores 0 and 1), whereas the remaining 42% of the UTB were not in suitable condition for optimal plaque removal. Garbin et al. conducted a study wherein the deterioration of toothbrushes was studied in preschool children.[6] Among the 333 UTB analysed, 58% of the toothbrushes were in adequate condition for utilization (scores 0 and 1), whereas 42% had inadequate bristles for their function (scores 2 and 3); these results were similar to our own. In contrast, Terreri et al. studied toothbrush wear in a daycare facility and reported that 78% of the toothbrushes were not suitable for plaque removal.[7] However, because the studies by Garbin et al. and Terreri et al. were conducted on preschool children while in our study the participants were university students, the relevance of their findings to the outcome of our research is limited.

This study examined the relationship between toothbrush bristle wear and the period of toothbrush use (in months) in a population of university students. Approximately 56% of the toothbrushes were used for 1 to 3 months and

Table 3. Scoring criteria for visible dirt on toothbrush handle

Score	Criteria for scoring visible dirt on toothbrush handles
0	Toothbrush handle is clean.
1	Visible dirt seen up to one-third of toothbrush handle.
2	Visible dirt seen on more than one-third and less than two-thirds of the toothbrush handle.
3	Visible dirt seen on more than two-thirds of the toothbrush handle.

received a score of 0. Even after being used for a period of 4.5 months, toothbrushes were scored at 1 and were still in optimal condition for plaque removal. Rosema et al. conducted a study on the plaque removal efficacy of new and used (3-month-old) toothbrushes.[8] Their study found no difference in plaque removal efficacy of new and 3-month-old UTB. In addition the study concluded that the wear of the bristles is more important than the period of brush use with regards to plaque removal efficacy, which supports the findings of our study.[8] Approximately 38% of the study participants used their toothbrushes for a period of 5 to 9 months, which exceeds the time period of effective toothbrush use as prescribed by the ADA.[3,4] This research finding highlights the need for dental professionals to educate their clients about and reinforce the need to replace toothbrushes after 3 to 4 months of use or after significant wear of the bristles, whichever is earlier. Kreifeldt et al. conducted a study to measure and compare plaque removal efficiencies of different toothbrush designs and used their findings to quantify the loss of plaque removal efficiency of worn toothbrushes, as well as to elucidate the causes.[9] The Kreifeldt et al. study was published in 1980, before the Rawls et al. index for toothbrush bristle wear (1989) was formulated. Kreifeldt et al. used the words "light matting" and "heavy matting" in their study to measure toothbrush bristle wear. The word "matting" used in the Kreifeldt et al. study corresponds to the Rawls et al. index scores of 2 (light matting) and 3 (heavy matting). Kreifeldt et al. recommended that a standard toothbrush be discarded when it shows signs of matting, regardless of age.[9]

Muller-Bolla et al. conducted a study to create a drawing to help adults establish when to replace a toothbrush.[10] Pictures of worn brushing surfaces were generated using an image acquisition system. Images in each study phase were superimposed to provide a single reference outline to indicate when a toothbrush should be replaced. The authors of the study claim to have created a simple drawing that could help adults to determine when they should replace UTB.[10] Information on toothbrush wear as it relates to replacement could easily be added to toothbrush packaging and would be helpful for consumers. It would also be prudent to engage the general public in toothbrush exchange programs during oral health campaigns, wherein guidelines for brush replacement could be reinforced to all participants. Such direct interaction between dental professionals and members of the public offers a clear opportunity for oral health education. During these oral health campaigns, instructions for oral hygiene maintenance were given to the participants by the staff members of the Faculty of Dentistry.

The cleanliness of the toothbrush handle reveals information about the storage condition of those toothbrushes and also the attitudes of the participants. Around 8% of UTB had visible dirt (defined as any unclean matter in brownish colour to black fungal deposits) on more than one-third of the handle. Some of the participants might have submitted their old, dirty toothbrush just to get a free new toothbrush.

Table 4. Frequency and mean number of months used versus agreed Rawls et al.'s index score

Number of months	Rawls et al.'s index agreed score								Total toothbrushes examined (n=121)	
	0 (n=18)		1 (n=52)		2 (n=34)		3 (n=17)			
	n	%	n	%	n	%	n	%	n	%
1	4	3.3	4	3.3	0	0.0	0	0.0	8	6.6
2	2	1.7	16	13.2	0	0.0	0	0.0	18	14.9
3	9	7.4	32	26.4	1	0.8	0	0.0	42	34.7
4	2	1.7	0	0.0	5	4.1	0	0.0	7	5.8
5	1	0.8	0	0.0	6	5.0	1	0.8	8	6.6
6	0	0.0	0	0.0	13	10.7	3	2.5	16	13.2
7	0	0.0	0	0.0	4	3.3	8	6.6	12	9.9
8	0	0.0	0	0.0	5	4.1	4	3.3	9	7.4
9	0	0.0	0	0.0	0	0.0	1	0.8	1	0.8
Mean	2.67		4.48		5.85		7.06			

Limitations

This study considered time of brushing per session as 2 minutes based on self-reporting by the client. Clients usually overestimate their brushing time. For greater accuracy and validity, this study should have controlled for this variable rather than relying on client self-reports. Powered toothbrush designs have incorporated this understanding by incorporating timers, typically set for 2 minutes, to enable the user to accurately assess their brushing time. However, the efficacy of this feature has not been evaluated. Incorrect brushing technique, excessive pressure applied during brushing, and overestimation or underestimation of the self-reported brushing time by the participants could affect the wear of the toothbrush bristles. This study did not examine these aspects (brushing technique and pressure applied) by the participants which could affect toothbrush bristle wear. Future research studies on toothbrush bristle wear should include these variables.

CONCLUSION

The results of this research study indicate that the replacement of UTB should be primarily based on the amount of wear noticed on the bristles. The general time frame advised of 3 to 4 months can be a secondary factor to be considered, as many individual factors come into play with regards to the splaying of the bristles in the toothbrush.

REFERENCES

1. Perry DA. Plaque control for the periodontal patient. In Newman MG, Takei H, Klokkevold PR, Carranza FA. *Carranza's clinical periodontology*, 11th ed. St. Louis, MO: Elsevier Saunders; 2012.
2. Conforti NJ, Cordero RE, Liebman J, Bowman JP, Putt MS, Kuebler DS, Davidson KR, Cugini M, Warren PR. An investigation into the effect of three months' clinical wear on toothbrush efficacy: Results from two independent studies. *J Clin Dent.* 2003;14:29–33.
3. American Dental Association. ADA Seal of Acceptance Program: Toothbrushes [online]. Available from: http://www.ada.org/en/science-research/ada-seal-of-acceptance/ada-seal-products/product-category/?supercategory=5.
4. American Dental Association. Learn more about toothbrushes [online]. Available from http://www.ada.org/1321.aspx [accessed on 10/04/2014 at 22:00].
5. Rawls HR, Mkwayi-Tulloch NJ, Casella R, Cosgrove R. The measurement of toothbrush wear. *J Dent Res.* 1989;68:1781–85.
6. Garbin CA, Garbin AJ, dos Santos KT, de Lourdes Carvalho M, Lima DC. Evaluation of toothbrush bristles' deterioration used by preschool children. *Int J Dent Hyg.* 2009;7:285–88.
7. Terreri ALM, Saliba CA, Saliba NA, da Silva PR. Evaluation of toothbrush wear and tear in a day care facility. *Rev Fac Odontol Lins.* 1999;11(2):42–44.
8. Rosema NA, Hennequin-Hoenderdos NL, Versteeg PA, van Palenstein Helderman WH, van der Velden U, van der Weijden GA. Plaque-removing efficacy of new and used manual toothbrushes--a professional brushing study. *Int J Dent Hyg.* 2013;11:237–43.
9. Kreifeldt JG, Hill PH, Calisti LJ. A systematic study of the plaque removal efficiency of worn toothbrushes. *J Dent Res.* 1980;59:2047–55.
10. Muller-Bolla M, Lupi-Pégurier L, Bertrand MF, Velly AM. Manual toothbrush wear and consequences on plaque removal. *J Clin Dent.* 2007;18:73–78.

Prevalence of human papillomavirus types 16 and 18 within a dental student clinic setting

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ABSTRACT

Human papillomavirus (HPV)-associated oropharyngeal cancers are projected to increase at significant rates in the next few decades. With information on the natural history and carcinogenesis of HPV still at a young stage, more research is necessary. This study investigated the prevalence of 2 high-risk HPV types in a dental student clinic setting in order to give oral health professionals a broad picture of oral HPV infection. Real-time polymerase chain reaction (PCR) was used to detect HPV types 16 and 18 in 110 oral rinse samples. Only one sample was positive for HPV, specifically type 18. We conclude that high-risk HPV prevalence is very low in a dental student clinic setting.

RÉSUMÉ

Selon les prévisions, le taux des cancers oropharyngiens associés au papillomavirus humain (VPH) devrait croître à un rythme important au cours des prochaines décennies. Puisque l'information sur l'histoire naturelle et la carcinogenèse du VPH est à un stage précoce, il faut faire davantage de recherche. La présente étude a porté sur la prévalence de deux types de VPH à haut risque, dans le cadre d'une clinique dentaire en milieu scolaire, en vue de donner aux professionnels de la santé buccodentaire un portrait plus clair de l'infection buccale à VPH. L'utilisation de la réaction en chaîne de la polymérase (PCR) en temps réel a permis de déceler les VPH de types 16 et 18 dans 110 échantillons de bains de bouche. Un seul échantillon était positif pour le VPH, plus précisément le type 18. Nous concluons que la prévalence du VPH à haut risque est très faible dans le cadre d'une clinique dentaire en milieu scolaire.

Key words: carcinogenesis; human papillomavirus; oropharyngeal cancers; prevalence; students, dental

EDITOR'S NOTE

The study described in this article is part of a larger picture. It was performed to produce preliminary data for grant writing and further research. Commonly undertaken by students who wish to gain experience with research, such pilot studies set parameters for advanced research. Rather than assuming that proposed methods are watertight, the researcher can experience the challenges of the investigation and gain invaluable insights: limitations become more evident; alternatives may present themselves. For example, when seeking a suitable laboratory for sample analysis, contacting and connecting with a variety of labs is beneficial to determine the best fit. This study delivered preliminary information that enabled the implementation of more complex data collection on a wider population in research that is still in progress.

BACKGROUND

The human papillomavirus (HPV) is a circular, double-stranded DNA molecule[1] with approximately 200 different types that have been characterized.[2] HPVs that affect mucosal regions are classified either as low risk, which usually produce warts, or high risk, which are associated with cervical cancer.[2,3] High-risk HPVs contain the oncoproteins E6 and E7, which are responsible for inhibition of apoptosis, deactivation of tumour suppressor proteins, and creation of an environment for genome instability, thus increasing risk for malignancy.[3]

Annually, it is estimated that 263,000 oral and 135,000 pharyngeal cancers occur globally.[4] Together, these 2 cancers represent the sixth most common cancer in the world.[5] Oral HPV infection is increasing at a considerable rate, and the projected number of HPV-positive oropharyngeal cancer cases is expected to surpass the annual number of cervical cancer cases by 2020.[6] The most prevalent type of HPV associated with oral infection is type 16.[7,8] Both types 16 and 18 have been demonstrated to be oncogenic in oropharyngeal cancers.[9-11]

The main purpose of this study was to observe the prevalence of high-risk HPV16 and 18 in the healthy population within a dental student clinic setting, as oral health professionals should be aware of the current pathological trends.

METHODS

Study population

Subjects were selected randomly at the University of Washington's student dental clinic (Seattle, WA). Consent forms and simple health questionnaires were completed by 110 subjects who met inclusion criteria. One subject declined to participate due to personal reasons. Children,

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pregnant females, current cancer patients, and those with HIV were excluded. Human subject regulations and protocols were followed throughout the study under the Fred Hutchinson Cancer Research Center IRB guidelines.

Collection and DNA purification methods

For sample collection, all study subjects rinsed and gargled for 30 seconds with Original Mint Scope® mouthwash. Four subjects requested to use Crest® alcohol-free mouthwash due to a history of alcoholism. Oral rinse samples were centrifuged for 15 minutes at 4°C to form a pellet, the supernatant was discarded, and the pellet was placed in -80°C until further processing. The Puregene® DNA Purification Kit was used to isolate genomic DNA from the buccal cell pellet within the mouthwash samples (Qiagen item #158467, manufacturer's protocol was followed).

HPV and analytic methods

Taqman real-time polymerase chain reaction (PCR) assays were used for detection on the ABI Prism 7900 Sequence Detection System, with 40 cycles in a reaction (denaturation at 95°C; annealing and extension at 60°C). Absolute quantification was used to determine HPV16 and 18 viral load, and total human genomic DNA in the sample was determined on Alu sequences. Serial dilutions of human genomic DNA, and the E7 regions of HPV16 and 18, of known concentrations, were used as standard curves for quantification and acted as positive controls.

Alu Primers
Forward: GGCCAACACGGTGAAACC
Reverse: CCACGCCCGGCTAATTTT

Alu Probe: CGTCTCTACTAAAAATAC

HPV16 E7 Primers
Forward: CGGACAGAGCCCATTACAATATT
Reverse: CGCACAACCGAAGCGTAGA

HPV16 E7 Probe: TAACCTTCTGTTGCAAGTGT

HPV18 E7 Primers
Forward: CCGACGAGCCGAACCA
Reverse: TGGCTTCACACTTACAACACATACA

HPV18 E7 Probe: AACGTCACACAATGTT

Smoking history was categorized as follows: non-smoker (0 packs); light smoker (<1 pack/week); moderate smoker (≥1 pack/week, ≤1 pack/day); heavy smoker (≥1 pack/day). For those who smoked cigars or chewed tobacco we calculated the equivalent in packages of cigarettes smoked. Alcohol history was categorized as follows: none (never drinks); rarely/occasionally (1 drink every 1-2 months); light (1-6 drinks/week for females, 1-13 drinks/week for males); moderate (7 drinks/week for females, 14 drinks/week for males); heavy (>7 drinks/week for females, >14 drinks/week for males).

All data analysis was completed using Stata MP 13.1 (StataCorp LP, Texas, USA).

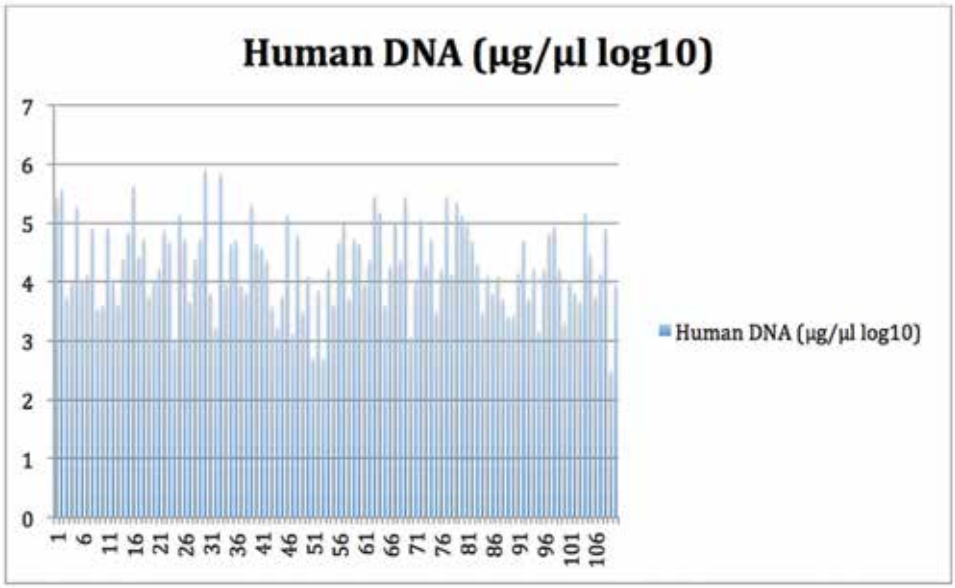
RESULTS

We did not detect HPV16 in any of the 110 subjects (Table 1), but we did detect HPV18 in one sample (0.9%). All samples had a substantial amount of human DNA (Figure 1). For the one subject with HPV18, 0.5 copies/cell of HPV18 DNA were quantified. The majority of subjects were Caucasian (86%), non-smokers (46.4%), light drinkers (49.1%), and non-marijuana users (99.1%).

Table 1. Demographics of study subjects

Demographic data n=110	
Gender	
Male	51 (46.4%)
Female	59 (53.6%)
Age range	
20–39	27 (24.6%)
40–49	13 (11.8%)
50–59	21 (19.1%)
60–69	29 (26.4%)
70+	20 (18.2%)
Race	
Asian	5 (4.6%)
Black	6 (5.5%)
White	92 (83.6%)
Other	7 (6.4%)
Ethnicity	
Hispanic/Latino	4 (3.6%)
Non-Hispanic/Latino	106 (96.4%)
Smoking history	
Non-smoker	51 (46.4%)
Light smoker	1 (0.9%)
Moderate smoker	23 (20.9%)
Heavy smoker	35 (31.8%)
Alcohol use history	
None	24 (21.8%)
Rarely/occasionally	16 (14.6%)
Light drinker	54 (49.1%)
Moderate drinker	3 (2.7%)
Heavy drinker	13 (11.8%)
Any marijuana use	
Yes	1 (0.9%)
No	109 (99.1%)
HPV16 positive	0 (0%)
HPV18 positive	1 (0.9%)

Figure 1. Human DNA quantity in oral rinse samples



Note: Y-axis indicates quantity of DNA; X-axis represents sample number

DISCUSSION

For oral health professionals, understanding the general prevalence of oral HPV infection within a clinic setting is pertinent given the rising number of oropharyngeal cancers worldwide. A study by Gillison et al. of 5579 US residents demonstrated the prevalence of oral HPV infection from 2009–2010.[7] The authors found 3.7% of oral rinse samples to be positive for high-risk HPV, with 1.0% of that number being positive for HPV16. Another study, with a much smaller sample size, detected HPV16 in 4 Hispanic females (2.6%, n=151).[12] This study also took place in a US dental school clinic (University of Nevada, Las Vegas), and is thus more suitable for comparison to ours, though none of our subjects was positive for HPV16. However, the demographics were much different for race: 51.7% of their subjects were non-Caucasian; in our study, only 16.4% were non-Caucasian, which reflects a geographical difference. In general both studies show a low oral HPV prevalence.

The single subject who had HPV infection had an extremely low copy number, which is in concordance with our previous study indicating significantly high copy numbers for those with cancer compared to those without.[13]

Former smokers have more than double the risk of acquiring oral HPV infection, and current smokers have almost 3 times the risk.[14] A very recent large cross-sectional study by Fakhry et al. presented a statistically significant dose-response relationship between current tobacco use and oral HPV16 infection.[15] Their results showed that oral HPV16 prevalence was higher in current tobacco users compared with never or former tobacco users (n=6887, p=0.004). Marijuana use is also demonstrated to be associated with oral HPV infection.[16] Thus, we collected smoking, alcohol, and marijuana use history to view any trends with oral HPV infection. Because our results demonstrated a lack of HPV-infected individuals we did not find a trend. However, it should be noted that the one patient with HPV18 was a heavy smoker and heavy drinker.

Limitations

One limitation of our study is that we could not control how well a subject would gargle and swish the mouthwash, which had an effect on the quantity and quality of DNA collected. However, we did calculate viral load as HPV copies/cell to alleviate this caveat. Another concern is that Scope® has a strong mint taste, which may not be suitable for those with sensitive mouths.

Sexual behaviour is seen as an important risk factor for oral HPV infection.[16–18] Unfortunately we did not include questions on sexual behaviour or sexual history in our questionnaire, which would have added more depth and detail to this study.

In conclusion, this study showed that high-risk HPV oral infection is very low in the general healthy population within a dental student clinic setting.

REFERENCES

1. Dell G, Gaston K. Human papillomaviruses and their role in cervical cancer. *Cell Mol Life Sci.* 2001;58(12–13):1923–42.
2. Bernard HU, Burk RD, Chen Z, van Doorslaer K, zur Hausen H, de Villiers EM. Classification of papillomaviruses (PVs) based on 189 PV types and proposal of taxonomic amendments. *Virology.* 2010;401(1):70–79.
3. Doorbar J, Quint W, Banks L, Bravo IG, Stoler M, Broker TR, Stanley MA. The biology and life-cycle of human papillomaviruses. *Vaccine.* 2012;30 Suppl 5:F55–F70.
4. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer.* 2010;127(12):2893–917.
5. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. *Oral Oncol.* 2009;45(4–5):309–16.
6. Chaturvedi AK, Engels EA, Pfeiffer RM, Hernandez BY, Xiao W, Kim E, Jiang B, Goodman MT, Sibug-Saber M, Cozen W et al. Human papillomavirus and rising oropharyngeal cancer incidence in the United States. *J Clin Oncol.* 2011;29(32):4294–301.
7. Gillison ML, Broutian T, Pickard RK, Tong ZY, Xiao W, Kahle L, Graubard BI, Chaturvedi AK. Prevalence of oral HPV infection in the United States, 2009–2010. *JAMA.* 2012;307(7):693–703.
8. Hariri S, Unger ER, Sternberg M, Dunne EF, Swan D, Patel S, Markowitz LE. Prevalence of genital human papillomavirus among females in the United States. The National Health And Nutrition Examination Survey, 2003–2006. *J Infect Dis.* 2011;204(4):566–73.
9. Gillison ML, Koch WM, Capone RB, Spafford M, Westra WH, Wu L, Zahurak ML, Daniel RW, Viglione M, Symer DE et al. Evidence for a causal association between human papillomavirus and a subset of head and neck cancers. *J Natl Cancer Inst.* 2000;92(9):709–720.
10. Mineta H, Ogino T, Amano HM, Ohkawa Y, Araki K, Takebayashi S, Miura K. Human papilloma virus (HPV) type 16 and 18 detected in head and neck squamous cell carcinoma. *Anticancer Res.* 1998;18(6B):4765–768.
11. Michaud DS, Langevin SM, Eliot M, Nelson HH, Pawlita M, McClean MD, Kelsey KT. High-risk HPV types and head and neck cancer. *Int J Cancer.* 2014;135(7):1653–61.
12. Turner DO, Williams-Cocks SJ, Bullen R, Catmull J, Falk J, Martin D, Mauer J, Barber AE, Wang RC, Gerstenberger SL et al. High-risk human papillomavirus (HPV) screening and detection in healthy patient saliva samples: a pilot study. *BMC Oral Health.* 2011;11:28.
13. Martin E, Dang J, Bzhalava D, Stern J, Edelstein ZR, Koutsky LA, Kiviat NB, Feng Q. Characterization of three novel human papillomavirus types isolated from oral rinse samples of healthy individuals. *J Clin Virol.* 2014;59(1):30–37.
14. Kreimer AR, Pierce Campbell CM, Lin HY, Fulp W, Papenfuss MR, Abrahamsen M, Hildesheim A, Villa LL, Salmeron JJ, Lazcano-Ponce E et al. Incidence and clearance of oral human papillomavirus infection in men: the HIM cohort study. *Lancet.* 2013;382(9895):877–87.
15. Fakhry C, Gillison ML, D'Souza G. Tobacco use and oral HPV-16 infection. *JAMA.* 2014;312(14):1465–67.
16. Cook RL, Thompson EL, Kelso NE, Friary J, Hosford J, Barkley P, Dodd VJ, Abrahamsen M, Ajinkya S, Obesso PD et al. Sexual behaviors and other risk factors for oral human papillomavirus infections in young women. *Sex Transm Dis.* 2014;41(8):486–92.
17. Gillison ML, Castellsague X, Chaturvedi A, Goodman MT, Snijders P, Tommasino M, Arbyn M, Franceschi S. Comparative epidemiology of HPV infection and associated cancers of the head and neck and cervix. *Int J Cancer.* 2013;134:497–507.
18. D'Souza G, Cullen K, Bowie J, Thorpe R, Fakhry C. Differences in oral sexual behaviors by gender, age, and race explain observed differences in prevalence of oral human papillomavirus infection. *PloS One.* 2014;9(1):e86023.

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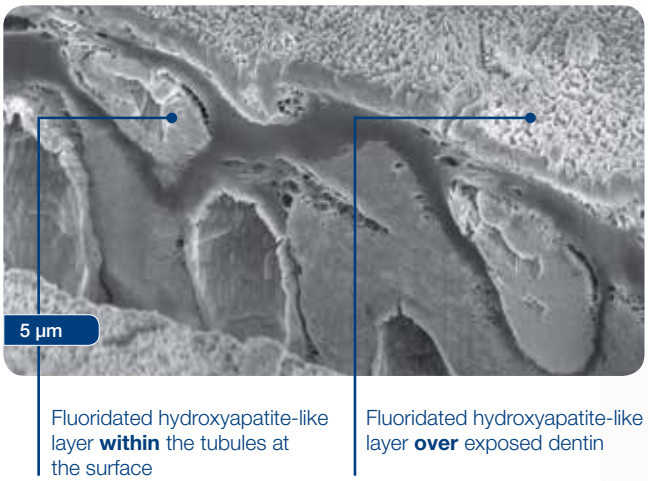
Building a hydroxyapatite-like layer over exposed dentin and within dentin tubules[2,8–11]



In vitro cross-section SEM image of hydroxyapatite-like layer formed by supersaturated NovaMin® solution in artificial saliva after 5 days (no brushing).[10]

Adapted from Earl J, et al.[10]

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1. Earl J, et al. *J Clin Dent.* 2011;22(Spec Iss):68–73. **2.** LaTorre G, et al. *J Clin Dent.* 2010;21(Spec Iss):72–76. **3.** Edgar WM. *Br Dent J.* 1992;172(8):305–312. **4.** Arcos D, et al. *A J Biomed Mater Res.* 2003;65:344–351. **5.** Greenspan DC. *J Clin Dent.* 2010;21(Spec Iss):61–65. **6.** Lacruz RS, et al. *Calcif Tissue Int.* 2010;86:91–103. **7.** De Aza PN, et al. *Mat Sci: Mat in Med.* 1996;399–402. **8.** Burwell A, et al. *J Clin Dent.* 2010;21(Spec Iss):66–71. **9.** West NX, et al. *J Clin Dent.* 2011;22(Spec Iss):82–89. **10.** Earl J, et al. *J Clin Dent.* 2011;22(Spec Iss):62–67. **11.** Efflandt SE, et al. *J Mater Sci Mater Med.* 2002;26(6):557–565. **12.** Parkinson C, et al. *J Clin Dent.* 2011;22(Spec Iss):74–81. **13.** Du MQ, et al. *Am J Dent.* 2008;21(4):210–214. **14.** Pradeep AR, et al. *J Periodontol.* 2010;81(8):1167–1113. **15.** Salian S, et al. *J Clin Dent.* 2010;21(3):82–7. **16.** Zhong JP, et al. The kinetics of bioactive ceramics part VII: Binding of collagen to hydroxyapatite and bioactive glass. In Bioceramics 7, (eds) OH Andersson, R-P Happonen, A Yli-Urpo, Butterworth-Heinemann, London, pp61–66. **17.** Wang Z, et al. *J Dent.* 2010;38:400–410. Prepared December 2011, Z-11-518.

The intersection of interprofessional collaboration with dental hygiene education and research

Dear editor,

I consider myself a researcher and, as a result of completing the degree program for dental hygienists at The University of British Columbia in 2000, I have been aware for some time of how crucial dental hygiene research is to the advancement of the profession. In the last issue of the *Canadian Journal of Dental Hygiene* (Volume 49, Number 1, February 2015), Mandy Hayre suggested that, while dental hygiene research is increasing, there is still a need for more in order to advance the profession. She also indicated that there is a significant body of literature supporting dental hygiene as a true profession with its own unique scope of practice and body of knowledge.[1]

Dental hygienists generally view the recent creation of our professional identity statement and changes in self-regulation, independent practice, and educational opportunities as contributing to the advancement of the profession. According to the Canadian Dental Hygienists Association, all provinces are now self-regulating, with the exception of PEI and the territories.[2] Additionally, in a recent issue of *Oh Canada!*, Wright noted that dental hygienists can practise independently across Canada, except in Quebec, PEI, and the territories.[3] Insofar as education and research are concerned, there are 4 dental hygiene baccalaureate programs offered in Canada, and The University of Alberta has recently launched a master's program for dental hygienists. Nonetheless, there remains a demand for more dental hygiene research in order to further construct and solidify our professional identity.

Alongside this call to increase dental hygiene research, there are recommendations for dental hygienists to practise in interprofessional contexts and collaborate with other health care professionals.[3,4] Interprofessional collaboration will most definitely impact our professional identity by allowing dental hygienists to gain more recognition and respect both within our communities and from other health care professionals. However, the positive impact that such collaboration may have on dental hygiene's professional identity may not outweigh its possible negative effects. It is important to be critically aware of the intersection of dental hygiene education and research with interprofessional collaboration at this point in dental hygiene's advancement, as all identities are constructed.

According to Darby and Walsh:

> Dental hygienists are licensed preventative oral health care professionals who have graduated from accredited dental hygiene programs in institutions of higher education. They function in interrelated roles of clinician, educator, administrator or manager, advocate, and researcher to prevent oral disease and promote health...[6]

Because dental hygienists must be licensed and complete rigorous education and training to acquire and assimilate the unique, specialized knowledge and culture of the profession, dental hygiene may be perceived, from a sociological perspective, as being elitist. When we review the definition by Darby and Walsh, belonging to the dental hygiene profession is most definitely about elitism. Sociological critiques of professionalism as "elitist" should be considered when contemplating interprofessional collaboration.

Furthermore, professionalism has, in the past, been equated with paternalism.[7] As long as dental hygiene practice is scientifically evidence based, we cannot avoid charges of paternalism, as scientific knowledge, in my opinion, is paternalistically constructed. We would have to consider and utilize epistemologies other than positivist in our research in order to transcend this problem.

According to Hayre, for many years dental hygiene did not have its own body of research to draw from to establish itself as its own profession.[1] Even now, dental hygiene continues to rely heavily on nursing and other disciplines for research articles. While interprofessional collaboration may prevent the duplication of research,[5] there appears to be a contradiction between the recommendation to collaborate with other health professions to avoid duplicating research and the recommendation for dental hygiene to generate its own research.

As Hayre pointed out, there is no doctoral program for dental hygienists in Canada, and the few dental hygienists in Canada with PhDs have had to be resourceful and creative in order to create the PhD opportunities for themselves.[1] Until recently, the same was true for the dental hygienists holding a master's degree. Turning to other professions to mentor and conduct dental hygiene research may seem like a logical choice. Yet such interprofessional collaboration could be extended to the point of PhD professionals, who aren't dental hygienists, holding faculty positions to mentor dental hygiene students and dental hygiene research within dental hygiene departments in university settings. Can these professionals truly act as leaders in dental hygiene education and research without experiencing the dental hygiene education process or experiencing clinical practice as a dental hygienist? Would he or she have the insight required to create dental hygiene research topics or fully understand and resonate with the research? Furthermore, would it be ethical for the PhD professional, who is not a dental hygienist, to receive credit for dental hygiene research? Lastly, would this collaborative dental hygiene research result in the advancement of the dental hygiene profession?

As a researcher in a real-life situation, I was invited to participate in research where I would train resident pediatricians to apply fluoride varnish so they would feel more comfortable including this procedure in their scope of practice. Being involved in this research project might have led to an opportunity for me to obtain my PhD. While this experience is an example of interprofessional collaboration in research and education, is it an example of dental hygiene research and education that will have more positive than negative effects on the advancement of the profession?

To reiterate, dental hygiene as a profession may be more vulnerable in interprofessional situations, as it is still striving for and solidifying its professional identity. Dental hygiene is currently recognized as a profession, yet the efforts to further advance the profession may lead to growing elitism. Perhaps dental hygiene needs to reflect and think more critically about these issues at this point in its professional advancement.

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REFERENCES

1. Hayre M. Research and dental hygiene education. *Can J Dent Hyg.* 2015;49(1):6–9.
2. Canadian Dental Hygienists Association. *Dental hygiene profession in Canada.* Rev. ed. Ottawa: CDHA; 2014. Available from: www.cdha.ca/pdfs/profession/Regulatory_Authority_Chart_March_2015.pdf
3. Wright A. 2013. Dental hygienists practising with denturists: A prescription for success? *Oh Canada.* 2013;Fall:52–53.
4. Casier K. 2014. Interprofessional collaboration and core competences in dental public health. *Oh Canada.* 2014;Fall:48–49.
5. University Dental Hygiene Study Club. Interprofessional competency. Lecture by Dr. Minn Yoon, The University of Alberta, Edmonton, Alberta, 18 March 2015.
6. Darby ML, Walsh MM. *Dental hygiene theory and practice,* 3rd Ed. St. Louis, Missouri: Saunders Elsevier; 2010.
7. Zmetana K. On professionalism and self identity. *Can J Dent Hyg.* 2013;47(2):53–54.

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