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The intersection of oral health knowledge and oral health literacy of baby boomers

Exploring reported dental hygiene practice adaptations in response to water fluoridation status

Implementing the Pediatric Oral Quality of Life instrument in clinical practice

EDITORIAL

Quality assurance: A professional responsibility

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The mission of the *Canadian Journal of Dental Hygiene* is to publish high-quality, credible, and accessible research to inform practice, education and policy, and promote the oral health and well-being of the public.

CONTENTS

JUNE 2018 VOL. 52, NO. 2

The *Canadian Journal of Dental Hygiene* is the official peer-reviewed publication of the Canadian Dental Hygienists Association (CDHA). 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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Quality assurance: A professional responsibility

Salme Lavigne*, PhD, RDH

In Canada, we as dental hygienists are very fortunate to have the privilege of professional self-regulation. Along with that privilege, however, comes the responsibility of quality assurance. In other words, our professional colleges are in place to protect the public and to ensure that people receive the quality of care they deserve. With dental hygienists practising in 10 provinces and 3 territories, each of these jurisdictions operates separately and, thus, the quality assurance requirements vary considerably. In many provinces, there is still the requirement of a specified number of annual mandatory continuing education (CE) credits, while in other provinces, a portfolio is required, and in others still, combinations of portfolios, CE credits, and even mandatory examinations at specified intervals exist to measure the quality of care provided by their registrants.

Salme Lavigne

Whether you live in a province that requires strictly CE credits or in one where you are responsible for making decisions regarding how you will meet the goals that you set for yourself through a professional portfolio, most colleges accept quality assurance evidence in a variety of formats. These include, but are not limited to, traditional live CE courses at conferences or other professional development events; online learning in the form of courses or webinars that may be provided by both professional groups (such as the Canadian Dental Hygienists Association [CDHA]) and dental industry (such as Crest + Oral-B and Colgate). Some online courses, such as those provided by dentalcare.com, may award a certificate upon successful completion of a test at the end of the course.

There are a lot of options for those who prefer traditional live CE offerings, as most Canadian provinces have annual dental conferences that also include courses designed specifically for dental hygienists. In addition, many provincial dental hygiene associations and regulatory colleges also organize annual conferences specifically for dental hygienists. Of course, CDHA's biennial national dental hygiene conference is delivered in different locations throughout the country, thus providing the opportunity for dental hygienists to attend a national conference close to home. CDHA's next conference will be in St. John's, Newfoundland, from October 3 to 5, 2019. For those who are more adventurous, there are also international dental hygiene conferences that one can attend in more exotic venues. These events definitely provide a broader perspective of dental hygiene practice and research throughout the world. The International Federation of Dental Hygienists (IFDH) delivers conferences every 3 years, with the next one coming up in Brisbane, Australia, in August 2019. Other options include the American Dental Hygienists' Association annual conference, the American Academy of Periodontology annual conference (Vancouver, October 2018), Europerio (Amsterdam, June 2018), the Canadian Association of Public Health Dentistry conference (Vancouver, September 2018), and the list goes on!

As the only national peer-reviewed dental hygiene journal in Canada, the *Canadian Journal of Dental Hygiene* exists to provide dental hygienists with the most current research findings and, in particular, research that aligns with CDHA's research agenda. There are many ways to use the original research articles found in the journal to meet your quality assurance needs. To fulfill portfolio goals, dental hygienists can read articles specific to a particular goal and then explain how the evidence in those articles (applied in their practice) enabled them to achieve that goal. Another way to explore the journal is through study club discussions where dental hygienists take turns reporting on current literature findings related to a contemporary topic and then have a lively discussion about the translation of that research to practice. Of course, there are many other journals that should also be searched for specific topics of interest besides CJDH. We are, however, very proud to say that CJDH, the official journal of CDHA, is one of only a small handful of peer-reviewed dental hygiene journals in the world. Among the others are the *International Journal of Dental Hygiene*, the official journal of the International Federation of Dental Hygienists, and the *Journal of Dental*

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Hygiene, which is the official journal of the American Dental Hygienists' Association.

In this particular issue of the journal, we have a variety of original research articles for you to translate into practice, as well as a narrative review and a short communication. I hope you will find these articles useful in helping you to fulfill your quality assurance requirements. Happy reading!

Quality is not an act, it is a habit.

—Aristotle

ISSUE AT A GLANCE

We are pleased to feature 3 original research articles in this issue. **Alison MacDougall, Lori Weeks, William Montelpare, and Sharon Compton** explore the oral health literacy levels and knowledge of the oral–systemic connection among baby boomers (pp. 99–109). **Salima Thawer, Congshi Shi, Cynthia Weijs, and Lindsay McLaren** examine reported dental hygiene practice adaptations in response to a change in water fluoridation status in a Canadian city (pp. 110–21). **Cynthia Gadbury-Amyot, Melanie Simmer-Beck, and JoAnna Scott** share the results of their study on the implementation of a pediatric oral health quality of life instrument in clinical practice (pp. 122–31).

This issue also includes a narrative review by **Dana Belinski and Zul Kanji** on the intersections between clinical dental hygiene education and perceived practice barriers (pp. 132–39), as well as a short communication by **Sameep Shetty, Nancy Agarwal, and Premalatha Shetty** on the use of eupnea to reduce anxiety in dental clients prior to oral injection (pp. 140–43). Finally, we offer 2 book reviews: *Health Promotion in Canada* (4th edition) by **Donald Ross** (pp. 149–50) and *Noncarious Cervical Lesions and Cervical Dentin Hypersensitivity* by **Laura Brown** (pp. 153–54).

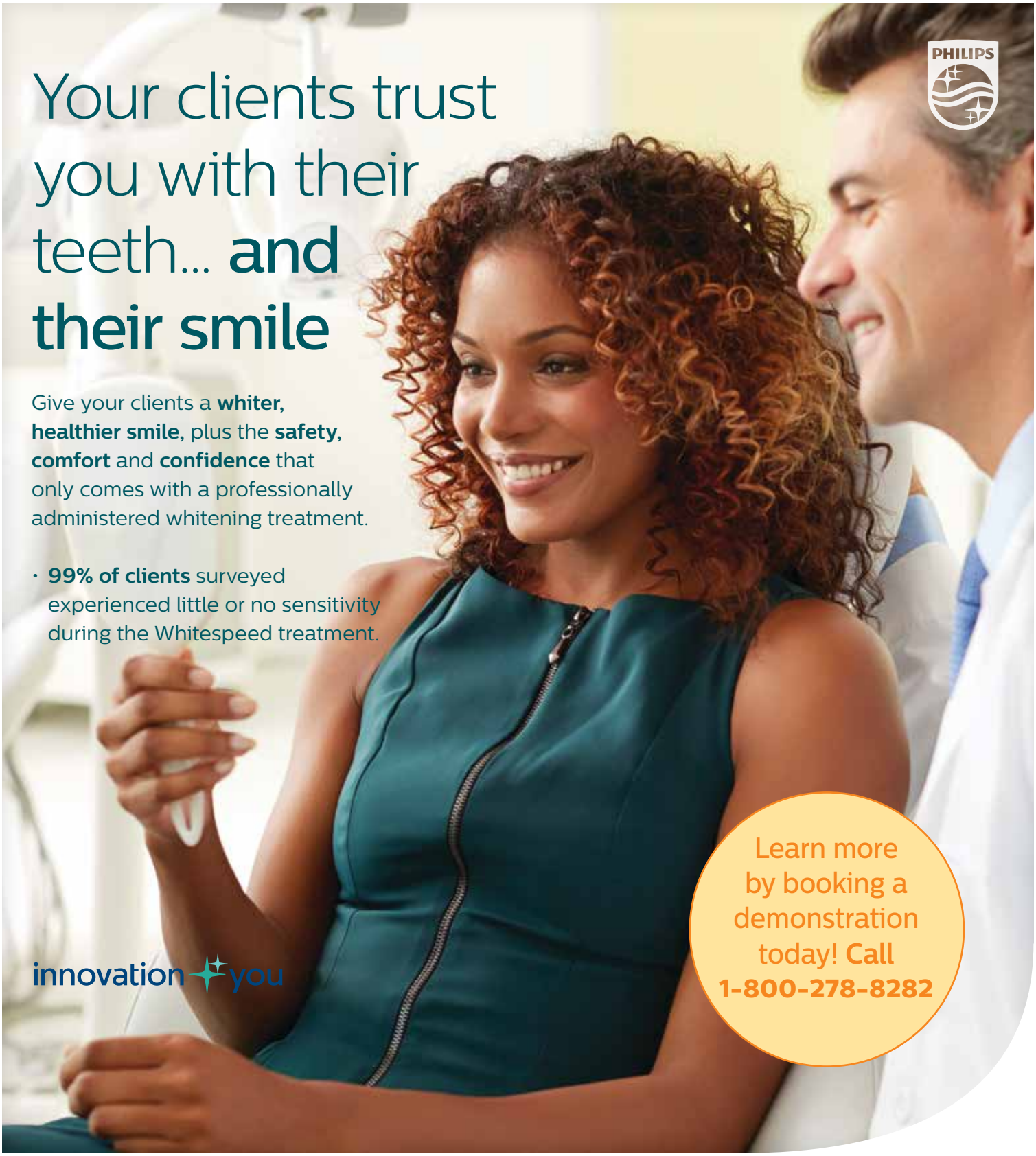
PLAIN LANGUAGE ABSTRACTS

MacDougall AC, Weeks LE, Montelpare WJ, Compton S. The intersection of oral health knowledge and oral health literacy of baby boomers. *Can J Dent Hyg*. **2018;52(2):99–109.**
This study examines the oral health literacy levels and knowledge of the association between oral health and common chronic diseases among adults, ages 50 to 69. Sixty-nine adults responded to an online questionnaire; the authors calculated oral health literacy and knowledge scores for all participants and within distinct age groups. While participants had adequate oral health literacy scores, many were unaware of the association between oral conditions and chronic diseases such as diabetes, cancer, cardiovascular and respiratory diseases. Dental hygienists have a role to play in educating their older clients on the oral–systemic link and supporting their healthy aging.

Thawer S, Shi C, Weijs C, McLaren L. Exploring reported dental hygiene practice adaptations in response to water fluoridation status. *Can J Dent Hyg*. **2018;52(2):110–21.**
Community water fluoridation has been proven effective in reducing the incidence of dental caries in populations, yet many communities are opting to discontinue this public health initiative. This study explores whether dental hygienists working in communities where water fluoridation has ceased have adapted their professional practice to offset the real or perceived changing caries risk, compared to those working in still-fluoridated communities. A total of 154 dental hygienists in Alberta participated in the study. Those working in fluoridation-cessation communities were more likely to report increasing their recommendations for more frequent in-office fluoride treatments and less likely to report recommending a reduction in the number of radiographs to detect decay. Further research is needed to better understand the interplay between clinical dental hygiene practice and community water fluoridation.

Gadbury-Amyot CC, Simmer-Beck ML, Scott JM. Implementing the Pediatric Oral Quality of Life (POQL) instrument in clinical practice: Early results. *Can J Dent Hyg*. **2018;52(2):122–31.**
Quality of life measurements are recognized as vital to the provision of client-centred health care. This study evaluated the experience of oral health care practitioners in administrating the Pediatric Oral Quality of Life instrument to children, parents, and guardians in 3 clinical settings. Twelve practitioners provided full responses to an online questionnaire, revealing that their clients were receptive to the collection of quality of life data and, in some cases, provided greater insight into the child's oral health and well-being. Oral health practitioners demonstrated an increased awareness of the importance of collecting quality of life data but require further education on using the data to guide the process of care.

Belinski D, Kanji Z. Intersections between clinical dental hygiene education and perceived practice barriers. *Can J Dent Hyg*. **2018;52(2):132–39.**
Many dental hygienists have reported barriers to the provision of effective clinical therapy, which may be associated with challenges first encountered in entry-to-practice education. This article reviews the literature on perceived practice barriers and experiences of students and faculty in clinical dental hygiene education programs. Students report a desire for more individualized coaching from educators, better calibration among educators, and less stressful, time-constrained learning environments. Educators note a need for more teacher training and mentoring from experienced faculty. Additional research examining dental hygiene students' clinical experiences in entry-level programs and their relation to challenges experienced in professional clinical practice is needed.



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The intersection of oral health knowledge and oral health literacy of baby boomers

Alison C MacDougall*, MSc, RDH; **Lori E Weeks**[§], PhD; **William J Montelpare**[‡], PhD; **Sharon Compton**[Δ], PhD, RDH

WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Older clients report that dental professionals are their primary source of oral health knowledge.
- Low oral health literacy levels among this group may prevent them from acquiring, understanding, and acting upon oral health information.
- Dental hygienists should identify clients with low oral health literacy levels and work to ensure that they understand the importance of oral health to overall health.

ABSTRACT

Background: The 4 main chronic diseases causing death worldwide are cardiovascular disease, diabetes, cancer, and respiratory disease, and there is strong evidence demonstrating an association between oral conditions and each of these diseases. Unlike previous generations, baby boomers are keeping their own natural teeth as they age. Given this fact, older adults need to be aware of oral–systemic associations and must possess appropriate literacy and knowledge skills to support healthy aging. **Purpose**: This preliminary, descriptive study explored baby boomers' levels of oral health literacy and oral health knowledge about the association between oral health and common chronic diseases. **Methods:** This study collected both qualitative and quantitative data using questionnaires delivered over the internet. The questions consisted of fixed responses and open-ended items. This study received ethics approval from the University of Prince Edward Island Research Ethics Board. **Results**: A total of 69 community dwelling participants (19 males; 50 females) ages 50 to 69 years participated in the study. Oral health literacy and oral health knowledge scores were calculated for the total sample and within distinct age groups. A Pearson product-moment correlation coefficient was used to determine relationships between the 2 independent variables: 1) oral health literacy and 2) oral health knowledge. The results indicated a low but positive correlation between oral health literacy and oral health knowledge scores (r = 0.31, n =69, p = 0.008). **Conclusion:** While participants had adequate oral health literacy scores, many lacked knowledge of the association between oral diseases and common chronic diseases. Dental hygienists can play an integral part in educating aging clients to help them improve their knowledge of this association. Due to the small and relatively homogenous sample recruited, it is not possible to generalize the results to all Canadian baby boomers. Additional studies with more diverse participants are required to further explore the association between oral health literacy and oral health knowledge.

RÉSUMÉ

Contexte : Les maladies cardiovasculaires, le diabète, le cancer et les maladies respiratoires sont les 4 principales maladies provoquant la mort à l'échelle mondiale, et il existe des preuves solides qui démontrent un lien entre les affections buccodentaires et chacune de ces maladies. Contrairement aux générations précédentes, les baby-boomers conservent leurs propres dents naturelles à mesure qu'ils avancent en âge. Par conséquent, les adultes plus âgés doivent être conscients du lien entre les affections buccodentaires et les maladies systémiques, et doivent maîtriser la littératie et les connaissances pertinentes qui les aideront à vieillir en santé. **Objet :** La présente étude descriptive préliminaire explore le niveau de littératie et de connaissance en santé buccodentaire des baby-boomers sur le lien entre la santé buccodentaire et les maladies chroniques courantes. **Méthodologie :** Cette étude a recueilli des données à la fois qualitatives et quantitatives à l'aide de questionnaires diffusés sur Internet. Les questions étaient à réponses fixes ou ouvertes. Cette étude a reçu l'approbation éthique du comité d'éthique de la recherche de l'Université de l'Île-du-Prince-Édouard. **Résultats :** Un total de 69 participants âgés de 50 à 69 ans qui résident dans la communauté ont pris part à l'étude (19 hommes et 50 femmes). Les scores de littératie et de connaissance en santé buccodentaire ont été calculés sur l'ensemble de l'échantillon et selon les différents groupes d'âge. Un coefficient de corrélation de moment-produit de Pearson a été utilisé pour déterminer les liens entre les deux variables indépendantes : 1) la littératie en santé buccodentaire et 2) la connaissance en santé buccodentaire. Les résultats révèlent une corrélation faible, mais positive entre les scores de littératie en santé buccodentaire et ceux de connaissance en santé buccodentaire [r = 0,31, n = 69, p = 0,008]. **Conclusion** : Bien que les scores de littératie en santé buccodentaire des participants soient acceptables, plusieurs parmi ces derniers manquaient de connaissance sur le lien entre les maladies buccodentaires et les maladies chroniques courantes. Les hygiénistes dentaires peuvent jouer un rôle à part entière dans l'éducation des clients vieillissants afin de les aider à améliorer leur connaissance sur ce lien. En raison du petit échantillon relativement homogène de personnes qui ont été recrutées, il n'est pas possible d'appliquer les résultats à tous les baby-boomers canadiens. Il est nécessaire d'effectuer des études supplémentaires comprenant davantage de participants pour mieux explorer le lien entre la littératie et la connaissance en santé buccodentaire.

Key words: aging, baby boomers, chronic disease knowledge, dental hygiene, oral health, oral health literacy

CDHA Research Agenda category: risk assessment and management

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INTRODUCTION

Oral health and its impact on overall health is an important yet regularly overlooked component of healthy aging.[1-3] Canada, like many countries, is facing an era of population aging with the number of older adults rapidly increasing due to low fertility rates, longer life expectancy, and the existence of a large baby boom generation.[4-6]

The large baby boom cohort reaching older adulthood comprises 2 distinct groups referred to as early boomers (those born between 1946 and 1955) and late boomers (those born between 1956 and 1964).[1,7,8] Baby boomers grew up in an era that heralded substantial advances in medical care, improvements in public health, higher standards of living, and significant increases in educational attainment.[9-11] More than any other cohort before them, baby boomers have had access to oral care, oral health promotion initiatives, and dental insurance throughout their lives and, as a result, they are more likely to retain at least some of their own teeth for their entire lifetime.[1,11]

As people age, they may develop multiple chronic conditions, which not only cause premature death in some cases, but also place a financial burden on individuals, families, and society in general.[12] The 4 main chronic diseases causing death worldwide are cardiovascular disease (CVD), cancer, chronic respiratory disease, and diabetes, and there is evidence demonstrating a link between these conditions and oral diseases.[13,14] According to the World Health Organization, oral diseases share common risk factors with all 4 leading chronic diseases.[15] Poor oral health affects quality of life across the lifespan, and oral health extends beyond dental disease, with an unhealthy mouth affecting an individual's ability to eat and speak properly, their nutritional status, body mass index, and self-image, as well as increasing the risk for developing chronic diseases.[11,16]

Oral health and general health are related in that poor oral health causes disability, general health problems may cause or worsen oral health conditions, and oral diseases and chronic diseases share common risk factors.[17] The diseases for which an association with periodontal disease has been reported include CVD, stroke, respiratory disease, rheumatoid disease, pancreatic cancer, diabetes mellitus (types 1 and 2), osteoporosis, and osteoarthritis.[18-22]

Research shows that having periodontal disease can increase the probability that CVD will occur, irrespective of the effect of other causal or risk factors.[23-25]Aspiration pneumonia is a multifactorial respiratory disease that is influenced by oral-related factors such as difficulty swallowing, dependency on feeding tubes, and presence of cariogenic bacteria and periodontal pathogens.[26] People with diabetes, especially poorly controlled and uncontrolled diabetes, have an increased susceptibility to chronic infections and inflammation of oral tissues, including periodontal disease, dental caries, and oral candidiasis.[18,25,27,28] The side effects of oral cancer treatment can result in poor oral outcomes such as difficulty swallowing, chewing, and speaking, and can be cosmetically disfiguring resulting in increased depressive symptoms and social isolation.[29-31] New research demonstrates that the periodontal pathogen *Porphyromas gingivalis* infects the epithelium of the esophagus in esophageal squamous cell carcinoma (ESCC) patients, establishing an association between infection with *Porphyromas gingivalis* and progression of ESCC.[32]

Individuals with low health literacy skills often have poorer health knowledge and health status, exhibit unhealthy behaviours, are less likely to use preventive services, and have higher rates of hospitalizations, increased health care costs, and ultimately poorer health outcomes than those with higher literacy levels.[33] Researchers have proposed a conceptual model of causal pathways between health literacy and health outcomes, in which health literacy is determined by patient literacy level and extrinsic factors grouped as 1) access to and utilization of health care; 2) provider–patient interaction; and 3) self care.[34]

Oral health literacy (OHL) is the process of acquiring oral health information, appraising concepts, and appropriately applying oral disease prevention and treatment recommendations.[35,36] Having low OHL has been shown to contribute to oral health disparities, and those with low OHL are more likely to be poor, not well educated, older, and have limited English language skills.[37-39] It has been suggested that those with low OHL may be unable to communicate effectively with health care providers, and this gap in communication may account for poor oral health outcomes.[40-41] A growing number of studies has been able to demonstrate that low OHL levels are associated with poor oral health knowledge.[42-44]

The body of medical literature linking health literacy to health knowledge continues to grow; however, far less is known about the influence of OHL on oral health knowledge. The purpose of this study was to explore baby boomers' levels of OHL and oral health knowledge about the association between oral health and common chronic diseases.

METHODS

Research questions

1. *"To what extent do older adults possess oral health literacy and oral health knowledge?"*
2. *"What is the relationship between study participants' oral health literacy scores and oral health knowledge scores?"*
3. *"Do cohort and gender influence the relationship between oral health literacy and oral health knowledge scores?"*
4. *"What demographic variables predict higher oral health literacy and oral health knowledge scores?"*

Study description and design

This web-based study opened in January 2015, was available for 4 weeks, and took approximately 30 minutes to complete. Participants did not receive any compensation for participating. The study was based on a concurrent parallel mixed-methods design that involved collecting both quantitative and qualitative data simultaneously, analysing the data separately, and then comparing the results to see if the findings confirmed or disconfirmed each other.[45] This design was chosen to develop a more complete understanding of the research problem through the collection of different types of data. Questionnaires and open-ended questions were delivered via an online platform to enable recruitment of geographically dispersed participants who may not have participated in a face-to-face study. A web-based approach also assured anonymity to participants who were being asked to share personal experiences about their oral health knowledge. Research shows that respondents may be less inhibited online and reveal more personal information and deeper feelings than in face-to-face interviews due to increased anonymity and higher levels of private self-awareness offered in an online environment.[46] Prior to participant recruitment, the study received approval from the University of Prince Edward Island Research Ethics Board File No. 6005983. Those who agreed to participate in the survey were required to read an information sheet and provide consent before gaining access to the study.

Pilot study

A pilot study was first conducted with students from a local campus of Seniors College. The first author visited a regularly scheduled class designed for adults ages 50 and older and delivered a short presentation about the study. Students in the class were invited to participate in the web-based study and provide feedback via email to the first author. The feedback questionnaire included questions about ease of use, unnecessary use of jargon or unclear terminology, time necessary to complete the study, and identification of any unclear instructions or questions. A total of 8 students participated in the pilot study and completed the feedback questionnaire. Based on the findings from the pilot study, ambiguous questions identified by participants were revised to ensure user clarity. Another benefit of completing the pilot study was that it helped to better estimate the time required to participate in the study.

Participant recruitment

Inclusion criteria were as follows: individuals between the ages of 50 and 69, able to read and write in English, with access to a computer with internet service. Participants were recruited through various methods including printed posters and postcards distributed to community venues such as grocery stores, pharmacies, churches, and a local farmers market; information posted on the university's homepage and an email message to university alumni; a radio interview with the first author; a story featured on the local CBC website; an invitation to participate distributed through Facebook and Twitter; and study posters and postcards displayed in a local dentist's office. A snowball technique was also used whereby study participants were encouraged to share the study link with others whom they felt might be interested in participating.

Study questionnaire

The online study consisted of 4 sections designed to collect information on demographics, oral health literacy, oral health knowledge, and oral care behaviours. For this article, the data collected concerning oral care behaviours will not be discussed. Results are based upon responses obtained from 3 quantitative questionnaires: a demographic questionnaire, the Oral Health Literacy–Adult Questionnaire (OHL–AQ),[47] and the author-created Oral Health–Chronic Disease Knowledge Questionnaire (OH–CDKQ), as well as data collected from participants' answers to open-ended questions.

The Demographic Questionnaire was used to collect information about sociodemographic and self-reported general and oral health characteristics of study participants.

There are numerous tools available that measure OHL using a range of indicators.[48] This study utilized the OHL–AQ,[47] a validated quantitative instrument, consisting of 17 items including reading comprehension, numeracy, listening, and decision making. Naghibi Sistani and colleagues[47] determined that the scale content validity index was 0.90 and the content validity ratio 0.85. This questionnaire was developed as a functional, short-format OHL instrument specifically for use with adults in community or population-based studies. The scoring strategy implemented for this questionnaire was as follows: correct answers were scored 1 and incorrect answers or unanswered questions were scored –1. An oral health literacy score was determined by summing the correct scores up to a maximum score of 17; higher scores suggest higher oral health literacy.

The OH–CDKQ was developed by the first author to determine a participant's working knowledge of the links between oral health and the 4 most prevalent chronic diseases: cardiovascular disease, cancer (with a focus on oral cancer), respiratory diseases (with a focus on aspiration pneumonia), and diabetes. Questions for this knowledge survey were developed based upon a review of current research into the association between oral health and those 4 common chronic diseases. This questionnaire consists of 19 questions that can be answered true, false or unsure. Correct answers were scored 1, incorrect answers were scored –1, and unsure answers received a 0. A neutral value was awarded to questions answered "unsure" in an attempt to avoid penalizing participants who acknowledged they did not know the answer to a question. A composite score was derived by summing all

Figure 1. Questions exploring participants' views of their oral health literacy and knowledge

Study Open-Ended Questions
What oral health information do you search for?
How often do you come across oral health information that you do not understand?
What is your preferred source(s) for getting oral health information?
When you come across conflicting oral health information, how do you decide which information to believe?
Tell me in your own words what key information older adults should know about the link between oral health and chronic diseases.

scores, to a maximum of 19, to generate a final score. As with the OHL–AQ, higher OH–CDKQ scores suggest higher levels of oral health knowledge.

The online survey included 5 open-ended questions designed to explore participants' views regarding their oral health literacy and oral health knowledge (Figure 1).

Statistical analysis

All quantitative data were analysed using the *SAS*: *The Statistical Analysis System, version 9*.[49] An alpha value of $p = 0.05$ was set as the criterion for accepting the null hypothesis and statistical significance with respect to the evaluation of comparisons. Descriptive statistics (means, medians, modes, standard deviations, and confidence intervals) were calculated to describe the sample characteristics and scores on the OHL–AQ and the OH–CDKQ questionnaires. Pearson product moment correlation coefficients were used to determine the relationship between oral health literacy and oral health chronic disease knowledge scores. Paired t-tests and analysis of variance were used to determine any differences in oral health literacy scores and oral health knowledge scores.

Transcripts of participants' responses to the open-ended questions were examined using qualitative content analysis. This style of analysis goes beyond merely counting words and instead focuses on examining language for the purpose of classifying large amounts of text into an efficient number of categories that represent similar meanings.[50] The overall analysis focused on the examination of what the participants said in their responses to the open-ended questions, referred to as manifest content.[51] Identifying manifest content involves accurately representing the information that the participants provide without imposing preconceived categories or interpretations of the data invented by the inquirer.[52] In the current analysis, content related to oral health literacy and the linkages between oral health and chronic disease were included.

RESULTS

Sixty-nine (69) respondents who met the inclusion criteria completed the survey. Demographic characteristics by total population and cohort are presented in Table 1. The participants ranged in age from 50 to 69 years with a mean age of 59.07 ($SD = 5.39$); more women (n = 50) than men (n = 19) completed the study. Data from participants were further analysed based upon birth cohort; the average age was 63.9 years ($SD = 2.71$) for early boomers and 54.48 years ($SD = 2.54$) for late boomers. This sample included individuals with a variety of educational backgrounds. All participants reported their minimum educational attainment as some college or trade school. Approximately 24% of respondents reported having graduate school education, with almost twice as many early boomers (32.35%) having a graduate-level education compared to late boomers (17.14%). Over half (52.17%) of all study participants reported living in an urban setting. This sample consisted of baby boomers from middle to high socioeconomic status families; 46.38% reported an annual household income greater than $75,000. Late boomers were more likely to report a total household income greater than $75,000 (60%) than early boomers (32.35%). All participants reported having natural teeth (100%), and over 72.46% stated that they had private dental insurance. Just over 37% of late boomers reported "excellent" (37.14%) on the self-rated dental health scale while slightly less than 18% of early boomers reported "excellent" (17.65%) on the self-rated dental health scale.

The mean OHL-AQ score for the total sample was 13.36, 95% CI [12.62, 14.10] and scores ranged from –1 (n = 1, 1.45%) to 17 (n = 8, 11.59%) with 15 (n = 20, 28.99%) being the most frequently occurring score (Figure 2).

The mean OH–CDKQ score for the total sample was 10.01, 95% CI [9.13, 10.89] and scores ranged from 2 (n = 1, 1.45%) to 16 (n = 3, 4.35%) with the most frequently occurring score being 10 (n = 9, 13.04%) (Figure 3). As with the OHL–AQ scores, higher OH–CDKQ scores suggest greater levels of oral health knowledge.

There was no significant difference in the OHL–AQ scores between early boomers M = 13.21, 95% CI [11.89, 14.53] and late boomers M = 13.51, 95% CI [12.77, 14.25]; $t(67) = -0.40$, $p = 0.69$. Similarly, no significant difference in the health knowledge scores for early boomers M = 10.15, 95% CI [8.96, 11.34] and late boomers M = 9.88,

Table 1. Demographic characteristics by age cohort

	Total sample N = 69	Early boomers n = 34	Late boomers n = 35
Gender, n (%)			
Female	50 (72.46)	25 (73.53)	25 (71.43)
Male	19 (27.54)	9 (26.47)	10 (28.57)
Age in years, M (SD)	59.07 (5.39)	63.9 (2.71)	54.48 (2.54)
Age category, n (%)			
65–69	15 (21.74)	15 (44.12)	–
60–64	19 (27.55)	19 (55.18)	–
55–59	18 (26.11)	–	18 (51.42)
50–54	17 (24.60)	–	17 (48.58)
Education, n (%)			
Graduate work	17 (24.64)	11 (32.35)	6 (17.14)
University degree	30 (43.48)	13 (38.24)	17 (48.57)
Some college or trade school	22 (31.88)	10 (29.41)	12 (34.29)
Income, n (%)			
>$74,999	32 (46.38)	11 (32.35)	21 (60.00)
$52,000–$74,999	14 (20.29)	11 (32.35)	3 (8.57)
$26,000–$51,999	11 (15.94)	7 (20.59)	4 (11.43)
<$26,000	6 (8.70)	2 (5.88)	4 (11.43)
Not reported	6 (8.70)	3 (8.82)	3 (8.57)
Community of residence, n (%)			
Urban	36 (52.17)	17 (50.00)	19 (54.29)
Small town	13 (18.84)	7 (20.59)	6 (17.14)
Rural	20 (28.99)	10 (29.41)	10 (28.57)
Private dental insurance, n (%)			
Yes	50 (72.46)	23 (67.65)	27 (77.14)
No	19 (27.54)	11 (32.35)	8 (22.86)
General health, n (%)			
Excellent	28 (40.58)	10 (29.41)	18 (51.43)
Good	33 (47.83)	20 (58.82)	13 (37.14)
Fair	7 (10.14)	4 (11.76)	3 (8.57)
Poor	1 (1.45)	-	1 (2.86)
Dental health, n (%)			
Excellent	19 (27.54)	6(17.65)	13 (37.14)
Good	37 (53.62)	21 (61.76)	16 (45.71)
Fair	9 (13.04)	7 (20.59)	2 (5.71)
Poor	4 (5.80)	-	4 (11.43)
Have natural teeth, n (%)	69 (100.00)	34 (100.00)	35 (100.00)

Figure 2. Distribution of scores on Oral Health Literacy–Adult Questionnaire

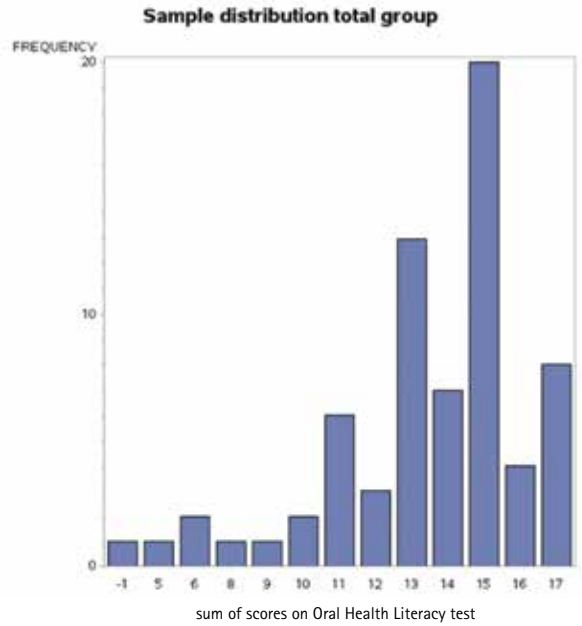
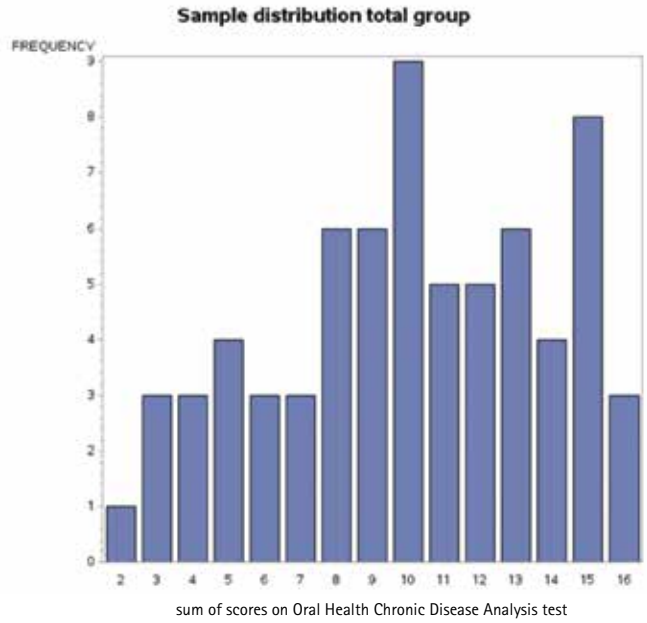


Figure 3. Distribution of scores on Oral Health–Chronic Disease Knowledge Questionnaire



95% CI [8.55, 11.21]; $t(67) = 0.28$, $p = 0.78$ were found.

The average OHL–AQ sum score in the total sample (N = 69) was 13.36, 95% CI [12.62, 14.10]; the OH–CDKQ sum score was 10.01, 95% CI [9.13, 10.89]. The measure of relationship between these two variables was $r = 0.31$, n = 69, $p = 0.008$, indicating a low but positive correlation between the OHL–AQ and the OH–CDKQ sum scores.

When analysing between group differences based on cohort and gender, cohort was positively correlated with scores, in that late boomers ($r = 0.47$, n = 35, $p = 0.005$) versus early boomers ($r = 0.24$, n = 34, $p = 0.16$) exhibited low but positive correlations between OHL–AQ scores and OH–CDKQ scores. Gender was also positively correlated with scores in that females ($r = 0.36$, n = 50, $p = 0.009$) versus males ($r = 0.17$, n = 19, $p = 0.49$) exhibited low but positive correlations between OHL–AQ scores and OH–CDKQ scores.

To determine what demographic variables predict higher OHL and oral health knowledge scores, a backward stepwise regression of demographic variables to establish models of best fit was conducted. The significant predictive model that resulted from this procedure for OHL was OHL–AQ score = 2.13 (gender) + 1.23 (education) + 0.59 (income) + 0.29 (OH–CDKQ score); ($F[4] = 343.63$, $p = <0.0001$, $R^2 = 0.955$) This means that females with higher educational attainment, higher annual household income, and higher scores on the OH–CDKQ are more likely to have higher OHL–AQ scores. The significant predictors in this model explained 95.5% of the variance in the dependent variable OHL score as denoted by the R^2.

The significant predictive model that resulted from the oral health knowledge backward elimination regression procedure was OH–CDKQ score = 1.89 (private insurance coverage {y/n}) + 0.56 (OHL–AQ score); ($F[2] = 263.67$, $p = <0.0001$, $R^2 = 0.89$) This means that study participants with access to private dental insurance and higher scores on the OHL–AQ are more likely to have higher OH-CDKQ scores. The significant predictors in this model explained 89.0% of the variance in the dependent variable oral health knowledge score as denoted by the R^2.

Responses to open-ended questions provided further insight into participants' OHL and oral health knowledge. Direct quotes from participants are identified by the respondent's ID number, followed by cohort (C1) early or (C2) late boomers and sex (M, F).

The majority of participants reported not having any problems understanding any oral health information.

> *"Very rarely (do I have problems understanding) if at all." [ID35 C2 M]*
>
> *"For the most part none. I have been having regular check up and cleanings for the last 40 years and currently (last several) have had no issues so not inclined to search out information." [ID 62 C2 F]*
>
> *"Not very often…I always cross-examine my Dentist or his assistant at least." [ID 18 C1 M]*

Many participants relied on their dental provider for sharing pertinent oral health information.

> *"If I did need to get information, I would go talk to my dentist or dental hygienist." [ID 62 C1 F]*
>
> *"I expect my dental team to inform me of necessary changes." [ID 26 C2 M]*

"I rely on my dentist to provide what is needed." [ID 32 C2 F]

This reliance was based upon a strong sense of trust in advice from dental professionals.

"[I would] talk to my dentist who I respect and trust." [ID 51 C 1 F]
"I have trust in the information provided by my dentist." [ID 12 C1 M]
"I would trust my dentist over something I found on the internet or heard from a non medical source."[ID 62 C2 F]

These comments reinforce the importance of spending time educating clients about the impact that oral health has on general health because they will most likely not seek out this type of information by themselves. *"I do not search for oral health information." [ID 84 C2 M]* This concept was also echoed in the words of one woman who said: *"I have not searched for oral health information recently." [ID 19 C2 F]* Of those who did search for oral health information, it was usually to find out about a specific problem they were experiencing. *"When one of my molars had to be extracted or crowned, I searched for info about options, costs, importance of the work." [ID 40 C2 F]*

Many participants expressed the opinion that good oral health is part of a healthy lifestyle.

"It is important for a number of reasons including: (1) proper chewing of food which enhances digestion and nutrition; (2) if some problems are caught early more serious problems such as tooth extraction, cancer or heart disease may be prevented or lessened;(3) it can also affect how you feel about yourself. If your teeth look good you may smile more and not be self conscious about how you look when you talk etc." [ID 62 C2 F]

Yet few participants had a clear understanding or appreciation of the specific link between oral health and common chronic diseases.

"Simply put what is the link? I know nothing about how oral health and other diseases are related. The dentist never mentions this at regular visits. The family doctor never mentions this whenever I visit him. Older adults should know exactly what to do to prevent other diseases from developing as a result of poor oral health and they should be taught just what proper oral health encompasses" [ID 89 C1 M]

Some participants were aware of a connection between oral health and CVD.

"I know it affects our overall nutrition because if you have bad teeth and gums and there is pain, you won't feel like eating or you choose food that may not be best for you. Also I feel it impacts heart health." [ID 63 C2 F]
"You need to eat and drink to survive. You need a healthy mouth to maintain a healthy diet and to reduce the risk of heart disease as you age." [ID 19 C2 F]
"For proper chewing with food and prevention of tooth loss and prevention of heart disease." [ID 22 C2 F]

For some participants in this study, completing the surveys was an eye-opening experience that highlighted their own personal knowledge deficits about the oral health–chronic disease link. Some participants expressed interest in wanting to learn more about this topic as evidenced by the following comment: *"I saw information that I was not aware of earlier in this survey, and would need to learn more about it in order to understand it." [ID 40 C2 F]*

Some participants expressed concern that older adults may not possess the necessary knowledge or understanding of the link between oral health and chronic diseases: *"Older adults may not know the link between good oral health and heart disease." [ID 49 C1 F]*

Other respondents were forward thinking and felt that taking a preventive approach, such as increasing awareness of the oral health and chronic disease link, would be beneficial to older adults.

"I would think that a list of chronic diseases that can be affected by poor oral health would be helpful. A clear explanation of the link and simple preventive measures that the person should take to minimize the risk." [ID 62 C1 F]

One respondent identified a potential reason for older adults' knowledge gap. He felt that health care professionals, including dentists and doctors, were not doing enough to ensure that older adults were aware of the link between oral health and chronic diseases.

"I have always known that good oral hygiene was a necessary part of good overall health. I have just never known of the link to chronic diseases. Family doctors and dentists should be given tools to emphasize these links. It should also start before adults become older." [ID 38 C2 M]

These responses demonstrate that older adults need and want more information about the specific links between oral health and chronic diseases. Dental hygienists, as prevention specialists, can play a pivotal role in helping to reduce this knowledge gap.

DISCUSSION

Results from this study provide a glimpse into the OHL and oral health knowledge of a small group of baby boomers. Due to the exploratory nature and small, relatively

homogenous sample, the results must be interpreted with caution and cannot be applied to all baby boomers.

It was important to explore the OHL and knowledge of baby boomers because previous research has shown that older adults are more likely to have low levels of health literacy.[53,54] According to Bailit,[55] one of the main reasons that older individuals, especially those from lower socioeconomic groups, do not visit the dentist is their lack of knowledge about dental disease. Several studies report that people with low OHL levels have poor dental health knowledge, increased dental visits, and more severe oral disease.[56-58] Findings from Valerio and colleagues highlight the role that inadequate OHL plays as a barrier to understanding, processing, and using oral health related information to make informed diabetes management decisions.[27]

Findings from this study demonstrated a low but positive association between study participants' literacy and knowledge scores, which is similar to findings from other studies that explored the relationship between health literacy and knowledge.[43,44] Additionally, Gazmararian et al. explored the relationship between the health literacy and knowledge of disease of Medicare patients ages 65 years and older and demonstrated through multivariate analysis that health literacy was independently related to disease knowledge.[12]

In the current analysis, cohort predicted low but positive correlations between OHL and oral health knowledge scores. One explanation may be found in the work of Ettinger,[59] who investigated the role of cohort differences in oral health. He proposed that, by comparing the socioeconomic and dental events of each decade, one can track the impact of these developments on each generation's oral health behaviours.[59] Late boomers had early access to public health initiatives like water fluoridation and were influenced by toothpaste commercials on television unlike the older, early boomers. It is hypothesized that the younger boomers may have been exposed to more oral health information over their lifetime.

In this study, females with higher educational attainment, income levels, and oral health knowledge scores demonstrated higher levels of OHL. The influence of gender has been demonstrated in a cross-sectional study from Iran that measured OHL by also using the OHL-AQ. In that study, researchers found that women had higher OHL than men.[48] Another study by Khan et al. [38] demonstrated that the effect of gender was highly significant at the bivariate and multivariate levels, with females demonstrating greater OHL.[38]

Research shows that higher educational attainment increases overall literacy and knowledge of how to live healthier lifestyles,[60,61] and that income is a strong predictor of health services utilization especially for older adults.[12,62,63]

Results from this study demonstrated that oral health knowledge was also influenced by access to dental insurance; over 70% of participants reported having dental insurance. Study participants acknowledged that their primary sources for oral health information were dental professionals and the internet. There is a significant association between insurance and access to dental care, and research shows that many baby boomers have grown up with access to dental insurance plans.[3,64] The importance of third-party coverage is highlighted by the fact that older adults with dental insurance are 2.5 times more likely to make dental visits,[65] to retain more natural teeth, and to hold more favourable health beliefs.[66]

One of the key findings from this study is that participants' level of knowledge about the link between oral health and chronic diseases was quite low. This is similar to findings from studies that explored diabetic clients' awareness of the link between oral health and diabetes.[16,27] A possible explanation for weak knowledge is that most health promotion strategies neglect to include information regarding the oral health and chronic disease link. One study that examined diabetic educators' perception of the adequacy of their training for providing clients with information about the link between oral health and diabetes determined that 93.8% of offered curricula did not include an oral health module.[67]

Results from this preliminary study have implications for client education efforts because study participants expressed a desire for more information about the specific links between oral health and chronic diseases. An important factor influencing OHL is the ability of dental professionals to use effective communication that reflects the varying and sometimes limited OHL of their clients.[5,35] Individuals must be able to access, understand, interpret, and act on the health information they receive.[35,68] Some studies suggest that those with low literacy are unable to communicate effectively with health care providers and this gap in communication may account for poorer oral health status.[51,52] Dental hygienists are in a unique position to assess literacy and knowledge skills of their client and to provide client-centred health counselling. According to Payne and Locker,[69] client counselling has been demonstrated as an effective way of increasing knowledge, and providing education allows for the acquisition of non-material resources (such as knowledge) that promote healthy behaviours and better navigation through health resources.[70]

Not all older adults visit dental professionals on a regular basis. Therefore, certain segments of the population may not have access to oral health education. Research shows that older adults visit their medical doctor the most frequently of all age groups, yet visit the dentist the least frequently of all age groups.[11] Many non-dental health professionals receive minimal oral health training. Interdisciplinary training opportunities and expanded allied health professional school curricula that includes basic oral health education may help to increase

awareness of the importance of oral health for society's more vulnerable members.

Another strategy for increasing public awareness of the link between oral health and chronic disease is political advocacy. Professional dental and dental hygiene associations can lobby all levels of government to incorporate oral health information into all health policies and plans.

Limitations

The findings of this study should be interpreted in the context of a small sample size (n = 69) of primarily English-speaking, dentate participants with higher socioeconomic status. These results cannot be generalized to all baby boomers. More women than men participated, and females tend to have higher oral health literacy than males. Conducting the study through the internet may have prevented some people from participating. Sampling bias may have occurred in that this study may have attracted participants who were more dentally motivated and knowledgeable than the average baby boomer.

The correlations between OHL and oral health knowledge were positive but low, so results need to be interpreted with caution. Oral health knowledge was assessed using a newly developed questionnaire, which may have contributed to inconsistencies in the oral health knowledge scores of participants.

CONCLUSIONS

An aging population, increasing prevalence of chronic diseases, and the retention of natural teeth underscore the importance for older adults to be knowledgeable about the links between oral disease and common chronic diseases. Although baby boomers in this exploratory study demonstrated adequate OHL skills, their knowledge of the link between oral health and common chronic diseases was lacking. Since participants identified dental professionals as their main source for oral health information, dental hygienists can bridge this knowledge gap by educating older adults about the oral–systemic link. Further study is warranted to explore the relationship between OHL and oral health knowledge with more socioeconomically diverse baby boomers.

CONFLICT OF INTEREST

The authors have declared no conflicts of interest.

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Exploring reported dental hygiene practice adaptations in response to water fluoridation status

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WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Cessation of water fluoridation appears to be occurring with increasing frequency in Canadian communities.
- Dental hygienists serve as a key point of contact for the public, particularly in caries risk assessment and prevention.
- This study highlights the role of dental hygienists in assessing and adapting to changing caries risk when community water fluoridation status changes.

ABSTRACT

Background: As part of a broader research program on community water fluoridation (CWF) cessation and implications for dental health outcomes, this study explored whether dental hygienists working in communities where CWF had ceased reported having engaged in practice adaptations, as compared to dental hygienists working where CWF remained in place. **Methods:** All Alberta dental hygienists were invited to complete an online questionnaire about changes to their practice of dental hygiene since CWF cessation (e.g., in-office fluoride treatment recommendations, oral hygiene education) or, for those in still-fluoridated communities, during a similar timeframe. Reported practice adaptions between the 2 groups were compared using chi-squared analysis. **Results:** A total of 154 dental hygienists provided information on practice adaptations. Those working in fluoridation-cessation communities (62%) versus still-fluoridated communities (38%) were 1) more likely to report increasing their recommendations to clients for more frequent in-office fluoride; and 2) less likely to report decreasing their recommendations to clients for more frequent radiographs (x-rays) to detect decay, based on differences at the 5% significance level. However, the 95% confidence intervals were overlapping, suggesting that the effects were not robust. There were no differences between the 2 groups in attitudes towards fluoridation, a potential confounder. **Discussion and conclusions:** Research on CWF cessation and implications for population oral health is complex and must consider factors aside from fluoridation cessation that may change during the same period. Dental hygiene practice may be one important factor, and further research on the role of dental hygienists in assessing and adapting to changing caries risk in CWF cessation circumstances is warranted.

RÉSUMÉ

Contexte : Dans le cadre d'un programme de recherche plus vaste sur l'arrêt de la fluoration de l'eau des collectivités (FEC) et des répercussions sur la santé dentaire, la présente étude évalue si les hygiénistes dentaires qui travaillent dans les collectivités dans lesquelles la FEC a pris fin ont signalé des modifications à leur pratique professionnelle, par rapport aux hygiénistes dentaires qui travaillent dans les collectivités où la FEC est maintenue. **Méthodologie :** Tous les hygiénistes dentaires de l'Alberta, travaillant dans les collectivités qui ont cessé la FEC ou dans celles qui participent toujours à la FEC, ont été invités à répondre à un questionnaire en ligne sur les changements apportés à leur pratique de l'hygiène dentaire (p. ex. les recommandations de traitements au fluorure en cabinet, l'éducation de l'hygiène buccodentaire) pendant une période de temps similaire. Les modifications à la pratique qui ont été signalées entre les 2 groupes ont été comparées au moyen de l'analyse du chi carré. **Résultats :** Un total de 154 hygiénistes dentaires ont fourni de l'information sur les modifications de leur pratique. Ceux qui travaillent dans les collectivités avec arrêt de la fluoration (62 %) par rapport à ceux qui travaillent dans les collectivités qui participent toujours à la fluoration (38 %) étaient 1) plus sujets à signaler une augmentation des recommandations à leurs clients d'une fréquence accrue d'application de fluorure en cabinet, et 2) moins sujets à signaler une diminution des recommandations à leurs clients d'une fréquence accrue de radiographies (rayons X) en vue de déceler la carie, selon les différences au seuil de signification de 5 %. Cependant, les intervalles de confiance de 95 % se chevauchaient, laissant entendre que les effets n'étaient pas solides. Il n'y avait aucune différence entre les 2 groupes en matière d'attitude envers la fluoration, un facteur de confusion potentiel. **Discussion et conclusions :** La recherche sur l'arrêt de la FEC et ses répercussions sur la santé buccodentaire de la population est complexe, et doit tenir compte de facteurs, autres que l'arrêt de la fluoration, qui peuvent changer pendant la même période de temps. La pratique de l'hygiène dentaire peut être un facteur important, et d'autres recherches sont justifiées quant au rôle des hygiénistes dentaires en matière d'évaluation et d'adaptation à l'évolution des risques de carie dans le contexte de l'arrêt de la FEC.

Key words: Alberta, dental caries, dental hygienists, fluoridation, oral health, public health, surveys and questionnaires

CDHA Research Agenda category: access to care and unmet needs

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INTRODUCTION

Community water fluoridation (CWF) is the practice of controlled addition of a fluoride compound to a public water system to prevent and reduce dental caries in a population.[1] Systematic reviews have concluded that CWF has been effective in reducing dental caries in children since it began in 1945. However, methodological limitations of the studies have been identified.[2,3] Further, the majority of studies included in these systematic reviews were conducted prior to 1975,[2,3] thus raising questions about contemporary effectiveness.

More recently, there has been a trend in some communities to revisit their fluoridation status and, in some cases, to discontinue CWF.[4] Studies of fluoridation cessation are few in number.[3,5] A recent systematic review identified 15 instances of cessation in 13 countries, covering a broad time frame (1956–2003) and diverse geographic, political, and economic contexts.[5] The review concluded that the research collectively "points more to an increase in dental caries post-cessation than otherwise"; however, the authors emphasized that the literature is "highly diverse and variable in methodological quality," and recommended that, to build the knowledge base, researchers should take advantage of the natural experiment opportunity provided by instances of fluoridation cessation.[5]

One such opportunity presented itself in 2011, when the practice of water fluoridation was ceased in Calgary (Alberta, Canada) following a city council vote. A study was conducted to examine the implications of fluoridation cessation for children's dental health, which involved a comparison between Calgary and Edmonton (Alberta, Canada).[6,7] These 2 cities are comparable in size and demographic characteristics, but Edmonton showed no signs of revisiting its fluoridation status (in place since 1967). Results of the study indicated that trends observed were consistent with an adverse effect of fluoridation cessation.[6,7] However, the nature of the research (observational design, population-level measure) requires consideration of other factors that may have changed during the timeframe. These factors may represent mediators, moderators or confounders of the association between fluoridation cessation and dental health outcomes.

The present study considers adaptations to dental hygiene practice as one factor which may have changed over time, and which could therefore play an important role in understanding the influence of fluoridation cessation on dental health outcomes. In Canada, dental hygienists are primary oral health care professionals who serve individuals and groups, and work in varied practice settings.[8] Because they are the key providers of continuing preventive care, dental hygienists serve as a primary point of contact for the public within the clinical dental setting. As such, they may play a pivotal role in population oral health, including in the context of fluoridation cessation. Dental hygiene practice is evidence informed and shaped by clinical experience and client preferences. Interest in reported practice adaptations reflects the recognition that dental hygienists are informed, experienced professionals who may make small adjustments within their scope of practice, based on their expertise and knowledge of clients and the broader context (which may include fluoridation cessation). As one example, dental hygienists may (or may not) begin to devote more time to health promotion activities following fluoridation cessation, perhaps in an effort to offset an anticipated impact of cessation.

The purpose of this study was to explore whether dental hygienists in fluoridation-cessation communities report having engaged in practice adaptations as compared to those who practise in still-fluoridated communities, over the same time frame. As a working definition, practice adaptations entailed "self-initiated adjustments to one's day-to-day practice, within one's scope of professional responsibility, in response to contextual factors." This research topic is novel. Several studies have examined dental hygienists' knowledge and opinions on topics including fluoride and fluoridation,[9–15] and others have examined practice changes in the context of evaluation of training or education (e.g., was an educational intervention successful in changing practice behaviours).[16,17] However, no research on self-initiated practice adaptations by dental hygienists either specific to the context of CWF, or in general, was found.

METHODS

This study was approved by the University of Calgary's Conjoint Health Research Ethics Board (Ethics ID: REB15-2082).

Study population and recruitment

The target population was all registered dental hygienists in the province of Alberta, which includes the cities of Calgary and Edmonton. To practise in Alberta, dental hygienists must be registered with the College of Registered Dental Hygienists of Alberta (CRDHA). The college was contacted and agreed to notify its entire membership (N = 3117), via email, of the opportunity to participate in this study. Inclusion criteria were 1) member of CRDHA; 2) hold a current general practice permit; and 3) have direct interaction with clients (including on a part-time basis). Inclusion criteria were confirmed at the beginning of the questionnaire, and those not meeting one or more criteria were thanked and exited from the questionnaire.

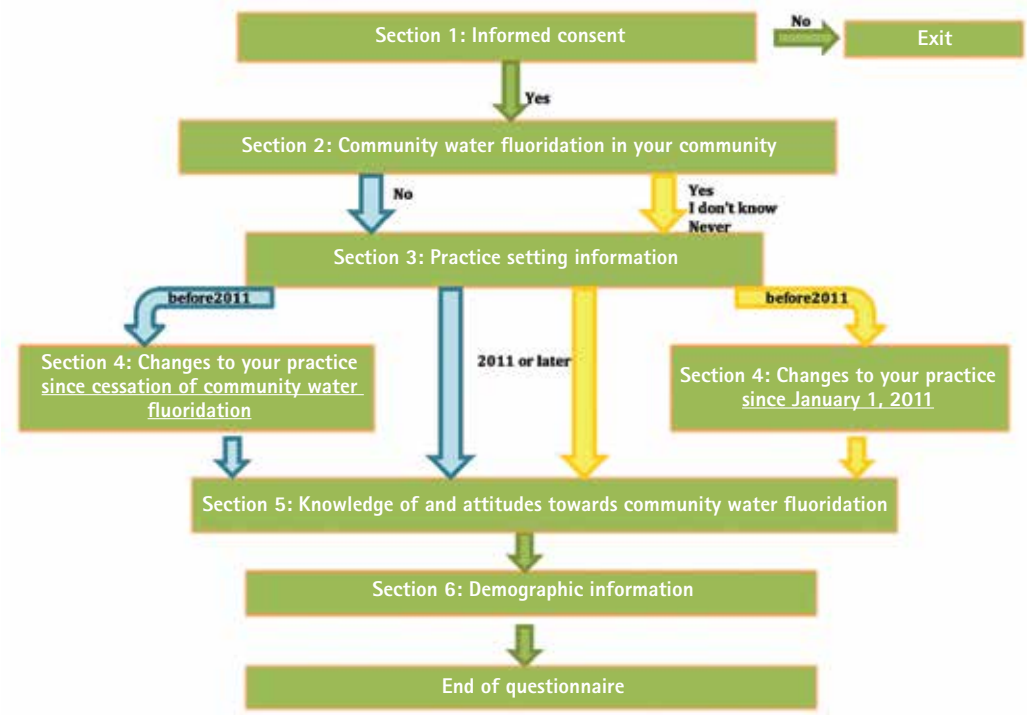
Data collection

Questionnaire design

The questionnaire (Figures 1A and 1B) was developed by the research team for this study and was administered via SurveyMonkey.[18] The questionnaire consisted of 6 sections: 1) informed consent; 2) CWF status; 3) practice setting information; 4) changes to practice; 5) knowledge of and attitudes towards CWF; and 6) demographic information. Participants were guided through different versions of

Figure 1. Simplified flowchart (1A) and description of sections (1B) of questionnaire

1A



1B

Section of questionnaire	General components

Section 1: Informed consent	• Study information
	• Invitation to participate
	• Inclusion criteria (general practice permit AND direct interaction with clients)
	  • Yes → go to Section 2
	  • No → Exit questionnaire

Section 2: CWF in your community	• CWF where you live
	• CWF where you work
	  • No → blue arrows (CWF cessation)
	  • Yes, I don't know, Never → yellow arrows (still-fluoridated or never-fluoridated)

Section 3: Practice setting information	• Length of career as an RDH
	• Predominant type of client (children, adults, both)
	• Employment status (temporary, permanent, part time, full time)
	• Municipality of employment (name and first 3 characters of postal code)
	• Year started work in municipality of employment
	  • Before 2011 → go to Section 4
	  • 2011 or later → go to Section 5

Section 4: Changes to practice questions	• Changes to in-office fluoride treatment recommendations • Changes to recommendations for client use of fluoride at home • Changes to oral hygiene education • Other changes to practice (i.e., frequency of clinic visits, dental sealants, radiographs) • Observed decay in practice
Section 5: Knowledge of and attitudes towards CWF	• Naturally occurring fluoride • Accessing information related to fluoride • Level of support for CWF • Level of agreement with arguments supporting or opposing CWF • CWF decision making
Section 6: Demographic information	• Type of practice setting(s) • Year of entry-to-practice graduation • Country (and province) of entry-to-practice graduation • Level of education, within and outside of dental hygiene • Gender • Age group

the questionnaire based on skip patterns related to their responses to specific questions. An overview of the different versions and brief description of each section of the questionnaire are provided next.

Section 1 required potential participants to provide informed consent and also to confirm that they were members of CRDHA with a current general practice permit and direct interaction with clients. Those participants who responded affirmatively moved on to Section 2. Those who responded negatively were exited from the questionnaire.

Fluoridation status of the community[Note1] in which the participant works was the key exposure variable; therefore, it was important to classify as accurately as possible. A twofold approach was taken. First, in Section 2, respondents reported separately on the fluoridation status of the communities in which they live and work since some dental hygienists may not live and work in the same community. Second, in Section 3, respondents were asked to name the community in which they work and provide the first 3 characters of the postal code. This information permitted verification of fluoridation status against a master list held by the authors. Gathering these pieces of information served 2 purposes: 1) to determine if the participant had accurate knowledge of CWF; and 2) to direct the participant, via skip patterns (denoted by the blue and yellow arrows in Figure 1A) to the appropriate set of practice adaptation questions (Section 4).

Section 3 asked further questions about dental hygienists' practice setting. Here, participants identified their length of time working as a dental hygienist, the predominant type of client (e.g., children or adults) at their primary practice setting, current employment status, information about the community where their practice setting was located (name and first three characters of postal code, as noted previously), and the year in which they started working in that community.

Because many communities in Alberta revisited CWF after the Calgary decision in 2011, January 1, 2011, was selected as an appropriate cutoff for all participants in the study. Those who reported that they started working in their current community in 2011 or later would not have been working in their community long enough to comment on practice adaptations made during the timeframe of interest. Therefore, those participants were guided directly to Section 5 by the survey skip logic, bypassing Section 4 (practice adaptations questions).

In Section 4, participants working in fluoridation-cessation communities reported on practice adaptations since fluoridation cessation (Figure 1A, blue arrows), whereas participants working in other types of communities (still-fluoridated, never-fluoridated) reported on practice adaptations since January 1, 2011 (Figure 1A, yellow arrows).

[1]In the survey questions, the term "municipality" was used to refer to a specific location (e.g., village, town, city). However, in this manuscript, the term "community" is used to align more closely with literature in this field.

Within both versions of Section 4, participants were asked specifically about their practice adaptations in the following key areas: a) in-office fluoride treatments; b) client use of fluoride at home; c) oral hygiene education; and d) other changes to practice (i.e., frequency of clinic visits, dental sealants, radiographs). The list of practice adaptations was developed by the research team, which includes dental hygiene expertise. The aim was to compile a reasonably comprehensive list of preventive practices that would be relevant and typical for a dental hygienist to perform in day-to-day practice. For each practice adaptation, response symmetry was ensured by asking about increases or decreases, as well as no change, to the practice. For ease of presentation on the questionnaire, similar practice adaptations were grouped together.

All participants were then directed to Section 5, which asked about participants' knowledge of and attitudes towards CWF because attitudes towards fluoridation were identified as a potential confounder. In other words, practice adaptations in response to fluoridation cessation may differ according to whether, or the extent to which, a dental hygienist views fluoridation as effective, safe, and ethically defensible, or not. The section was designed to capture those differences.

Section 6 included demographic questions, including practice setting type, year of graduation from a dental hygiene program, country and province of training, highest level of dental hygiene education, highest level of education outside of dental hygiene, gender, and age group.

In summary, the questionnaire was designed so that all participants completed sections 1, 2, 3, 5, and 6. Completion of Section 4 depended on the year in which the participant started working in the current community: those who started prior to 2011 completed Section 4; those who started in 2011 or later did not. The version of Section 4 completed depended on the CWF status of the community in which the participant worked: those who worked in a community where fluoridation had ceased responded to the "since fluoridation cessation" version of questions, whereas those who worked in a community with fluoridation in place or which had never initiated water fluoridation responded to the "since January 1, 2011" version of questions.

Pilot testing

Following multiple iterations within the team, the questionnaire was pilot tested with 10 individuals known to the researchers as having related expertise and/or falling just outside of the target population (e.g., dental hygienists from another province; individuals trained as dental hygienists but currently working in another sector; other dental professionals). Each pilot tester was asked to complete the questionnaire as though they were a participant, within the context of 1 of 3 fluoridation scenarios: 1) a fluoridation-cessation community; 2) a still-fluoridated community; and 3) a never-fluoridated

community. A one-on-one conversation with each pilot tester was scheduled, and feedback was solicited with respect to the clarity, comprehensibility, and suitability of the questions, as well as survey design. General feedback was also encouraged. Adjustments were made accordingly prior to the formal launch of the questionnaire to the target population.

Information about the study and a link to the questionnaire were directly emailed by CRDHA to all members, inviting them to participate. Reminder emails to encourage participation were sent at 4 weeks and 7 weeks, and the questionnaire was closed at 8 weeks from the date of the initial email message.

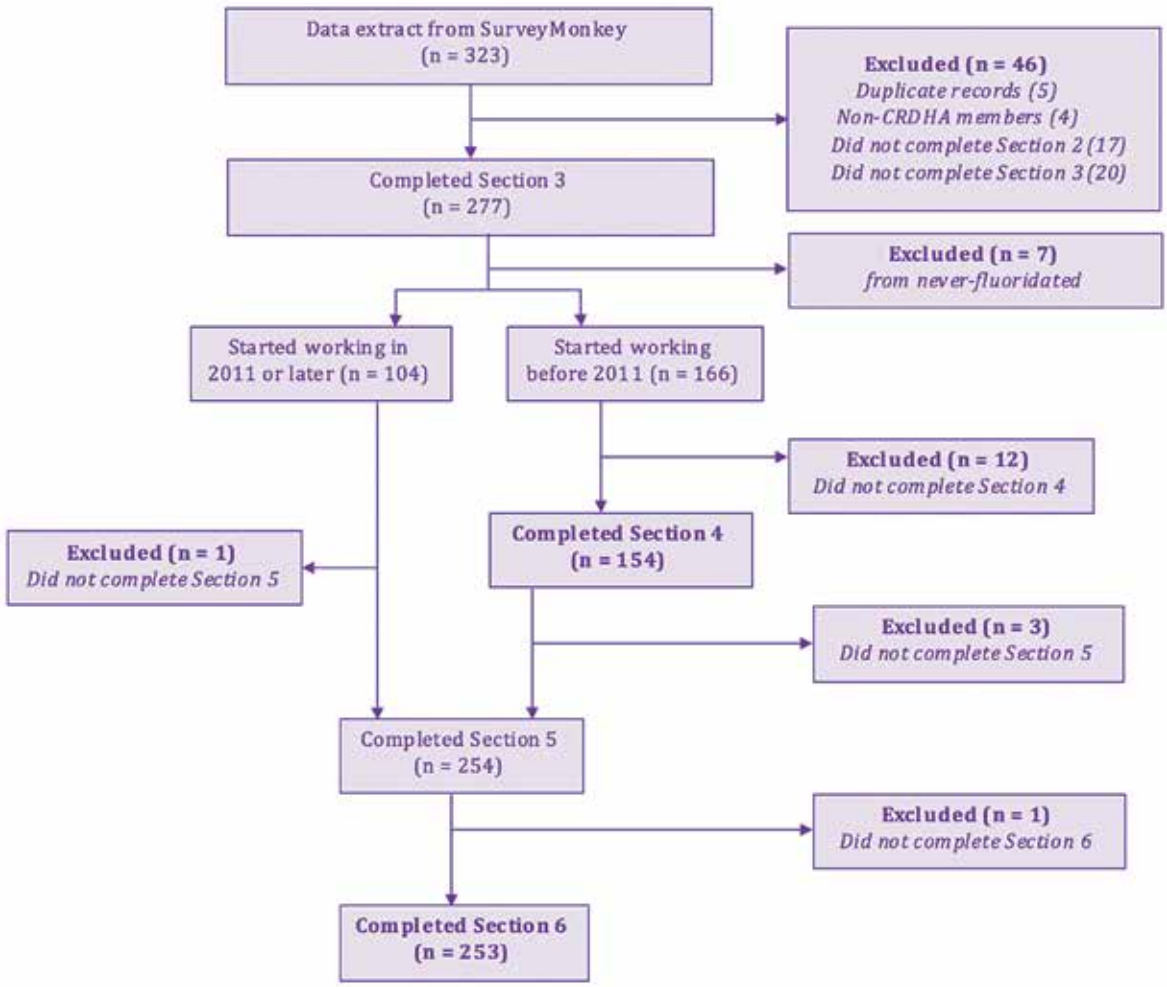
Data analysis

Stata 14 was used to manage and analyse data. A p value of <0.05 was used to indicate statistical significance. Chi-square tests and 95% confidence intervals were used to compare reported practice adaptations (proportions across the response options) between fluoridation status groups. Although multiple reminders were sent to the target population to increase participation, the relatively small sample size precluded multivariate analysis. Therefore, chi-square tests were conducted to examine whether dental hygienists' attitudes towards CWF, a potential confounder, differed by fluoridation status.

RESULTS

An analytic sample of n = 154 was obtained for the practice adaptations analysis, and n = 253 for the other analyses (Figure 2). Although the overall response rate to the questionnaire was low, at 8.1%, comparison of the sample with population aggregate data obtained from CRDHA (Table 1) reveals the sample resembled the target population with respect to gender and age. Although target population statistics on education or practice setting were not available, qualitative information provided by CRDHA suggests that the sample resembled the target population in that regard. Specifically, CRDHA indicated that approximately 85% to 90% of CRDHA members are diploma-level graduates and approximately 10% to 15% are degree-level graduates (personal communication,

Figure 2. Flow chart illustrating data exclusions



CRDHA registrar, August 31, 2016). In the study sample, the proportions were approximately 79% and 20%, respectively (Table 1). Further, from personal communication with CRDHA's registrar, the majority (unspecified) of the membership works in private practice; in the study sample, the proportion working in private practice was approximately 90% (Table 1). There is perhaps a small over-representation in the study sample of individuals working in public health. This is not surprising considering the public health focus of this study. When comparing the self-reported versus actual water fluoridation status of the community in which participants worked, it was noted that over 90% (n = 228) accurately identified the water fluoridation status of their community.

Table 2 shows the main results; namely, a comparison of reported practice adaptations between dental hygienists working in fluoridation-cessation communities and those working in still-fluoridated communities. Respondents working in never-fluoridated communities were excluded because there were only 7 of them (Figure 2).

The analysis revealed statistically significant between-group effects at the $p < 0.05$ level for two practice adaptations. However, the 95% confidence intervals overlapped. First, compared to dental hygienists working in still-fluoridated communities, dental hygienists working in fluoridation-cessation communities were more likely to have increased their recommendations to clients for more frequent in-office fluoride treatments (e.g., fluoride gel, foam, rinse or varnish) ($p = 0.03$, 95% CI currently fluoridated [30.3%, 55.4%], 95%CI fluoridation cessation [54.0%, 73.3%]). Second, compared to dental hygienists working in still-fluoridated communities, dental hygienists working in fluoridation-cessation communities were less likely to report having decreased their recommendations to clients for more frequent radiographs (x-rays) to detect decay ($p = 0.03$, 95% CI currently fluoridated [4.6%, 21.1%], 95%CI fluoridation cessation [0.1%, 7.3%]). In other words, dental hygienists in both types of communities (still-fluoridated and fluoridation-cessation) reported decreasing recommendations for more frequent radiographs, but dental hygienists in fluoridation-cessation communities reported decreasing those recommendations to a lesser extent. However, the fact that the 95% confidence intervals were overlapping suggests that these results were not robust.

Table 3 shows reported attitudes towards CWF by fluoridation status of community of work. No statistically significant differences in attitudes between dental hygienists working in still-fluoridated communities and those working in fluoridation-cessation communities were found.

Participants were also asked to identify if they had

Table 1. Gender, age group, primary practice setting, and educational attainment of sample, in comparison to target population data (i.e., full CRDHA membership)

	Study sample n (%)	Target population (CRDHA) n (%)	
Gender			**Gender**
Female	242 (95.7)	2988 (95.9)	Female
Male	7 (2.8)	129 (4.1)	Male
Prefer not to say	4 (1.6)	N/A (0)	Prefer not to say
TOTAL	**253 (100)**	**3117 (100.0)**	**TOTAL**
Age group			**Age group**
20–30	73 (28.9)	883 (28.3)	20–29
31–40	77 (30.4)	1038 (33.3)	30–39
41–50	64 (25.3)	651 (20.9)	40–49
51–60	30 (11.9)	416 (13.3)	50–59
61+	6 (2.4)	129 (4.1)	60+
Prefer not to say	3 (1.2)	–	Prefer not to say
TOTAL	**253 (100)**	**3117 (100.0)**	**TOTAL**
Primary practice setting[a]			
Private practice	227 (89.7)		
Community/Public Health	12 (4.7)		
Education/training	6 (2.4)		
Research	5 (2.0)		
Other	3 (1.2)		
TOTAL	**253 (100)**		
Educational attainment[a]			
Non-degree (e.g., diploma)	198 (78.3)		
Degree (e.g., bachelor's, master's or higher)	52 (20.6)		
Refused to answer	3 (1.2)		
TOTAL	**253 (100)**		

[a]Information on primary practice setting and educational attainment is not available for the target population. Please see the results section for more detail.

Table 2. Dental hygienists' reported practice adaptations, by water fluoridation status of the community in which they work

Practice adaptation
A) Changes to in-office fluoride treatment recommendations
Recommend more frequent application of in-office fluoride treatment (e.g., fluoride gel, foam, rinse or varnish)
Apply fluoride treatment (e.g., fluoride gel, foam or rinse) for a longer than recommended amount of time
B) Changes to recommendations for client use of fluoride at home
Recommend use of regular toothpaste containing fluoride
Recommend use of high-fluoride toothpaste (e.g., Colgate* PreviDent*5000 Plus [1.1% sodium fluoride])
Recommend use of mouthrinse containing fluoride (e.g., Listerine® Total Care® [sodium fluoride 0.02%]) at home
Recommend use of mouthrinse containing higher concentration of fluoride (e.g., Opti-Rinse 0.05% [daily] or 0.2% [weekly])
Recommend use of other fluoride product(s) (e.g., tablets, drops)
Recommend use of non-fluoride anticaries product(s) (e.g., sucrose-free polyol chewing gums, xylitol dentifrices, chlorhexidine, sialogogues)
C) Changes to oral hygiene education
Spend more time delivering oral hygiene education (in general, including but not limited to fluoride)
Recommend adjunctive tools for home oral hygiene (e.g., Sulcabrush®, Proxabrush®)
Distribute printed resources about oral hygiene (e.g., pamphlets)
Display information about oral hygiene (e.g., poster) in the practice setting
D) Other changes to practice
Recommend increased frequency of visits to clinic/practice
Recommend dental sealants on molars
Recommend dental sealants on premolars
Recommend radiographs (x-rays) more frequently to detect dental caries or decay

	Overall (% [95% CI])	Currently fluoridated (n = 59) (% [95% CI])	Fluoridation cessation (n = 95) (% [95% CI])	*P* value
Increased	55.8 [47.8, 63.6]	42.4 [30.3, 55.4]	64.2 [54.0, 73.3]	0.03
No change	37.7 [30.3, 45.7]	49.2 [36.5, 61.9]	30.5 [22.0, 40.6]	
Decreased	6.5 [3.5, 11.7]	8.5 [3.5, 19.0]	5.3 [2.2, 12.2]	
Increased	26.6 [20.2, 34.2]	33.9 [22.9, 47.0]	22.1 [14.8, 31.7]	0.27
No change	69.5 [61.7, 76.3]	62.7 [49.6, 74.2]	73.7 [63.8, 81.6]	
Decreased	3.9 [1.7, 8.5]	3.4 [0.8, 12.8]	4.2 [1.6, 10.8]	
Increased	39.6 [32.1, 47.6]	30.5 [20.0, 43.5]	45.3 [35.5, 55.5]	0.19
No change	55.8 [47.8, 63.6]	62.7 [49.6, 74.2]	51.6 [41.5, 61.6]	
Decreased,	3.9 [1.7, 8.5]	5.1 [1.6, 14.9]	3.2 [1.0, 9.5]	
Refused to answer	0.7 [0.1, 4.6]	1.7 [0.2, 11.4]	0.0 [N/A]	
Increased	60.4 [52.4, 67.9]	55.9 [43.0, 68.2]	63.2 [52.9, 72.3]	0.44
No change	36.4 [39.1, 44.3]	40.7 [28.8, 53.8]	33.7 [24.8, 43.9]	
Decreased	2.6 [1.0, 6.8]	1.7 [0.2, 11.4]	3.2 [1.0, 9.5]	
Refused to answer	0.7 [0.1, 4.6]	1.7 [0.2, 11.4]	0.0 [N/A]	
Increased	53.3 [45.3, 61.1]	49.2 [36.5, 61.9]	55.8 [45.6, 65.5]	0.43
No change	43.5 [35.8, 51.5]	49.2 [36.5, 61.9]	40.0 [30.6, 50.3]	
Decreased	3.3 [1.3, 7.6]	1.7 [0.2, 11.4]	4.2 [1.6, 10.8]	
Increased	48.1 [40.2, 56.0]	50.9 [38.1, 63.5]	46.3 [36.4, 56.5]	0.36
No change	50.0 [42.1, 57.9]	49.2 [36.5, 61.9]	50.5 [40.5, 60.6]	
Decreased	2.0 [0.6, 5.9]	0.0 [N/A]	3.2 [1.0, 9.5]	
Increased	13.0 [8.5, 19.4]	5.1 [1.6, 14.9]	17.9 [11.4, 27.1]	0.07
No change	82.5 [75.6, 87.7]	89.8 [78.9, 95.4]	77.9 [68.3, 85.2]	
Decreased	4.6 [2.2, 9.3]	5.1 [1.6, 14.9]	4.2 [1.6, 10.8]	
Increased	53.9 [45.9. 61.7]	52.5 [39.7, 65.1]	54.7 [44.5, 64.6]	0.49
No change	44.8 [37.1, 52.8]	47.5 [35.0, 60.3]	43.2 [33.5, 53.4]	
Decreased	1.3 [0.3, 5.1]	0.0 [N/A]	2.1 [0.5, 8.2]	
Increased	55.8 [47.8, 63.6]	52.5 [39.7, 65.1]	57.9 [47.7, 67.5]	0.39
No change	43.5 [35.8, 51.5]	45.8 [33.4, 58.7]	42.1 [32.5, 52.4]	
Decreased	0.7 [0.1, 4.6]	1.7 [0.2, 11.4]	0.0 [N/A]	
Increased	44.2 [36.4, 52.2]	47.5 [35.0, 60.1]	42.1 [32.5, 52.4]	0.34
No change	55.2 [47.2, 62.9]	50.1 [38.1, 63.5]	57.9 [47.7, 67.5]	
Decreased	0.7 [0.1, 4.6]	1.7 [0.2, 11.4]	0.0 [N/A]	
Increased	18.8 [13.4, 25.9]	22.0 [13.1, 34.6]	16.9 [10.5, 25.9]	0.67
No change	79.9 [72.7, 85.5]	76.3 [63.6, 85.5]	82.1 [73.0, 88.7]	
Decreased	1.3 [0.3, 5.1]	1.7 [0.2, 11.4]	1.1 [0.1, 7.3]	
Increased	13.6 [9.0, 20.1]	17.0 [9.3, 29.0]	11.6 [6.5, 19.8]	0.48
No change	85.7 [79.2, 90.5]	83.1 [71.1, 90.7]	87.4 [78.9, 92.7]	
Decreased	0.7 [0.1, 4.6]	0.0 [N/A]	1.1 [0.1, 7.3]	
Increased	49.4 [41.5, 57.3]	57.6 [44.6, 69.7]	44.2 [34.5, 54.4]	0.10
No change	50.0 [42.1, 57.9]	40.1 [28.8, 53.8]	55.8 [45.6, 65.5]	
Decreased	0.0 [N/A]	0.0 [N/A]	0.0 [N/A]	
Refused to answer	0.7 [0.1, 4.6]	1.7 [0.2, 11.4]	0.0 [N/A]	
Increased	22.1 [16.2, 29.4]	25.4 [15.8, 38.2]	20.0 [13.1, 29.4]	0.09
No change	74.7 [67.1, 81.0]	67.8 [54.7, 78.6]	79.0 [69.5, 86.1]	
Decreased	3.3 [1.3, 7.6]	6.8 [2.5, 17.0]	1.1 [0.1, 7.3]	
Increased	14.3 [9.6, 20.8]	10.2 [4.6, 21.1]	16.8 [10.5, 25.9]	0.06
No change	80.1 [73.4, 86.1]	80.0 [67.3, 88.2]	81.1 [71.8, 87.8]	
Decreased	5.1 [2.6, 10.1]	10.2 [4.6, 21.1]	2.1 [0.5, 8.2]	
Increased	22.1 [16.2, 29.4]	22.0 [13.1, 34.6]	22.1 [14.8, 31.7]	0.03
No change	73.4 [65.8, 79.8]	67.8 [54.7, 78.6]	76.8 [67.2, 84.3]	
Decreased	4.6 [2.2, 9.3]	10.2 [4.6, 21.1]	1.1 [0.1, 7.3]	

Table 3. Dental hygienists' reported attitudes towards CWF, by fluoridation status of community in which they work

Response	Overall (% [95%CI])	Currently fluoridated (% [95%CI])	Fluoridation cessation (% [95% CI])	*P* value
Attitudes towards community water fluoridation				
Level of support for community water fluoridation				
Supportive	86.2 [81.3, 89.9]	88.5 [80.7, 93.4]	84.6 [77.8, 89.6]	0.29
Neither opposed nor supportive	4.4 [2.4, 7.7]	4.9 [2.0, 11.1]	4.0 [1.8, 8.7]	
Opposed	9.1 [6.1, 13.3]	5.8 [2.6, 12.3]	11.4 [7.2, 17.7]	
Refused to answer	0.4 [0.1, 2.8]	1.0 [0.1, 6.6]	0.0 [N/A]	
TOTAL (n)	253	104	149	
Level of agreement with the following statements				
"Community water fluoridation is effective in preventing tooth decay in populations"				
Agree	91.6 [87.4, 94.5]	94.1 [87.4, 97.4]	89.9 [83.8, 93.8]	0.30
Neither agree nor disagree	1.2 [0.4, 3.7]	1.0 [0.1, 6.8]	1.4 [0.3, 5.3]	
Disagree	6.0 [3.6, 9.7]	2.9 [0.9, 8.8]	8.1 [4.6, 13.8]	
Refused to answer	1.2 [0.4, 3.7]	2.0 [0.5, 7.6]	0.7 [0.1, 4.7]	
TOTAL (n)	250	102	148	
"Community water fluoridation is harmful to people"				
Agree	10.4 [7.1, 14.8]	8.7 [4.5, 15.9]	11.6 [7.3, 17.9]	0.44
Neither agree nor disagree	10.0 [6.8, 14.4]	12.5 [7.4, 20.4]	8.2 [4.7, 13.9]	
Disagree	79.7 [74.2, 84.2]	78.9 [69.9, 85.7]	80.3 [73.0, 86.0]	
Refused to answer	0 [N/A]	0 [N/A]	0 [N/A]	
TOTAL (n)	251	104	147	
"Community water fluoridation is harmful to non-human organisms (e.g., animals, plants)"				
Agree	10.8 [7.5, 15.3]	10.6 [5.9, 18.2]	10.9 [6.8, 17.1]	0.78
Neither agree nor disagree	31.1 [25.6, 37.1]	29.9 [24.3, 42.4]	32.7 [23.0, 37.9]	
Disagree	57.0 [50.7, 63.0]	54.8 [45.1, 64.2]	58.5 [50.3, 66.3]	
Refused to answer	1.2 [0.4, 3.7]	1.9 [0.5, 7.5]	0.7 [0.1, 4.7]	
TOTAL (n)	251	114	137	
"Community water fluoridation infringes on individuals' freedom"				
Agree	26.3 [21.2, 32.1]	27.2 [19.4, 36.7]	25.7 [19.2, 33.4]	0.95
Neither agree nor disagree	15.1 [11.2, 20.2]	15.5 [9.7, 24.0]	14.9 [10.0, 21.6]	
Disagree	56.2 [49.9, 62.2]	54.4 [44.6, 63.8]	57.4 [49.3, 65.2]	
Refused to answer	2.4 [1.1, 5.2]	2.9 [0.9, 8.7]	2.0 [0.7, 6.2]	
TOTAL (n)	251	103	148	
"Community water fluoridation is equitable"				
Agree	66.0 [59.9, 71.6]	68.0 [58.3, 76.3]	64.6 [56.5, 72.0]	0.21
Neither agree nor disagree	26.0 [20.9, 31.8]	28.2 [20.3, 37.7]	24.5 [18.2, 32.2]	
Disagree	7.2 [4.6, 11.2]	3.9 [1.5, 10.0]	9.5 [5.7, 15.5]	
Refused to answer	0.8 [0.2, 3.2]	0 [N/A]	1.4 [0.3, 5.3]	
TOTAL (n)	250	103	147	
"Community water fluoridation is cost effective"				
Agree	83.3 [78.2, 87.5]	87.5 [79.6, 92.6]	80.4 [73.2, 86.1]	0.14
Neither agree nor disagree	7.5 [4.9, 11.6]	7.7 [3.9, 14.7]	7.4 [4.1, 13.0]	
Disagree	9.1 [6.1, 13.4]	4.8 [2.0, 11.1]	12.2 [7.8, 18.5]	
Refused to answer	0 [N/A]	0 [N/A]	0 [N/A]	
TOTAL (n)	252	104	148	

noticed an increase in decay within their practice. There was some indication that those in fluoridation-cessation communities were more likely to report having observed an increase in decay than those in still-fluoridated communities. For example, the percent who responded "yes, definitely" was 38.0% (28.6%–48.5%) in fluoridation-cessation communities versus 10.3% (4.6%–21.4%) in still-fluoridated communities. A higher proportion responded "yes, I think so" in fluoridation-cessation communities versus still-fluoridated communities, but the 95% confidence intervals were overlapping (33.7% [24.7%–44.1%] and 15.5% [8.2%–27.5%] respectively).

Finally, for each of the 4 groups of practice adaptations, respondents who reported a change (increase or decrease) were asked to identify the main reasons (amongst several alternatives) for that change. Focusing on those categories of practice adaptations for which there was a statistically significant ($p < 0.05$) difference between dental hygienists working in fluoridation-cessation versus still-fluoridated communities, it was found that dental hygienists in fluoridation-cessation communities always identified "community water fluoridation cessation" as the most common reason (range = 46% to 51%, across the practice adaptation categories that were significant), whereas dental hygienists working in still-fluoridated communities identified "new knowledge, learned via professional education session or similar" as the most common reason (range = 41% to 71%) (results not shown).

DISCUSSION

This study set out to explore whether, or the extent to which, dental hygienists report having adapted their practices based on the water fluoridation status (i.e., fluoridation-cessation versus still-fluoridated) of the community in which they work. Studies of this nature, within this population, have not been undertaken in the past, but are important as they can help to identify factors that may or may not mitigate an impact of fluoridation cessation on observed tooth decay in populations.

Two differences were observed in self-reported practice adaptations between dental hygienists working in fluoridation-cessation communities and those working in still-fluoridated communities. Although these differences were statistically significant based on a p value of less than 0.05, the 95% confidence intervals were overlapping, suggesting that the differences are not robust. Nonetheless, some brief interpretation is useful for informing future work. First, dental hygienists working in fluoridation-cessation communities were more likely to report having increased their recommendations to clients for more frequent in-office fluoride treatments (e.g., fluoride gel, foam, rinse or varnish). Second, dental hygienists from fluoridation-cessation communities were less likely to report having decreased their recommendations to clients for more frequent radiographs to detect decay. Current trends in dental professional guidelines include increasingly judicious use of radiographs.[19] In that context, it is not surprising that dental hygienists report having decreased this practice. The unique finding from this study is that dental hygienists working in fluoridation-cessation communities also decreased this practice, but less so than those in still-fluoridated communities.

These reported practice adaptations are consistent with dental hygienists identifying and/or anticipating a negative impact of fluoridation cessation on tooth decay, and attempting to mitigate that impact. Such practice adaptations align with caries risk assessment criteria and clinical guidelines, which recommend consideration of reduced exposure to topical fluoride, including from CWF, when assessing caries risk.[20-22] Further, hygienists in this survey who worked in fluoridation-cessation communities consistently identified "fluoridation cessation" as the most common reason for their reported adaptations.

No statistically significant differences were detected in terms of reported attitudes towards CWF, suggesting that these attitudes do not confound the relationship between fluoridation cessation and reported practice adaptations by dental hygienists.

Other research by McLaren et al. concluded, based on a short-term evaluation, that there appeared to be an adverse effect on dental caries following fluoridation cessation in Calgary, compared to Edmonton where fluoridation remains in place.[6,7 Note 2] To the extent that these conclusions are robust, the findings of the present study suggest that a worsening of tooth decay following fluoridation cessation occurred despite practice adaptations by dental hygienists. Collectively, these findings speak to the complex nature of research on population-level policy measures such as CWF and health outcomes, and the need to consider a breadth of factors, including but not limited to the role and practices of relevant health professionals.

This study has several key strengths. First, access to the study population was secured through the support of the professional body (CRDHA), which disseminated the study information. This method allowed the study invitation to reach all registered dental hygienists in the province of Alberta. Although the response rate was low (8.1%), similarly low response rates have been observed in other surveys of health professionals.[23] Further, a low response rate is not necessarily a problem if the sample is representative of the target population.[24] The study sample resembled the target population in terms of gender and age and, based on the limited information available from CRDHA, appeared qualitatively comparable on primary practice setting and educational attainment. The reasons for low response rate are not known. However, it is possible that the focus on water fluoridation may have been viewed by some dental hygienists (especially those

[2]The previous cessation study focused on Calgary and Edmonton, whereas the present study encompassed all of Alberta. However, Calgary and Edmonton are by a large margin the largest cities in Alberta, thus increasing the comparability of the different study findings.

in still-fluoridated communities) as not important, or, alternately, perhaps too controversial. More generally, the time required to complete the survey (12 min to 15 min), the topic, and survey fatigue are other potential explanations. A second strength is that the topic of this study is novel: no other studies of the role that self-initiated practice adaptations by dental hygienists might have in relation to CWF cessation were located. This is important and relevant given the increasing frequency with which CWF cessation seems to be occurring.

This study has some important limitations. First, there is potential for various forms of bias, including reporting bias (e.g., respondents may have chosen only to share limited or select information about their practice or attitudes), recall bias (e.g., respondents may have provided inaccurate responses to changes made in the past, due to inaccurate memory or other factors) and temporal bias (e.g., although the study was designed to capture the appropriate time frame for practice adaptations vis-à-vis fluoridation cessation, there is the possibility that some adaptations may have been made by dental hygienists prior to fluoridation cessation). Although the sample resembled the population with respect to gender, age, primary practice setting, and educational attainment, it could have been biased in other respects, such as participants' fields of study outside of dental hygiene (if any), as well as the proportion of respondents from rural versus urban areas. Information of this nature was not available from CRDHA due to privacy considerations.

Second, because of the novel and exploratory nature of the study, a full psychometric evaluation of the questionnaire was not conducted. The focus was to develop a questionnaire that had face and content validity, was easy to understand and complete, and that accurately classified respondents by fluoridation status. As research in this area is relatively new, this questionnaire was intended to be a starting point for research in this novel and timely area; others may build upon and strengthen the survey questions. Lastly, a relatively small sample size precluded multivariate analysis. Nonetheless, one key potential confounder was explored; namely, attitudes towards fluoridation, via stratified analysis.

CONCLUSION

In this study, the potential interplay between clinical dental hygiene practice and a population-level intervention (i.e., CWF) was explored. The findings suggest a potentially important role of dental hygienists in assessing and adapting to changing caries risk (actual or anticipated) when broader circumstances, such as CWF status, change. Suggestions for future research include 1) follow-up interviews with dental hygienists to better understand their views and practice vis-à-vis fluoridation; 2) replication of this study in other provinces or regions where fluoridation-cessation and still-fluoridated communities can be compared; and, 3) extension of this study to other dental professionals, such as dentists.

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CONFLICTS OF INTEREST

Dr. Cynthia Weijs reports grants from Alliance for a Cavity Free Future as well as personal fees from After 5 Study Club, outside the submitted work. Effective, July 1, 2017, Salima Thawer began serving a 3-year elected term as CRDHA councillor. All remaining authors declare no conflicts of interest.

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Implementing the Pediatric Oral Quality of Life (POQL) instrument in clinical practice: Early results

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WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- The dental hygiene profession has been slow to incorporate oral health-related quality of life measures into clinical practice, despite a growing movement towards person-centred care.
- This article explores oral health practitioners' experience in administering a quality of life instrument to pediatric clients in 3 different clinical settings.
- Collecting quality of life data requires little time yet provides key information to guide treatment planning and care for pediatric clients.

ABSTRACT

Purpose: The purpose of this study was twofold: first, to elevate the importance of oral health-related quality of life (OHRQoL) in the minds of oral health care providers involved in this project; and second, to evaluate the experience of those providers in administering the Pediatric Oral Quality of Life (POQL) instrument and propose strategies for implementation based on lessons learned. **Methods:** A workshop was conducted in summer 2016 during which participants were informed of their role in the project including the collection of OHRQoL data. At the end of the workshop attendees completed an evaluation stating that they agreed or strongly agreed that they had a good understanding of OHRQoL and felt competent to administer the POQL chairside. The oral health care workers administered the POQL to children and parents or guardians in fall 2016. A 17-item questionnaire designed to investigate how they felt about utilizing the POQL in practice was administered. **Results:** Twelve of nineteen practitioners (63%) provided full responses. Half were dental hygienists, 3 were dental assistants, 2 were office administrators, and 1 was a dentist. The majority reported full-time employment and had worked in their organization for 2 to 3 years. All child POQLs were completed chairside at various times during the appointment. Administration of the POQL took on average 6 minutes with most children receptive although not always sure why they were being asked how they felt about their teeth and mouth. Parents and guardians raised no objections to filling out the POQL or having their child do so. Oral health care workers reported the POQL provided greater insight into the child and his or her oral health. Challenges included the need to explain or rephrase questions, fitting the POQL instrument into the workflow, and time. **Conclusion:** Training and implementation of the POQL instrument introduced the concept of OHRQoL measures as a part of data collection in dentistry. The oral health care worker responses and comments on the 17-item questionnaire show an elevated awareness of OHRQoL as a result of participating in this project. These early results indicate that implementing an OHRQoL measure in practice requires little time while providing a more complete picture of the impact of a child's oral condition on their quality of life.

RÉSUMÉ

Objet : La présente étude visait 2 objectifs : le premier consistait à rehausser l'importance de la qualité de vie liée à la santé buccodentaire (QVLSB) dans l'esprit des prestataires de soins de santé buccodentaire qui ont participé à ce projet; le deuxième, à évaluer l'expérience de ces prestataires lorsqu'ils effectuaient l'évaluation de la Qualité de vie en matière de la pédiatrie buccodentaire (QVPB) et de proposer des stratégies pour une mise en œuvre fondée sur les leçons apprises. **Méthodologie :** Lors d'un atelier tenu pendant l'été 2016, des participants ont été avisés de leur rôle au sein du projet, ainsi que de la collecte des données sur la QVLSB. À la fin de l'atelier, les personnes présentes ont rempli un formulaire d'évaluation qui affirmait qu'elles étaient d'accord ou fortement d'accord que leur compréhension de la QVLSB était très bonne et qu'elles se sentaient compétentes pour effectuer l'évaluation de la QVPB auprès des clients. Les travailleurs de soins de santé buccodentaire ont effectué l'évaluation de la QVPB auprès d'enfants et de parents ou de tuteurs à l'automne 2016. Un questionnaire a été utilisé, lequel était composé de 17 éléments conçus dans le but d'examiner comment ces travailleurs se sentaient face à l'évaluation de la QVPB en cabinet. **Résultats :** Douze des dix-neuf praticiens (63 %) ont fourni des réponses complètes. Parmi ceux-ci, la moitié était des hygiénistes dentaires, 3 étaient des assistantes dentaires, 2 étaient des administrateurs de cabinet et une personne était dentiste. La majorité des participants ont signalé être employés à temps plein et avoir travaillé dans leur cabinet pendant 2 à 3 ans. Toutes les évaluations de la QVPB ont été effectuées auprès des enfants à divers moments pendant le rendez-vous. L'évaluation de la QVPB prenait environ 6 minutes et la majorité des enfants y étaient très réceptifs, bien qu'ils ne comprenaient pas toujours pourquoi on leur demandait comment ils se sentaient face à leurs dents et à leur bouche. Les parents et les tuteurs n'ont soulevé aucune objection à obtenir une évaluation de la QVPB, ni à ce que leurs enfants soient évalués. Les travailleurs de soins de santé buccodentaire ont affirmé que l'évaluation de la QVPB a fourni une meilleure compréhension de l'enfant et de sa santé buccodentaire. Les défis comprenaient le besoin d'expliquer ou de reformuler les questions, l'ajout de l'évaluation de la QVPB dans le flux du travail, ainsi que le temps. **Conclusion :** La formation et la mise en œuvre de l'évaluation de la QVPB ont introduit le concept des mesures de la QVLSB comme partie intégrante dans le cadre de la collecte de données en dentisterie. Les réponses et les commentaires que les travailleurs en soins de santé ont fournis sur le questionnaire montrent une conscientisation accrue de la QVLSB grâce à leur participation à ce projet. Ces résultats précoces démontrent que la mise en œuvre de mesures de la QVLSB dans les cabinets demande peu de temps et dressent un tableau plus complet de l'effet que l'état buccodentaire d'un enfant peut avoir sur sa qualité de vie.

Key words: oral health care providers, oral health-related quality of life, pediatric dentistry, Pediatric Oral Quality of Life (POQL), quality of life

CDHA Research Agenda category: capacity building of the profession

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INTRODUCTION

The World Health Organization (WHO) has emphasized for the past 70 years the importance of health providers considering a patient's quality of life.[1] WHO describes health as a "state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity."[2] Recently, the US Department of Health and Human Services' Healthy People 2020 has incorporated health-related quality of life (HRQOL) into its topics and objectives.[3] Healthy People 2020 comprises a set of 10-year national goals and objectives for improving the health of all Americans. Beyond traditional collection of biological data, practitioners are challenged to consider the psychosocial aspects of HRQOL. Therefore, it is important for health care providers to be educated about HRQOL and be given tools and strategies for gathering these data.

A recent movement in health care, commonly referred to as person-centred care, emphasizes the importance of providers considering health-related quality of life (HRQOL).[4] A shift in thinking exclusively about illness to a focus on wellness with emphasis on patient goals and preferences is critical to achieving the kind of HRQOL promoted by WHO and Healthy People 2020. Walji et al. describe person-centred care as "care given *with* the patient and his or her family, rather than care given *to* the patient."[4] Research has shown that person-centred care contributes to greater concordance between provider and patient when it comes to treatment plans, better health outcomes, and increased patient satisfaction.[5] It is within this context that oral health-related quality of life (OHRQoL) emerged.

Like the HRQOL, OHRQoL assesses the more subjective impact of oral health status on an individual's quality of life. OHRQoL has been defined as a "multidimensional construct that reflects (among other things) people's comfort when eating, sleeping, and engaging in social interaction; their self-esteem; and their satisfaction with respect to their oral health."[6] Brondani and MacEntee conducted a critical analysis of the past 30 years of literature on OHRQoL and concluded that, even though the concept had evolved over time, dentistry continues to operate predominately within a traditional biomedical, paternalistic, disease-oriented environment.[7] Within this mindset, there is an assumption that what is "normal" for the client is determined by the oral health care provider with little regard for client input. Dental hygienists have a real opportunity to distinguish themselves when it comes to the delivery of person-centred care, by placing people and families at the centre of decisions and working alongside them to achieve the best outcome.

Theoretical models for dental hygiene—the Human Needs Model (HN) and the Oral Health-Related Quality of Life Model (OHRQL)—developed in the 1990s are designed to provide a framework for developing dental hygiene diagnoses based on the biopsychosocial measures recognized as critical to outcomes in today's person-centred care environment.[8,9] The HN and OHRQL models guide dental hygienists beyond the collection and analysis of traditional biological data to also include the collection and analysis of psychosocial variables that ultimately affect client outcomes. A textbook was published in 1995 by the 2 dental hygiene researchers who developed the HN theory.[10] The text is currently being updated to a fifth edition. It has been reported that approximately 80 to 100 dental hygiene education programs in the United States and Canada have adopted this textbook.[11] The OHRQL model was one of several models of OHRQoL studied by Brondani and MacEntee. In their findings they acknowledge the OHRQL model as one of a few OHRQoL models to illustrate a new understanding of oral health as being about more than just illness.[7] Yet, a recent study exploring how the OHRQL is being applied in education, research, and practice found that the collection and use of this data has been minimal in all 3 settings.[12] While dental hygiene has the foundation upon which to build this person-centred health care movement, it is going to take greater effort to bring the education and practice communities onboard.

The literature on OHRQoL as it applies to adult populations spans several decades. However, the literature on ORHQoL in children has only recently begun to emerge. A variety of instruments for capturing these measures in children have been developed in recent years.[13-17] The Pediatric Oral Quality of Life (POQL) instrument was developed by a team of researchers from Boston University, with an emphasis on capturing experiences and views of both children and their parents or guardians.[18] Validity and reliability have been reported. [18] While parents and guardians can serve as proxies, research shows discrepancies between a proxy and child's scores, making the parent or guardian reports complementary to, not substitutes for, child reports.[19]

The current project is part of a larger study funded by the US Department of Health and Human Services National Institutes of Health–National Institute of Dental and Craniofacial Research (NIDCR) where the collection of OHRQoL from the participating children, parents, and guardians took place using the POQL instrument. Funding by NIDCR was contingent upon the collection of OHRQoL measures, as one of many measures to be included in the larger study. It is clear from this stipulation in the grant that the NIDCR recognizes the need for dentistry to become more person-centred, and one strategy for achieving this is the addition of quality of life measures that can quantify the psychosocial aspects of the individual. We are unaware of any studies to date that have examined the experience of the practitioner in the collection of pediatric oral health-related quality of life data. If dental hygienists are to take a leading role in the person-centred health care environment, it will be important to explore the experience of the practitioner and provide recommendations for how to collect OHRQoL data.

The purpose of this project was twofold: first, to elevate the importance of OHRQoL in the minds of oral health care providers involved in this project; and second, to evaluate the experience of oral health care practitioners in administering the Pediatric Oral Quality of Life (POQL) instrument and propose strategies for implementation based on lessons learned.

METHODS AND MATERIALS

This study was approved by the University of Missouri–Kansas City Institutional Review Board (#17-040).

Questionnaire

A 17-item questionnaire was developed by the authors to capture descriptive data and solicit feedback from participating oral health care workers about the process and procedures used for implementing the POQL instrument in practice. The questionnaire was delivered in an online format using SurveyMonkey®. It employed a combination of forced choice and open-ended responses.

Process and procedure

A mobile school-based dental program, a fixed school-located dental program, and a fixed safety-net dental clinic participated in this study. The 3 participating programs are all unique in the manner in which they deliver oral health care services to children. One program employs dental hygienists to participate in school-based oral health programs where mobile equipment is used for the delivery of care. Another program employs a more traditional mix of dental workforce personnel who deliver oral health care services in fixed school-located dental clinics. The third program conducts screenings in schools but the actual delivery of care is provided in 2 safety-net dental clinics in the community.

All 3 clinics agreed to integrate the POQL instrument (parent report and child self-report) into their standard process of care. An orientation to the study was provided at a full-day onsite workshop at the University of Missouri–Kansas City School of Dentistry. Directors and dental hygienists selected by each program attended the workshop. These attendees were responsible for taking the information learned at the workshop back to their respective programs. At the orientation, HRQL, OHRQoL, and the POQL instrument were introduced. Participants practised using the POQL instrument through role-play exercises followed by a group discussion to answer any questions that emerged about the administration of the POQL. The POQL instrument consists of a parent report (for children ages 5 to 14) and a child self-report (for those ages 8 to 14). Parents and guardians completed the POQL Parent Report instrument (Appendix 1) for children participating in the study. Oral health care providers administered the POQL Child Self-Report instrument to participating children ages 8 to 14 (Appendix 2). At the conclusion of the workshop, all participants completed an

Table 1. Questionnaire responses from oral health care workers

Question	Response n (%)[a]
Which of the following describes your primary role in your practice setting?	
Dental hygienist	6 (50%)
Dental assistant	3 (25%)
Office administrator	2 (17%)
Dentist	1 (8%)
Other (if other please explain)	0
Which of the following best describes your employment?	
Full time	10 (83%)
Part time	2 (17%)
Other (if other please explain)	0
Please indicate at which dental program you provide oral health care services	
Mobile school-based	4 (33%)
Fixed school-located	7 (58%)
Fixed safety-net	1 (8%)
How long have you worked in the dental program that you indicated above?	
0–1 years	3 (27%)
2–3 years	7 (64%)
≥4 years	1 (9%)
Which describes how you implemented the POQL?	
Paper form	11 (92%)
Software (entered in computer)	1 (8%)
Other (please explain)	0
	Mean (sd)
How many minutes did it take on average to administer the POQL survey to the children?	6.30 (4.0) minutes

[a]Percentages may not add up to 100% due to rounding

evaluation. Two of the questions were designed to measure their understanding of HRQL and OHRQoL and if they felt competent to administer the POQL chairside.

In spring 2017, directors of the 3 dental programs were contacted via e-mail to request assistance in distributing the 17-item questionnaire to individuals who had administered the POQL instrument as part of the project. The directors forwarded the e-mail and link to the questionnaire to 19 oral health care workers. The questionnaire was open for 2 weeks.

RESULTS

Nine participants attended the 2016 workshop and completed the post-workshop evaluation. All 9 participants either agreed or strongly agreed that they had a good understanding of the HRQL and OHRQoL and that they felt competent to administer the POQL chairside.

Of the 19 study participants identified by their respective programs as responsible for the administration of the POQL instrument, 12 completed the 17-item questionnaire resulting in a 63% response rate. The majority of the participants were dental hygienists (50%) followed by dental assistants (25%). Eighty-three percent (83%) reported working full-time, and the majority (64%) reported being employed in their current setting for 2 to 3 years (Table 1).

Table 2 provides verbatim responses from the oral health care workers who filled out the 17-item questionnaire. Across the 3 participating programs, study participants administered 326 child POQL instruments. Analysis of responses to the questionnaire showed that process and procedure were different in some aspects depending on the practice setting. For this reason, the responses in Table 2 have been categorized into 3 types of dental programs: mobile school-based dental program, a fixed school-located dental program, and a fixed safety-net dental clinic. An example of these differences is seen by how the POQL instrument was introduced to parents and guardians. In the mobile school-based program, one strategy was to send a letter home in the children's backpacks to introduce the concept to parents. Another strategy employed by the mobile school-based program was to have parents and guardians fill out the consent form for the child POQL and completion of the parent POQL during parent–teacher conferences, thereby minimizing the chance of information being lost in a backpack and not returned to the school. Those practising in fixed dental clinics (fixed school-located and fixed safety-net) introduced the POQL as part of the standard paperwork when the parent or guardian presented to the office with their child. In all instances a rationale was provided for administering the POQL, ranging from "we are participating in a study with UMKC" to "this survey is being used to help us see if our services at the clinic are helping clients with better oral health." Gaining acceptance from parents and guardians did not pose a problem regardless of practice setting. Overall, the practitioners found parents and guardians receptive and willing to participate and have their children participate.

When asked to comment on the reactions encountered from parents, guardians, and children when responding to the POQL questions, practice setting was not a factor. Parents and guardians willingly filled out their POQL with few to no questions. The practitioners experienced varying reactions from children. Some stated that the children were positive and, in many instances, seemed to "like being able to answer questions" and enjoyed the interaction. Some practitioners reported that the child was unsure about the POQL as illustrated by the following: "They did not always understand why we were asking about their feelings about how they felt" or "Some of the children seemed confused by why we asked such silly questions at times." When asked about challenges encountered when incorporating the POQL into their process of care, 2 of the 12 (17%) practitioners noted the need to restate or reword some of the questions in order to help the children understand what they were being asked. It was not surprising to find that time was a factor, along with trying to find a good fit in the workflow or routine to administer the instrument. Most of the practitioners reported administering the instrument either at the beginning of the appointment before any treatment was rendered, or when waiting for the dental exam. When asked specifically about the time involved to administer the POQL, the average time was 6 minutes, and ranged from 2 minutes to 15 minutes.

Participating practitioners were asked if they learned anything from the data collected. The majority (75%) provided responses that ranged from "have not seen the results yet" or "I didn't look at the data that much..." to "yes that...some kids are greatly impacted by their teeth" to "the answers were sometimes interesting, like a middle school student who was missing #9...reported she didn't mind...but she felt embarrassed and sad because the boys at school made fun of her."

DISCUSSION

The first purpose of this project was to elevate the importance of OHRQoL in the minds of the oral health care providers involved in this project. Participants were initially introduced to HRQL and OHRQoL during the orientation workshop held for the study. The literature on HRQL and OHRQoL was examined along with the impact of social determinants. Researchers estimate that over half of an individual's or community's health is attributable to social determinants.[20] Examples include income, gender, where a person lives, access to health care, and insurance. Responses on the post-workshop evaluation conducted in summer 2016 and prior to the launch of the project showed that 100% of the attendees agreed or strongly agreed that they had a good understanding of OHRQoL and felt competent to administer the POQL chairside. Qualitative comments in Table 2 regarding whether they learned anything from data collected from the administration of the

Table 2. Analysis of oral health care worker responses to open-ended questions

POQL question	Summary of comments (verbatim) from participating dental programs		
	Mobile school-based	Fixed school-located	Fixed safety-net
How did you introduce to your schools and/or patients that you would be using a questionnaire (POQL) to capture information on children's oral health-related quality of life?	• A letter was sent home in all the children's backpacks explaining the grant and expectations of school and parents. [one school used teacher conference times to inform parents] • To my patients I simply stated that I had some questions to ask them about their oral health.	• Asked pt to please fill out a questionnaire for (dental clinic) to better understand our pts • We stated that we were conducting an anonymous survey to see how dental care can impact lives • Would you mind answering a few questions for a school based survey we are doing? • We let them know that we were participating in a study from UMKC and asked if they would be willing to • Survey been used to help see if our serves at this clinic is helping clients with better oral health.	• Did not respond
How long did it take to gain acceptance from your schools and/or patients to the addition of POQL in your data collection process and actual implementation?	• Rural schools took two days. Urban schools took 3 to 4 weeks. • NA • Patients were fine with the process.	• Not sure • We were able to implement it right away. • Not very long from my perspective. But, I know it was more challenging for the front desk to get the parents survey sent home and returned. • Acceptance was very fast with the parents that came into our office. It took a few days and sometimes a follow up call for the questionnaires we sent home with the school kids. • Everyone was very willing to do survey. • The school and students are very accepting of our program	• It was easily added to the clinic policies
At what point in the appointment does the POQL get implemented?	• The children were interviewed prior to their preventive appts. • Immediately • At the beginning of the appointment, before any treatment. • In the beginning of the appointment.	• Either at the beginning or end when waiting for an exam • At the end of the appointment while waiting for an exam by the dentist • Usually at the end of the appointment while waiting for an exam. • The first appointment that the patient came to when they got the surveys. For most it was their comps. but if the pt. was here for tx we would give it to them as well. • Beginning if have time or at end of appointment • At the very beginning of the appointment or at the end	• Initially for parents. After xrays with hygienist.
Please explain the reactions you encountered from *parents* when asked to fill out the POQL survey.	• The parents who were talked to in [site] were stopped at teacher conferences. I did not see them personally. The rest of the parents received the interview in the back pack and asked to return it the same way. Before we could any of this the school and school board needed to approve this line of communications. • N/A • I did not deal with parents at all.	• They didn't mind at all • No reactions, very receptive. Have a lot of paperwork that the parents are used to having to complete • From my stand point the patients that I encountered seemed to be receptive. • They were very willing to fill them out. • Everyone was happy to do anything, to keep program to continue • Many of the parents did not have a problem filling out the survey; never came across any problems	• They were pretty neutral about completing the document.
Please explain the reactions you encountered from the *children* when administering the POQL.	• Children needed encouraged to think of the question and answer. They are already anxious about our noise and smells let alone being asked these questions. Sometimes we had to reask the question in a different way. • Positive • Some thought it was weird but they all answered the questions for me. • Children were positive. I did not have any negative reactions from any children. I think they kind of liked being able to answer questions. I thought they enjoyed the interaction.	• They didn't mind at all • Some of the children seem confused by why we asked such silly questions at times • No reactions, very receptive. Have a lot of paperwork that the parents are used to having to complete • That they were willing to help us so that we may continue to serve the school based kids here and their families. • I only did the parent portion. • They did not always understand why we asking about their feelings about they felt • Many of the students did not have a problem filing out the survey; never came across any problems	• I don't think some kids really understood the questions or were afraid of what an "honest" answer may result in.

Table 2. *Continued*

POQL question	Summary of comments (verbatim) from participating dental programs		
	Mobile school-based	Fixed school-located	Fixed safety-net
What are the challenges you encountered with implementing the POQL survey into your process of care?	• Time and one more piece of paper. • NA • Some of the kids didn't really understand the questions. • Just remembering to ask the questions, make it part of the routine.	• None • Trying to implement it into my workflow. If I had time while waiting for an exam, this worked well • Some of the wording of the children survey. I had to reword things like 'Have you ever cried because of your teeth. Some of the kids looked at you like you were crazy. • Taking the time to explain, when we had people waiting to check in/out. • No problems using was time during visit get it fill out	• Time was the only challenge I believe
Did you learn anything from the data collected on the POQL survey? Please explain	• It was interesting to get the child's point of view of their own health. • NA • Kids are more accepting of their physical appearance when they are younger. The older the kids were, the more likely that the appearance of their teeth/smiles bothered them a little. • The answers were sometimes interesting, like a middle school student who was missing #9. She reported that she didn't mind how she looked, but she felt embarrassed and sad because the boys at school made fun of her.	• Yes that parents don't always know when child is in pain or how long they have been • Yes, that children are more open when you ask open ended questions • Yes that they are some kids are greatly impacted by their teeth. That it takes a family as a whole to help educate and encourage and teach Oral Hygiene. • I didn't look at the data that much, but it seems that the parents were not as concerned as I thought they would be when their child was in pain.	• Have not seen the results yet
Did collecting POQL data from your patients change anything in the way you provide care?	• No • NA • No • Reminded me to be sympathetic to children's feelings about their personal image and their space.	• No • No, comprehensive care for every patient, every time • I like to think we do a great job as is in providing the best care possible. • No, not really. We are kind to all of our patients. • Some patient need more oral health education.	• Not yet
Is there anything else you would like us to know about collection of oral health-related quality of life data using the POQL?	• No • I found it to be quite enjoyable, it let me take some extra time with the children, and to get to know them personally.	• No • No • No	• Did not respond

POQL instrument provide further evidence that some of the project participants saw how OHRQoL data contributed to a fuller picture of the client and family, thereby supporting person-centred care. Practitioners reported learning things about the client that they would never have known had they not collected POQL data, such as instances of students being embarrassed about their oral conditions, and a sense that children enjoyed being asked how they felt about their health and oral health. As to whether the POQL data resulted in any changes in the way care was provided, the results in Table 2 show that, in general, the addition of POQL data had little impact on the provision of care. This finding illustrates the need for further education on how this data can be used in the provision of person-centred care. Collectively, the outcomes of this study provide evidence that the importance of OHRQoL was elevated in the minds of oral health care providers involved in the project.

The second purpose of this project was to evaluate the experience of oral health care practitioners administering the POQL instrument and to propose strategies for implementation based on lessons learned. Process and procedure for the implementation of the POQL instrument were dependent upon the context in which each practice operated. For example, one of the programs incorporated the POQL instrument into its electronic health record, while other programs used a paper-based approach to gather this information. Practitioners in this study found the addition of the POQL instrument to their daily routine to take a minimal amount of time—approximately 6 minutes. While time was identified as a barrier, it actually took little time to make the POQL part of the workflow. In addition to time, a concern over resistance by children, parents, and

guardians was raised at the summer 2016 workshop. Table 2 shows that children, parents, and guardians were receptive to the administration of the POQL.

Limitations to this project include both the number and settings of participating programs. The 3 programs represented non-traditional settings: mobile school-based, fixed school-based, and fixed safety-net. While findings from the present study are not generalizable to all dental programs, they nevertheless enable us to understand how the POQL instrument can be utilized in a clinic setting and suggest areas for further empirical exploration.

CONCLUSION

Based on the findings from this project, several recommendations regarding process and procedure for implementing the POQL instrument in practice are offered. They are as follows:

- Practitioners need to be educated about person-centred care and the impact of social determinants on health, in order to understand why they are collecting the data as oral health care providers.
- Practitioners need education on HRQL and OHRQoL. If this has not been introduced during their professional education, then it is even more imperative that time be devoted to educating them. This could easily be accomplished through continuing education programs.
- Practitioners can learn how to administer the POQL instrument through role playing or other strategies, allowing them to become comfortable with asking these questions of children and addressing any questions that parents or guardians may have.
- The POQL instrument should become a standard part of data collection (both child and parent or guardian) and therefore not require parental or guardian consent beyond normal consent for receiving oral health services.
- The POQL instrument (both child and parent or guardian) should be collected early in the appointment so that this information can be used in the assessment process and subsequent treatment planning.

Finally, further research is needed regarding the implementation of OHRQoL measures in the practice of dentistry and dental hygiene. Practitioner insights into how this information informs the process of care and assists in the delivery of person-centred care are needed. Additionally, research exploring the outcomes of care in environments where OHRQoL measures are factored into treatment planning and decisions is essential.

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CONFLICT OF INTEREST

The authors have declared no conflicts of interest.

APPENDIX 1. MODIFIED PEDIATRIC ORAL QUALITY OF LIFE (POQL) PARENT REPORT (AGES 5 TO 14)

PARENT Report on School-Age Quality of Life (Ages 5–14)

ID _____ Site _____ Date ___/___/___ (month/day/year)

PLEASE ANSWER THE FOLLOWING QUESTIONS

How would you rate your child's health in general?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐
In general, how would you rate the health of your child's ***teeth and mouth***?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐
Compared to one year ago, how would you describe the health of your child's teeth and mouth ***now***?	Much better ☐	Somewhat better ☐	About the Same ☐	Somewhat worse ☐	Much worse ☐

In the past 3 months . . .	**HOW OFTEN DID THIS HAPPEN?**					**HOW BOTHERED WERE YOU?**					
	All of the Time	Some of the Time	Once in a While	Did Not Happen	Don't Know	Very Bothered	Somewhat Bothered	Bothered a Little Bit	Never Bothered	Did Not Happen	Don't Know
1. Did your child have pain because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Did your child have trouble eating any foods (hard / hot / cold) because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Did your child have trouble paying attention in school because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Did your child miss school because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Did your child not want to laugh or smile around others because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Did your child worry that he or she was not a good looking to others because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Was your child unhappy with the way he or she looked because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Was your child angry or upset because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Did your child feel worried because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Did your child cry because of his or her teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Now we will ask about things that may have happened with YOU and YOUR FAMILY during the past 3 months because of your child's teeth or mouth.

In the past 3 months . . .	**HOW OFTEN DID THIS HAPPEN?**				**HOW BOTHERED WAS YOUR CHILD?**				
	All of the time	Some of the time	Once in a while	Did not happen	Very bothered	Somewhat bothered	Bothered a little bit	Never bothered	Did not happen
1. Were you worried about paying for your child's dental treatment?	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Did you feel guilty because of problems with your child's teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Did you feel angry or frustrated because of problems with your child's teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Did you feel helpless because of problems with your child's teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐

Finally, please tell us a few things about yourself.

In general, how would you rate the health of ***your*** teeth and mouth?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐
In general, how would you describe ***your*** experiences with your dentist?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐
When was ***your*** last visit to a dentist?	Less than 6 months ago ☐	6–12 months ago ☐	More than 1 year ago but less than 2 years ago ☐	2–5 years ago ☐	More than 5 years ago or never ☐

What was the reason(s) for ***your*** last dental visit? *Please check all that apply.*	Routine exam and/or cleaning ☐	Emergency (tooth injury) ☐	Emergency (toothache) ☐	Having tooth (teeth) pulled ☐	Filling ☐
	Root canal ☐	Crown(s) or cap(s) ☐	Braces/space maintainers ☐	Other (*specify*) _____	

Thank you!

APPENDIX 2. MODIFIED PEDIATRIC ORAL QUALITY OF LIFE (POQL) CHILD SELF-REPORT (AGES 8 TO 14)

CHILD Self-Report — School-Age Quality of Life (Ages 8–14)

ID _____ Site _____ Date ___ ___/ ___ ___/ ___ ___
month day year

PLEASE ANSWER THE FOLLOWING QUESTIONS

How would you rate your health in general?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐
In general, how would you rate the health of your ***teeth and mouth***?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐
Compared to one year ago, how would you describe the health of your teeth and mouth ***now***?	Much better ☐	Somewhat better ☐	About the same ☐	Somewhat worse ☐	Much worse ☐

In the past 3 months . . .	**HOW OFTEN DID THIS HAPPEN?**				**HOW BOTHERED WERE YOU?**				
	All of the Time	Some of the Time	Once in a While	Did Not Happen	Very Bothered	Somewhat Bothered	Bothered a Little Bit	Never Bothered	Did Not Happen
1. Did you have pain because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Did you have trouble eating any foods (hard/hot/cold) because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Did you have trouble paying attention in school because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Did you miss school because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Did you not want to laugh or smile around others because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Did you worry that you were not a good looking to others because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Were you unhappy with the way you looked because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Were you angry or upset because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Did you feel worried because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Did your cry because of your teeth or mouth?	☐	☐	☐	☐	☐	☐	☐	☐	☐

In general, how would you describe your experiences with your dentist?	Excellent ☐	Very good ☐	Good ☐	Fair ☐	Poor ☐

When was your last visit to a dentist?	Less than 6 months ago ☐	6–12 months ago ☐	More than 1 year ago but less than 2 years ago ☐	2–5 years ago ☐	More than 5 years ago or never ☐

What was the reason(s) for your last dental visit? *Please check all that apply.*	Routine exam and/ or cleaning ☐	Emergency (tooth injury) ☐	Emergency (toothache) ☐	Having tooth (teeth) pulled ☐	Filling ☐
	Root canal ☐	Crown(s) or cap(s) ☐	Sealants ☐	Braces/space maintainers ☐	Other (*specify*) _____

Thank you!

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Intersections between clinical dental hygiene education and perceived practice barriers

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WHY THIS ARTICLE IS IMPORTANT TO DENTAL HYGIENISTS

- Many dental hygienists perceive barriers to the provision of clinical services arising from shortcomings in their clinical dental hygiene education.
- This review explores the impact of challenges faced in dental hygiene education programs on the professional practice of new graduates.
- Suggestions to help educators and administrators address these challenges are offered.

ABSTRACT

Background: A growing body of research demonstrates the degree to which dental hygienists cite barriers to the provision of clinical therapy. Many of these barriers appear to be associated with challenges experienced in entry-to-practice clinical education. This review explores the intersection between clinical dental hygiene education and perceived barriers to the provision of effective clinical therapy. **Methods:** Fifty full-text journal articles and eight graduate theses retrieved from PubMed, Education Source, SAGE Journals, EMBASE, and the Cochrane Library databases were reviewed and thematically analysed. **Results/Discussion:** Emergent themes revealed inconsistencies in dental hygienists' provision of clinical responsibilities; students' perceptions of calibration discrepancies in clinical dental hygiene education; clinical stressors influencing students' development of clinical skills; challenges in andragogic preparation; difficulty in recruiting qualified clinical educators; and challenges in students' transition to professional practice. Findings indicate time limitations, confidence, a desire for additional education, and a perceived lack of dentist support were leading barriers to dental hygienists' provision of clinical therapy. Dental hygiene students reported receiving inconsistent feedback from clinical educators and expressed a desire for greater clinical supervision and calibration. Clinical educators reported a desire for greater calibration efforts, faculty support, and andragogic preparation. **Conclusion:** A review of the literature demonstrates an association between the barriers cited to the implementation of clinical dental hygiene services in professional practice and challenges experienced within clinical dental hygiene curricula.

RÉSUMÉ

Contexte : Un nombre croissant d'études démontre à quel point les hygiénistes dentaires témoignent d'obstacles en matière de l'exécution de leurs responsabilités cliniques. Plusieurs de ces obstacles semblent être associés aux défis occasionnés par la formation menant à l'entrée en pratique clinique. La présente étude explore le croisement entre la formation en hygiène dentaire clinique et les obstacles perçus en matière de prestation efficace de la thérapie clinique. **Méthodologie :** Les textes intégraux de cinquante articles de journaux et de huit thèses universitaires repérés des bases de données de PubMed, Education Source, SAGE Journals, EMBASE et de la Cochrane Library ont été étudiés et analysés par thèmes. **Résultats ou discussions :** Les thèmes émergents ont révélé des incohérences dans l'exécution de responsabilités cliniques des hygiénistes dentaires, la perception des étudiants à l'égard des divergences en matière de calibration de la formation en hygiène dentaire clinique, les facteurs de stress cliniques qui ont une influence sur le perfectionnement des compétences cliniques des étudiants, la préparation andragogique inadéquate et la difficulté à recruter des enseignants-cliniciens qualifiés, et les obstacles à la transition des étudiants vers la pratique professionnelle. Les conclusions montrent que les contraintes de temps, l'absence de confiance, le désir d'une formation supplémentaire et la perception d'un manque d'appui de la part du dentiste étaient les obstacles principaux à la prestation de la thérapie clinique par les hygiénistes dentaires. Les étudiants en hygiène dentaire ont signalé avoir reçu des commentaires contradictoires de la part des enseignants-cliniciens et ont exprimé vouloir une supervision clinique plus étendue, ainsi qu'une meilleure calibration. Les enseignants-cliniciens ont signalé souhaiter des efforts accrus en matière de calibration, un meilleur soutien par l'administration scolaire, et une préparation andragogique dans le cadre de discussions sur les défis dans le domaine de l'éducation. **Conclusion :** Un examen de la documentation révèle une association entre les obstacles cités en matière de la mise en œuvre des services cliniques d'hygiène dentaire dans une pratique professionnelle et des défis qui ont été relevés au sein du programme clinique d'hygiène dentaire.

Key words: clinical competence; dental hygiene; education, dental; education, professional; faculty, dental; oral hygiene

CDHA Research Agenda category: capacity building of the profession

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INTRODUCTION

Compared to other health professions, many entry-to-practice dental hygiene programs are shorter in duration and have less practice time in clinical placements.[1-4] The number of dental hygiene programs facing these time-related challenges is increasing.[5,6] Despite the growing number of dental hygiene programs and dental hygienists globally, high rates of dental and periodontal disease continue to exist.[7-9] According to the World Health Organization, dental caries affects 60% to 90% of school children as well as the vast majority of adults. From those cases that have been documented, most children show signs of gingivitis,[9] and 1 in every 2 adults has mild, moderate or severe periodontitis.[10]

Dental hygienists report an underprovision of clinical services, including tobacco cessation counselling, nutritional counselling, and the recording of vital signs, citing barriers such as time constraints, low confidence, adverse client reactions, and a desire for additional education and development of skills in these subject areas.[11-23] Dental hygienists partially attribute these challenges to their entry-level education. Students report that their clinical educators require greater calibration and note that they experience difficulties in developing clinical competence because procedures or abilities are practised irregularly within their curriculum.[24-29] In addition, students desire increased individual educator feedback, and they perceive a lack of uniformity within clinical evaluations.[24-29] These challenges serve as significant sources of stress during their clinical education,[24-29] and may be exacerbated by the extent to which clinical educators are qualified. Several studies report that some clinical dental hygiene educators enter academia with less formal instruction in educational methodologies compared to clinical educators in other health disciplines.[24,25,30]

The transition from clinical education to professional clinical practice may also be complicated by an absence of a clinical practicum in many dental hygiene programs during which students can engage in clinical activities outside of their educational institution.[4,6,31] These practicums provide students with interprofessional experiences and may increase their exposure to populations otherwise not seen within their institution.[4,6,31] Practicum experiences have also been noted to increase students' self-confidence in practising autonomously.[31] In North America, medical doctors are evaluated through a postgraduation residency, and registered nurses participate in a clinical practicum prior to graduation. This narrative review explores the challenges experienced in clinical dental hygiene education and the impact these challenges may have on the provision of clinical therapy following graduation. Suggestions aimed at addressing these challenges are also presented.

METHODS

The electronic databases PubMed, Education Source, SAGE Journals, EMBASE, and the Cochrane Library were searched using the following keywords: dental hygiene, clinical calibration, perceived barriers, student perspectives, educator perspectives, clinical therapy, scaling and root planning, and clinical education. The abstracts of relevant studies were read in order to determine their suitability for inclusion in this review, and reference lists of selected studies were scanned for additional resources. Fifty full-text journal articles and eight graduate theses were selected and read in full. A summary of emergent themes relating to perceived barriers in the provision of effective clinical therapy and to challenges faced during clinical dental hygiene education has been compiled. Paucities in the literature have also been reported. Reviewed articles included qualitative, quantitative, and mixed methodologies and were published between 1997 and 2016. Excluded from this review were non-peer reviewed articles and studies not written in English.

DISCUSSION

Five themes emerged from this literature review: 1) barriers to the provision of clinical care; 2) calibration issues in clinical dental hygiene curricula; 3) stressors affecting clinical development in educational environments; 4) challenges in recruiting qualified clinical faculty; and 5) difficulties experienced by students when transitioning to clinical practice.

Barriers to the provision of clinical dental hygiene care

Only 36% to 58% of clinical dental hygienists, regardless of years of experience or level of education, report that they are confident in offering tobacco cessation counselling.[11,15,16] Additionally, 61% to 71% of clinical dental hygienists report irregular or infrequent provision of tobacco cessation counselling.[11,14,17,19] Other data indicate that approximately 60% of dental hygienists infrequently perform extraoral examinations during clinical care,[32,33] while approximately 40% regularly complete extraoral exams on clients.[32,33] Barriers to providing this care include time constraints, a desire for additional education, a lack of confidence in carrying out these responsibilities, inadequate client education materials, client resistance, and a perception of inadequate dentist support.[11-14,17-19,32] Studts et al. report that barriers to the implementation of tobacco cessation counselling may be linked to a lack of reinforcement of tobacco cessation education within the dental hygiene curriculum,[11] and Tremblay et al. note that dental hygienists in Quebec believe they should intervene with smokers, but feel they do not have the skills to intervene effectively.[17] Those dental hygienists who do provide regular tobacco cessation counselling further

report a loss of confidence when clients are unwilling to quit.[13,34] Additionally, a majority of dental hygiene students and clinicians report that they do not provide nutritional counselling due to time constraints, lower confidence in their abilities, and a desire for increased dentist buy-in.[20-22] Research indicates that health history, vital signs, and special needs assessments are not completed in clinical practice as often as in academic settings, and that dental hygienists view time constraints, practice-centred factors (including time limitations in the practice schedule), inadequate financial reimbursement, and a desire for increased education as barriers to their provision of these services.[13,23] Dental hygienists are generally aware of the benefits of providing such services; however, perceived barriers consistently impede their efforts. Inadequate time is cited repeatedly in the literature as a significant barrier,[11-15,17,18,32] and research has recommended a re-examination of dental hygiene curricula to emphasize the importance of integrating these skills.[12,13,15,16,19,32]

With regard to the initiation of referrals, Williams et al. examined clinical dental hygiene students' knowledge of when a referral to a periodontist may be indicated.[35] They found that students were able to consistently identify client risk factors indicating the need for a periodontist referral.[35] However, when tested in clinical practice on their initiation of a referral for clients with these risk factors, students' scores were comparatively low. Students consistently hesitated to refer clients, which Williams et al. concluded was a result of students' difficulty in connecting theory to practice. They indicated that students may have a false sense of confidence when reflecting on their own clinical abilities.[35] Although this study was conducted on graduating dental hygiene students, the authors suggest that knowledge and skills developed in dental hygiene programs may correlate well with future practices as clinicians.[35]

Calibration issues in clinical dental hygiene curricula

Clinical teaching environments are critically important for students in medical and dental professions. Clinical educators are central to the effective delivery of clinical curricula. Paulis examined a group of 258 clinical dental hygiene students from 48 dental hygiene programs in the US, and found that dental hygiene students perceive their clinical educators to be underprepared for clinical education.[24] Although many clinical educators are expert practitioners in their field, not all have relevant formal education in adult teaching methodologies.[25] In addition, the degree to which clinical educators are oriented and calibrated to the institution's policies and procedures and to the expectations placed upon learners prior to teaching in a clinical environment varies.[24] Students note that greater calibration among faculty, particularly regarding evaluation and grading procedures, is needed.[24,26,36] They also desire a greater degree of supervision and individual coaching during clinical education.[24,26,36] Dental hygiene students believe that clinical educators could also benefit from additional years of clinical experience prior to teaching[24] and cite inflexibility and a strenuous high-stakes learning environment as challenges in their clinical education.[26] Students further report a desire for instructors to obtain more formal education in andragogic methodologies, communication techniques, and assessment and evaluation theories prior to teaching in a clinical setting.[24,25]

Many clinical educators and program directors also desire increased opportunities for calibration and preparation. There appears to be a discrepancy between the clinical preparation that new educators expect to receive from existing faculty and the level of mentorship that they actually receive. New clinical educators report feeling underprepared compared to existing faculty members for their roles in clinical education.[24,34-41] At a northwestern American college, faculty in the dental hygiene program assessed clinical students using varied methods, designs, and scoring tools. Faculty neither calibrated their evaluation techniques nor communicated their approaches with one another. A review of student assessments in this setting indicated a divergence from best practice standards for the evaluation of clinical students.[42] Dental school faculty in Michigan were assessed for differences in diagnosis and management of periodontal disease; clinical educators' diagnoses of periodontal conditions varied greatly.[43] The greatest variation occurred among dental hygiene faculty members; the least variation occurred among first- and second-year periodontal graduate students. This discrepancy highlighted that a lack of calibration in the diagnosis of periodontal disease may also result in calibration challenges between dental professions post-graduation.[43]

The accreditation standards for dental hygiene programs in the US and Canada require that clinical educators obtain a background in educational theory and methodology prior to commencing clinical education.[44,45] For example, the Commission on Dental Accreditation of Canada (CDAC) states: "Dental hygienists appointed as clinicians, assigned preclinical and clinical supervisory responsibilities, must have training in educational theory and methodology and a minimum of three years of dental hygiene clinical experience."[44, p22] In Canada, dental hygiene programs must also undertake a calibration process for faculty members to ensure consistency in their evaluation of students. The specific calibration process is largely up to the individual institution, as long as policies and procedures to encourage inter-educator consistency are in place.[44] The literature indicates that students and faculty members desire greater calibration and preparation efforts for clinical educators in order to facilitate the proficient transfer of clinical skills to students.[24,26,30,37,39,41] This literature strongly suggests that

calibration efforts must be ongoing, in order to support consistent practices.

Similar challenges exist in other health care disciplines and across the globe. Clinical nursing instructors in Australia report that student nurses are often taught by clinical educators who have little to no prior formal teaching experience.[40] These instructors cite many barriers to their provision of optimal clinical education.[40] DaRosa et al. maintain that "while medical school faculty have a critical responsibility to prepare future physicians, medical school curricula have not kept pace with societal needs and are graduating students who may be lacking the knowledge and skills required to practice effectively in the 21st century."[41, p453] Medical school clinical instructors are primarily employed for their knowledge and clinical abilities in their areas of specialty rather than their teaching expertise.[41,46] In fact, the literature indicates that instructors from different medical disciplines are frequently unaware of each other's learning objectives, leading to inconsistent educational outcomes.[41,46,50]

Medical faculty frequently report a desire for increased formal training in education, time constraints, and a lack of opportunities for participation in faculty development activities as barriers to effective calibration.[48,51,52] Dudek et al. found that medical instructors may pass their students in a clinical setting even if these instructors feel their students should fail.[53] Participants in this study identified a lack of day-to-day documentation of student performance, a lack of knowledge of what specifically to document, anticipation of an appeal process, and a lack of remediation options as major reasons for passing students who may have been performing poorly.[53] DaRosa et al. reported that medical faculty members may intend to graduate well-prepared physicians,[41] but there are multiple factors—curricular, cultural, environmental, and financial—impeding their efforts.[41,48,50] Time limitations, physical space issues, and limited educational budgets are common problems in clinical education.[41,46,52] Dental hygiene and other health care faculties confront similar challenges regarding calibrating clinical faculty. Additional instruction in educational methodologies for faculty, the development of ongoing formal calibration opportunities within health programs, and the use of standardized assessment tools for evaluating students and faculty will likely be effective strategies for reducing inconsistencies experienced in clinical education.[24,30,37,38,40,43]

Stressors affecting clinical development in educational environments

Research indicates that student anxiety has a detrimental effect on academic achievement and learning.[26-29] Dental and dental hygiene students perceive stressors in clinical environments as potential barriers to a positive learning experience. This perception of clinical educational experiences as stressful may hinder or delay the acquisition of clinical dental hygiene competencies.[26-29,54] The most significant stressors noted by clinical health care students are extensive clinical requirements, insufficient instructor availability, taxing interpersonal relationships, organizational and clinical curricular challenges, differing opinions between faculty, and a non-uniformity in clinical instructor guidance.[26-29,54] Inapproachability of faculty has also been documented as a source of clinical stress for students.[26,27] In American associate degree dental hygiene programs, academic difficulties and challenges in acquiring clinical skills are the predominant reasons for program non-completion.[55] A systematic review of clinical stressors in dental programs found the intense workload, faculty-related factors, and personal factors to be major influencers of student performance and of a decline in psychoemotional well-being. Among the factors identified were extensive school regulations, a stressful atmosphere involving many high-stakes clinical assessments, smoking habits, substance abuse, and a lack of time for socialization and relaxation.[29,54] Identifying these sources of stress in dental hygiene education is a critical first step towards enhancing the student experience. Improving educational experiences and reducing student anxiety through lower-stakes assessments and protected independent study time within a curriculum can facilitate students' retention and application of knowledge and abilities within their education and their professional practice.[26-29]

Challenges in recruiting qualified dental hygiene educators

Despite the demand for qualified clinical educators, dental hygienists and dental hygiene educators indicate that clinical dental hygiene education may not be a desirable career.[56] In 2013, dental hygiene program directors identified several concerns in the American Dental Hygienists' Association Dental Hygiene Program Director Survey. These include recruitment of new faculty, finding qualified professionals with an interest in teaching, competition for qualified faculty, and budgetary concerns.[56] McGuinness also notes that dental hygiene education has faced difficulty in recruiting and retaining competent qualified clinical educators.[30] Even the most competent and experienced clinicians may not have experience in the effective education of students.[30,56]

Candidates for clinical dental hygiene educator positions perceive the income to be less lucrative compared to private clinical practice and believe that specific factors influence faculty shortages in dental hygiene programs. Among these factors are minimal mentoring of new faculty, a lack of modeling to prospective dental hygiene educators, low diversity among faculty, and low levels of institutional support.[56]

In 2015, CDAC added to its requirements for dental hygiene programs that all dental hygiene educators should possess a baccalaureate degree.[44] According to the 2015 Canadian Dental Hygienists Association Job Market

and Employment Survey, only 19% of dental hygienists practising in Canada have a bachelor's degree, and only 6% have a degree specifically in dental hygiene.[57] Program directors continue to struggle to recruit qualified faculty with the minimum required credentials as the pool from which to select candidates remains relatively small.

Part-time private practice dentists and dental hygienists are being increasingly utilized to deliver undergraduate clinical education.[58] There is a need for effective recruitment processes and ongoing faculty development to support those who are both clinicians and educators.[58] A group of experienced dental practitioners who shifted from positions as full-time clinicians to part-time clinical educators identified common themes including complexity in dental education and differences in clinical environments as challenges in their transition.[58] These part-time educators noted that juggling time and multiple students in an unfamiliar, busy, and stressful environment can be difficult. They reported that the clinical educational environment can sometimes provoke feelings of isolation among new clinical educators and indicated that the dynamic of 3 parties—instructor, student, client (as opposed to 2 in clinical practice)—was stressful.[58] These part-time educators reported that the need to be sensitive to the diverse learning styles of each student was often challenging and noted that the complexity of practising a new skill set (the process of clinical education) was perhaps the most significant challenge of all. Clinicians who wish to teach require ongoing institutional support in the development of their role as an educator, through faculty mentorship and opportunities to hone their teaching abilities.[58]

Difficulties experienced during the transition to professional practice

Dental hygiene diploma programs generally do not integrate a residency or clinical practicum component in curricula for graduating students as is commonly seen with other health care entry-to-practice programs. Such an opportunity may facilitate the transition from academia to professional clinical practice for diploma graduates.[4] This practicum model may be structured differently in dental hygiene baccalaureate programs which prepare graduates for roles in alternative practice settings. Providing practicum or extended learning experiences for graduating students in settings such as community or public health, education, research, administration, and industry may better prepare degree graduates for these diverse roles.

The accreditation commissions for dental hygiene schools in North America indicate that dental hygiene faculties must ensure students' participation in a community placement, wherein they can implement health promotion or health education activities.[44,45] There is no specific requirement for students to participate in a clinical community placement in which they can be assessed on the application of clinical skills in community settings. Research indicates that health professionals including dentists, physicians, and nurses report similar barriers to dental hygienists in the provision of effective clinical services to special care populations in community settings.[59-70]

For example, graduating dental hygiene students in Newcastle, Australia, participated in a 12-week placement in a residential seniors' care facility. They felt ill-equipped for the seniors' care placement program even though they had attended a preplacement orientation. Students expressed feelings of being overwhelmed by the residential seniors' care environment, and recommendations for a more realistic preplacement orientation program were made to enable students to transition from the classroom to a special care environment more effectively.[71] A study of senior University of North Carolina dental hygiene students indicated that their placement in a 3-week practicum experience during their final semester increased their clinical self-confidence in the dental hygiene process of care.[31] This research concluded that dental hygiene programs could ease the transition into professional practice by requiring students to participate in extended community practicum experiences.[31,71]

CRITIQUE OF THE LITERATURE

Quantitative, qualitative, and mixed methods studies were included in this review. Randomized controlled trials were used frequently, allowing the authors control over experimental conditions and minimizing confounding factors.[72] Focus groups and individual interviews were used in qualitative studies, and purposeful sampling was appropriately employed in order to select those participants most able to provide the needed information.[73,74] Focus groups can elicit a candid expression of perceptions as comfort among group members and peers is common, and many focus groups were ideally sized between 6 and 8 participants.[73] Individual interviews were also advantageous as participants were not swayed or biased by other participants' responses.[75] Member checking and respondent validation, verbatim transcription after audiorecordings, and systematic thematic analyses were employed, contributing to data completeness. In many cases, participants in qualitative studies were interviewed until data saturation was achieved, and open-ended, semistructured interview questions allowed for a greater expression of information. Pilot testing and follow-up surveys to non-respondents were administered, ensuring a focused and comprehensive collection of data.[74-76] Ethical approval and participant consent were received across all studies reviewed, and participant anonymity and confidentiality were guaranteed.[77]

Limitations

In some quantitative studies, research methodologies including cross-sectional analyses, regression analyses, and

observational designs were utilized. These methodologies allow a greater opportunity for influence from confounding factors than carefully conducted randomized controlled trials, and give authors a decreased degree of control over experimental conditions.[72] Some quantitative designs utilized small sample sizes[72] and infrequently, among both methods, convenience sampling was used. These approaches could limit external generalizability of quantitative research and internal trustworthiness of qualitative results.[76] Data saturation was not unanimously cited in qualitative studies, and potential power struggles or insecurities within focus groups may have influenced participant responses. Participants who answered emailed surveys may have had a greater interest in the subject material than did non-respondents, thus positively biasing the results.[73,75] Many studies employed closed-ended or fixed-response only options for questionnaires, which could restrict the information gathered and limit deeper insight into perceptions.[75]

CONCLUSION

There is an abundance of literature exploring perceived barriers to the provision of clinical therapy among dental hygienists, perceived challenges in clinical teaching methodologies, and inconsistencies across and within dental hygiene education programs. However, there is a scarcity of literature on perceived barriers to the provision of effective clinical therapy in relation to clinical educational experiences. Research indicates that many dental hygienists perceive challenges in their provision of clinical services, such as smoking cessation counselling, nutritional counselling, vital signs assessment, and performing extraoral examinations. There appears to be an association between these challenges experienced in professional practice and those experienced within entry-level clinical curricula. Students in clinical dental hygiene programs report a desire for increased individualized coaching from educators, increased calibration among educators, and less stressful, time-constrained learning environments.

Suggestions to help address these challenges include ongoing calibration exercises for clinical educators, mentorship programs for new educators, lower-stakes clinical evaluations that assess the ongoing development of competence throughout the duration of the program, and the integration of clinical placements or practicums particularly in community settings to assist in the transition to professional practice.

Additional research examining dental hygiene students' clinical experiences in entry-level programs and their relation to challenges experienced in professional clinical practice is needed, particularly in a Canadian context. Such research may elucidate pathways to address and overcome these barriers and may result in suggestions for improving the implementation and evaluation of clinical curricula.

CONFLICT OF INTEREST

The authors have declared no conflicts of interest.

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Eupnea prior to oral injection

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ABSTRACT

Clients may be at risk for medical emergencies during oral health care treatment, be it invasive or noninvasive. Stress has often been identified as a trigger for medical emergencies, thus employment of stress reduction strategies has been suggested to prevent such events from occurring, particularly in apprehensive and medically compromised clients. Although oral health professionals are trained to categorize the psychological nature of an individual and his or her expected response to treatment procedures, actual behaviour is difficult to predict. One of the procedures clients often find stressful in dentistry is the injection of local anesthetic prior to commencement of a procedure. One stress reduction strategy suggested in the literature is the use of "eupnea" or deep breathing, although not typically employed routinely by oral health professionals. This short communication aims to illustrate the beneficial effects of eupnea and suggests that it may be useful for clients who find the injection of local anesthetics to be stressful. Eupnea could potentially minimize the incidence of medical emergencies in the oral health care setting.

RÉSUMÉ

Les clients peuvent être susceptibles aux urgences médicales pendant les traitements de soins buccodentaires, invasifs ou non. Le stress a souvent été ciblé comme un élément déclencheur d'urgences médicales, c'est pourquoi l'utilisation de stratégies de réduction de stress éviterait que de tels évènements se produisent, notamment chez les clients appréhensifs et affaiblis par des troubles médicaux. Bien que les professionnels de santé buccodentaire soient formés pour catégoriser la nature psychologique d'une personne et prédire sa réaction aux procédures, il est difficile d'anticiper le comportement réel. En dentisterie, l'injection d'un anesthésique local au début d'un traitement est une des interventions qui occasionne du stress chez les clients. L'utilisation d'« eupnée » ou de respiration profonde, bien que ce ne soit pas une pratique habituelle des professionnels de santé buccodentaire, est une stratégie de réduction de stress proposée dans la documentation. Cette courte communication vise à illustrer les effets avantageux de l'eupnée et suggère qu'elle peut être utile pour les clients qui trouvent qu'il est stressant de recevoir une injection d'un anesthésique local. L'eupnée pourrait minimiser l'incidence d'urgences médicales qui ont lieu dans les milieux de santé buccodentaire.

Key words: anxiety, deep breathing, eupnea, local anesthesia, stress

CDHA Research Agenda category: risk assessment and management

Stress is an inevitable part of life in this fast-paced world where individuals are constantly juggling professional and personal activities. The American Society of Anesthesiologists (ASA) classifies patients and their treatment outcome based on the general assessment of their preoperative health.[1,2] The original classification system, first developed in 1941, as well as subsequent revisions only address the physical status of the patient.[1,2] However, there have also been further subclassifications and modifications to the ASA system by other authors.[3,4] One such modification incorporates anxiety into the ASA categories and assigns a risk level to initiating dental treatment with each patient group (Table 1). For example, Fehrenbach notes that ASA I patients are healthy with little or no anxiety and, thus, should be comfortable with dental procedures. In contrast, ASA II patients have mild systemic disease and exhibit more extreme anxiety and fear towards dentistry.[4,5] She recommends that dental professionals treating clients assessed as ASA II or III proceed with caution and consider implementing a stress reduction protocol prior to treatment; for clients assessed as ASA IV or higher, dental treatment is not recommended until the client's physical health status has improved.[4]

Studies have also shown that stress may shift the classification of an apparently healthy person (ASA I) to a higher level (ASA II), or that of one with mild to moderate disease (ASA II) to one with moderate to severe systemic disease (ASA III),[6,7] because stress makes individuals more easily prone to physical and psychological illness such as infection, heart disease, and depression.[8,9] Stress can also alter blood parameters and body homeostasis.[6,7] In other words, stress affects almost all aspects of human functioning. The visible signs of emergency stress response may include irritability, confusion, and decreased attention span, all of which can disrupt clinical treatment and interfere with the successful outcome of the oral procedure.

Local anesthetic (LA) administration is often cited as one of the most stressful procedures for dental clients.[10,11]

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Table 1. American Society of Anesthesiologists physical status classification system with added assessment of anxiety

Classification	Definition	Anxiety over dental procedures
ASA I	A normal healthy patient	Little or no anxiety; little or no risk during dental treatment
ASA II	A patient with mild systemic disease	Anxiety and fear towards dentistry but minimal risk during dental treatment. Proceed with caution.
ASA III	A patient with severe systemic disease	Stress reduction protocol and other dental treatment modifications indicated.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Dental treatment should be postponed until medical condition improves.
ASA V	A patient who is not expected to survive without the operation	Dental treatment is contraindicated, except for palliative reasons.
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	
E	Emergency surgery required; used to modify the classification (e.g., ASA III-E)	
P	Pregnant patient; used to modify the classification (e.g., ASA III-P)	

Sources: American Society of Anesthesiologists. ASA Physical Status Classification System. Available from: https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system; and Fehrenbach (2018)[4].

Fear of a painful injection and perception of an irreversible numbness postinjection are common clinical problems that could potentially be alleviated by utilizing some form of cognitive behaviour management.[12,13] Use of a behavioural stress reduction technique prior to the administration of LA could allow the client to receive the injection with less anxiety and subsequently enable the oral procedure to be completed more efficiently in a pain-free environment.

A significant number of medical emergencies in dental offices occur during or after LA administration, and most are stress related and completely preventable.[14.] Liau et al. noted in their study that the mean anxiety scale score before LA administration was 9.3, with a range from 4 to 20. Women had a significantly higher mean dental anxiety score than men. Younger age was associated with a higher anxiety scale score. Severe preoperative anxiety was associated with significantly increased heart rate during administration of anesthetic.[15,16] Although short lived, the fear of LA administration for some is often enough for them to refuse anesthesia altogether. Reinforcement and reassurance play a key role in reducing the pain of LA administration.

Dental anxiety is pervasive and has been associated with treatment errors due to poor client compliance during treatment that could result in subsequent poor oral health.[3,17] Anxiety reduction techniques should be easy to use, low in cost, non-pharmacological, noninvasive, comfortable, and effective.[18] Many stress management techniques have been studied, such as progressive muscle relaxation (PMR), autogenic training (AT), relaxation response (RR), diaphragmatic breathing, transcendental meditation, cognitive behavioral therapy (CBT), distraction, and hypnosis.[13,19] One such technique that has been shown to be effective is the use of deep breathing or "eupnea."[20-22] Stress activates the sympathetic nervous system while eupnea or deep breathing activates the parasympathetic nervous system. The sympathetic nervous system is catabolic; it safeguards the body from stress and life-threatening situations by a fight-or-flight response[23-26] while the parasympathetic nervous system is anabolic, and helps the body rest, digest, and recover.[27,28]

Eupnea has been shown to distract pediatric clients who normally may be fixated on a negative dental procedure.[20] Mori et al. observed that there was a significant decrease in blood pressure in clients who had taken deep breaths before the procedure as compared to those who did not perform eupnea before the procedure.[29] Busch et al. compared the effectiveness of relaxing deep and slow breathing (DSB) and attentive DSB. Study participants who performed relaxing DSB showed a significant decrease in pain perception and increase in pain threshold.[30] Brown et al. concluded that slow and deep breathing prior to any stress-related work can help to reduce stress, anxiety, post-traumatic stress disorder (PTSD), depression, stress-related medical illnesses, etc.[31]

Deep breathing (eupnea) also goes by the names of diaphragmatic breathing, abdominal breathing, belly breathing or paced respiration.[32] The mechanism of action for this technique is simple. When a deep breath fills the lungs with oxygen, the lower belly rises. Oxygen-enriched air spreads into the base of the lungs, a highly vascular area, making respiratory exchange more available compared to the upper lobe of the lung. With each deep breath, the diaphragm, which is attached to the heart, pulls the heart down and activates its function. This enables the body to pump fluid and nutrients into the heart vessels and eliminate toxins.[33-35]

In contrast, shallow breathing restrains the diaphragm's range of motion.[36] The inferior lobes of the lungs do not get their full share of oxygenated air. Triggers for shallow breathing include anxiety, stress, fatigue, mouth breathing, and other factors that cause hyperventilation. Homeostasis of the human body depends on the relationship between 2 gases: carbon dioxide and oxygen. An imbalance between the level of these 2 crucial gases can make an individual agitated (raised oxygen level relative to the level of carbon dioxide) or lethargic and sluggish (raised carbon dioxide level relative to the level of oxygen).[30,37-39]

Eupnea is the act of breathing deeply into the lungs by flexing the diaphragm rather than the ribcage. Eupnea enables one to take normal breaths while maximizing the amount of enriched oxygen that goes into the bloodstream. It is a way of interfering with the fight-or-flight response and eliciting the body's normal relaxation response. Lower cortisol levels and higher melatonin activity are maintained by deep breathing.[40] In contrast, thoracic breathing, a part of a typical stress response, can lead to an oxygen/carbon dioxide imbalance[41] that may result in elevation of blood pressure, heart rate, muscle tension, dizziness, and irregular breathing, and can exacerbate the stress–anxiety cycle.[42]

Deep breathing has been a component of relaxation techniques for a long time and has been used as a complementary method in the treatment of chronic pain syndromes to alleviate pain and harmonize the mood status of an individual. In concert with other relaxation techniques it efficiently reduces stress-related biological activity in healthy individuals. Eupnea replenishes the supply of oxygen to the brain, stimulates the parasympathetic nervous system, and reconnects the body with the mind.[43] It also stimulates a feeling of tranquility, dissociation from the surroundings, and suppresses the errant stress response.[30,44]

Deep breathing is free and noninvasive. However, time is required to master the technique and to re-educate clients from thoracic to diaphragmatic breathing. There are few contraindications associated with eupnea except in clients with severe chronic obstructive pulmonary disease. (COPD).[45] Deep breathing in this group of individuals has been shown to limit the mechanical efficiency and smooth coordination of chest wall motion which in turn can result in dyspnea or difficulty with breathing. Therefore, the use of this technique for stress reduction in clients with COPD is not advisable.[45,46]

The American Dental Association endorses stress reduction techniques in dental care, especially for clients with anxiety or a known heart disease.[47] Eupnea as a stress reduction technique has been used selectively by clinicians for anxious or medically compromised clients. However, it is the belief of these authors that the use of eupnea can be considered for clients who exhibit any signs of fear or anxiety prior to the administration of local anesthetics. Adoption of such a practice could minimize their anxiety and potentially prevent the incidence of medical emergencies. But further studies that can be validated objectively would shed a light on its significance on anxiety reduction and improve client care.

CONCLUSION

Dental injections are a routine part of dental practice, yet they are also the source of a great deal of stress for many clients, resulting in anxiety that could potentially be prevented through the use of deep breathing or eupnea. The purpose of this short communication was to explore eupnea as a treatment option for stress associated with the administration of local anesthetic by oral health practitioners. Further evidence-based research on eupnea and, in particular, the resulting changes in physiological parameters, is warranted before it can be considered routinely by clinicians as a means of helping their anxious clients.

CONFLICT OF INTEREST

The authors have declared no conflicts of interest.

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Prevent Tooth Pain and Sensitivity with the Latest Tooth Protection Technology

Leonard J. Litkowski, DDS, MS

PATIENT CASE: SARAH

Sarah, a 28-year old female patient presents for her Hygiene recall visit.

She describes having pain and points to her upper right side premolars and canine. The pain is very short in duration and is often caused by cold liquid, air or even the bristles of her toothbrush.

Sarah used to experience pain infrequently, but now it could occur every day, if she is not careful. Upon examination, gingival recession of about 1mm was observed in the area surrounding the first and second premolar and canine, with inflammation and plaque buildup.

The rest of her mouth is plaque free with no observed inflammation. Sarah admits to avoiding the area when she brushes, anticipating it will cause pain. She responded to an airblast and a sweep of the probe on the root surface. Her pain was 7 - 8 on a 10 point scale. No decay was observed.

Dentin Hypersensitivity

Sarah's symptoms are in keeping with Dentin Hypersensitivity (DH), a transient, short, sharp tooth pain arising from exposed dentin in response to a stimulus that cannot be attributed to any other form of dental defect or pathology.[1,2] Sarah is not alone. An estimated 36% of adults report having sensitive teeth associated with temperature, air or tactile stimuli.[3] Dentin Hypersensitivity often presents as an acute problem, but when it starts to occur on a chronic basis can lead to neglecting oral hygiene, failing to comply with instructions and avoiding dental appointments.[4,5]

Diagnosis, Mechanism and Management

Symptoms experienced by patients with dentin pain/sensitivity may also be associated with the following conditions, which should be diagnosed by examination:

- Dental Caries, Cracked Teeth, Fractured Teeth and Post-Treatment Neuralgias[2]
- Ruling out these causes of pain and confirming Dentin Hypersensitivity may take multiple visits

Mechanism of Dentin Hypersensitivity:

- Dentin is exposed, open tubules form at the exposed surface (Figure 1a) and trigger pulpal nerves in response to a stimulus[3]
- The Hydrodynamic Theory is the most accepted mechanism for Dentin Hypersensitivity. Rapid movement of fluid in open tubules results in nerve stimulation with a short sharp pain (Figure 1b)[3]
- Tubules must be open to the oral cavity and the pulp[3]

Figure 1a: Open tubules formed in dentin allowing for rapid fluid movement resulting in nerve stimulation[3,7]

Figure 1b: Fluid in tubules extending from exposed dentin triggers nerve stimulation[3,7]

Treatment Modalities include:

- Nerve depolarization using potassium-based products to prevent repolarization and thus reducing the transmission of the impulse[6]
- Tubule occlusion where a layer forms over and in the tubules, which blocks the movement of dentinal fluid and prevents the nerve stimulation[6]

Evolution of Tubule Occlusion Products

The body has a natural defense mechanism for surface demineralization and erosion of enamel by delivering a supersaturated solution of calcium (Ca) and phosphorous (P) in saliva. It has been demonstrated that supplying an additional Ca and P load in the form of amorphous calcium phosphate (ACP) slows the process and may block open tubules.

However the ACP could not remain at the surface for sufficient time for definitive reactions to proceed. To improve substantivity and surface retention, Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) was added. NovaMin (calcium sodium phosphosilicate) is one of the latest technologies for enhanced bonding of minerals to the surface. NovaMin demonstrated surface substantivity and bonding by delivering and retaining both calcium and phosphate to the sensitive area.

NovaMin Technology

NovaMin is a glass ceramic replacement material, developed for bones that were damaged due to traumatic injury (e.g. accidents, weapon trauma, cancer, etc.).[8] As such it was formulated to bond to both bone and soft tissue and was used in dentistry as a particulate for periodontal pocket bone regeneration.[9] Modification of the particulate size enhanced the ability of the material to penetrate the tubules, interact with the dentinal fluid and form a seal over and within the tubules effectively stopping fluid flow.[10] The hydroxy-apatite like occluding layer is harder than the underlying dentin and is resistant to acid challenges to the tooth surface.[11] Incorporating NovaMin with fluoride into a stable toothpaste formulation can effectively deliver desensitizing effects while maintaining the anti-cavity benefits.

*Forms a protective layer over the sensitive areas of the teeth. Brush twice a day for lasting sensitivity protection.
†Benefits observed with twice daily brushing.

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REVISIT SARAH

Making a recommendation in line with preventative dental practice

Sarah needs ongoing protection against the pain of sensitive teeth. She can achieve this by consistently using a toothpaste that repairs* the sensitive areas of her teeth, by releasing calcium and phosphate, the building blocks of teeth.[12]

Sensodyne is a dentist recommended dentifrice containing 5% w/w NovaMin, to†:

- Provide clinically-proven long-lasting protection against DH[12]
- Starts working from week 1[12]
- Offers effective protection against the pain of sensitive teeth, and with continued use, helps prevent it from coming back[12]
- Effectively clean teeth to help maintain gingival health[12]
- Provide fresh minty taste to leave mouth feeling fresh and clean[12]

To help Sarah receive continued protection against the pain and recurrence of sensitive teeth, recommend brushing with Sensodyne Repair & Protect twice daily.[12]

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Best Literature Review

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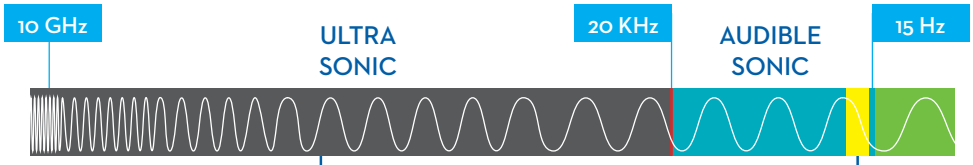
DEBUNKING POWERBRUSH MYTHS

MYTH
At-home sonic powerbrushes can achieve the results of professional in-office ultrasonic scaling devices

REALITY

- ALL powerbrushes can be considered SONIC but SONIC does not equal ULTRASONIC
- NO at-home powerbrushes can achieve professional scaling results

SONIC SCALE
How "sonic" are leading powerbrushes?[1]



Professional in-office cleaning devices:
Ultrasonic Scalers:
- Cavitron
- Cavimed

(28 KHz - 40 KHz)

At-home cleaning devices:
Powerbrushes:
- Oral-B GENIUS
- Sonicare DiamondClean

SONIC: Having a frequency within the audibility range of the human ear*

MYTH
Sonic powerbrushes create fluid movement to clean "beyond the bristles" for superior removal of plaque biofilm

REALITY

ALL powerbrushes require bristle contact to effectively clean teeth

High frequency movements of both oscillating-rotating and side-to-side powerbrush mechanisms create a dynamic fluid force resulting in a unique brushing experience

Oral-B® Pro CrossAction
Oscillating/Rotating Pulsating Action

Sonicare DiamondClean
Side-to-side Action

ORAL-B® GENIUS™ vs. Sonicare Facts
In a head-to-head comparison, Oral-B® GENIUS™ CrossAction is superior vs. Sonicare DiamondClean ($p<0.001$)[2,3]

28 PERCENT
INCREASE IN WHOLE MOUTH PLAQUE REMOVAL[2]

36 PERCENT
INCREASE IN BLEEDING SITE REDUCTION[2]

33 PERCENT
INCREASE IN APPROXIMAL PLAQUE REDUCTION[3]

Oral-B Oscillating-Rotating-Pulsating Power Toothbrush accepted by the ADA.[4]

www.dentalcare.ca

*Merriam-Webster online dictionary. Available at: https://www.merriam-webster.com/dictionary/sonic

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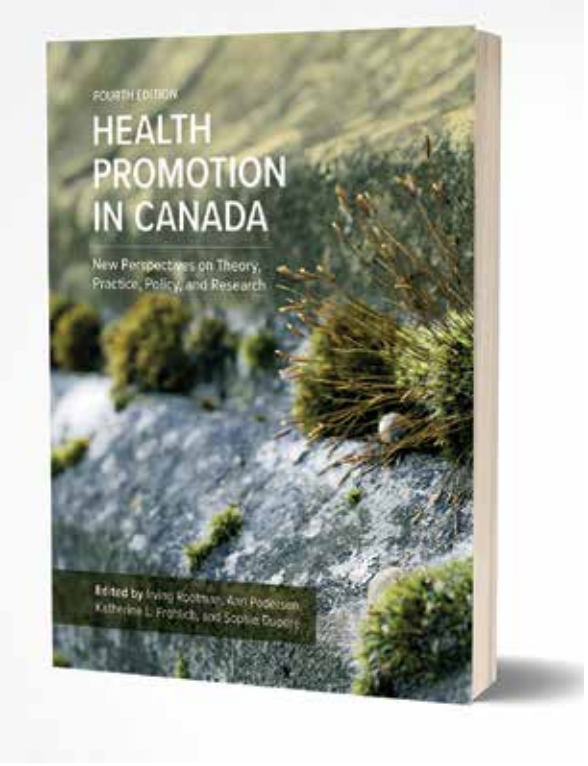
Health promotion in Canada: New perspectives on theory, practice, policy, and research, 4th edition

Edited by Irving Rootman, Ann Pederson, Katherine L Frohlich, and Sophie Dupéré
Toronto: Canadian Scholars; 2017. 498 pp. with index
ISBN 978-1-77338-006-3; available from Canadian Scholars
(www.canadianscholars.ca/books/health-promotion-in-canada-4th-edition)



Since its first publication in the mid-1990s, *Health Promotion in Canada* has become an important compendium that captures, in practical details, the fact that Canada is a pioneer in the field of health promotion practice, policy, and research. This new edition features updated content on health promotion ethics, social theory, health inequities, global ecological change, intervention entry points, and the evolving role of health promotion specialists such as dental hygienists.

The 4th edition expands upon the broad range of key health promotion theories presented in previous editions and introduces new, focused, and topical discussions related to health promotion practice specific to Canadian cities, communities, secondary and postsecondary education, as well as clinical settings. Several additional chapters have been strategically developed, dealing with gender-specific health promotion issues, well-being and mental health, health promotion practices for immigrants, and the ubiquitous influence that evolving digital media has in promoting health in our daily lives. The book is well laid out and leads the reader logically through the initial theoretical constructs of health promotion and how they have evolved and currently relate in the Canadian geographic, political, social, and cultural landscape. Each chapter sets out clear learning objectives and then reviews those objectives in a thought-provoking summary. While the book is intended primarily as a course text for university and college students, it is cleverly designed to be a reference for all health care promotion practitioners involved in clinical, public health or policy development roles. The practical examples used throughout the book relate directly to current issues faced by this country, specifically the shift in population demographics, the ever-increasing demand for government funding of social programs, and the impact of the global economy and evolution of technology on our daily lives.

For example, immigration in Canada is an important contributor to the economic and cultural growth of this country. In considering the health promotion needs of groups such as new immigrant women, the text recognizes that each group is diverse and may face multiple cultural, linguistic, and systemic barriers to healthy behaviour. Moreover, many theoretical constructs of potential importance to these groups have not been identified.

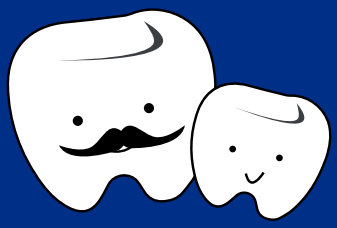
Given the recent attention to issues of mental health and homelessness in Canada's major cities, the authors demonstrate that treatment approaches on their own are not sufficient to improve population mental health. The solution requires a comprehensive approach embracing promotion and prevention alongside treatment and recovery; a focus on mental health rather than solely on mental disorder with a shift from a deficit model of illness to the health potential of people and their everyday settings for living.

The Truth and Reconciliation Commission, the National Inquiry into Missing and Murdered Indigenous Women and Girls, and the opioid crisis are a few high-profile, important issues that are currently being discussed at all levels of Canadian society. The text provides several strategies that address these issues with practical recommendations, building upon the resources in previous editions.

The text demonstrates, with several Canadian examples, that investing in health and social services, active citizenship, and health literacy across all levels of policy development enhances the social inclusion of vulnerable population groups. Health promotion can assist not only individuals and communities, but also institutions such as schools, colleges, and universities to meet their educational attainment targets and their social aims. People who attend school have a better chance of good health; young people who feel good about their school and who are connected to significant adults are less likely to undertake high-risk behaviours and are likely to have better learning outcomes.

Dr. Donald Ross teaches part time in the dental hygiene program at Vancouver Island University, Nanaimo, British Columbia, Canada.

He was formerly both a provincial (Ontario) and federal dental director for Health Canada's First Nations and Inuit Health Branch.



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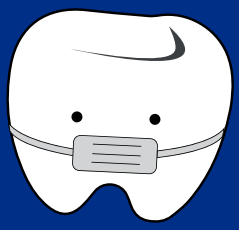

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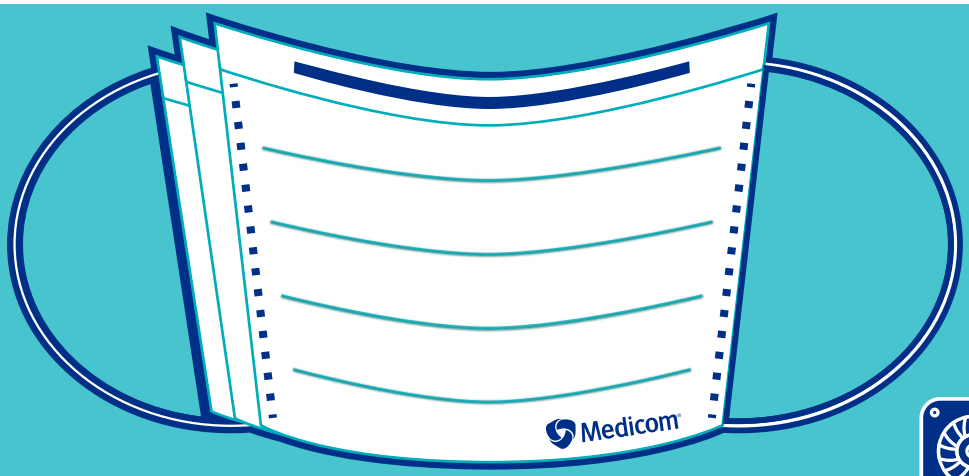
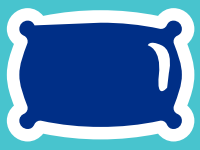


EARLOOPS ARE JUST THE RIGHT LENGTH FOR A **PERFECT FIT**



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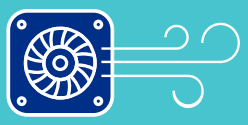

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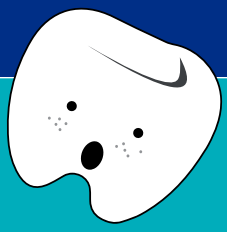

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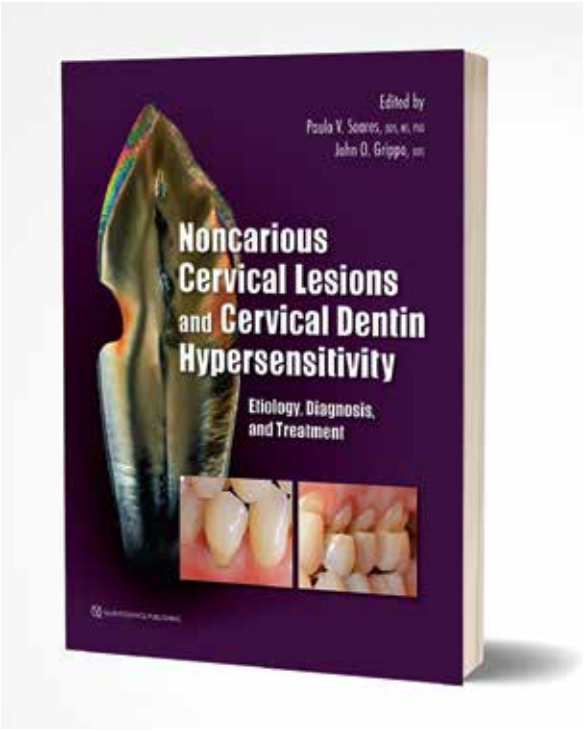
Noncarious cervical lesions and cervical dentin hypersensitivity: Etiology, diagnosis, and treatment

Edited by Paulo V Soares and John O Grippo
Chicago: Quintessence Publishing Co. Ltd; 2017. 196 pp. with index
ISBN 978-0-86715-714-7; available from Quintessence Publishing (www.quintpub.com)

INTRODUCTION

Noncarious cervical lesions (NCCLs) and cervical dentin hypersensitivity (CDH) are common, clinically relevant issues and have been investigated for centuries. This book thoroughly examines the history of documentation, contributing factors, anatomical considerations, as well as diagnosis and treatment. Throughout the textbook, the authors remind the reader of the importance of determining the etiology of the lesion and addressing those factors before masking the symptoms with desensitizer or fillings.



Although they have been documented since the 1700s, NCCLs and CDH are increasing in incidence largely due to individuals' increased psychological stress, acidic diets, and oral self-care techniques. These factors raise the risks of stress, friction, and biocorrosion of the tooth structure, which contribute to NCCLs and are thoroughly detailed in this comprehensive textbook.

The purpose of the book is to provide the most recent data on CDH and NCCLs in order to increase practitioners' awareness of contributing factors, develop their skills to recognize the conditions, and expand their understanding of the options available to manage these lesions. It is recommended for current and future clinical dental practitioners, students, and instructors.

ANALYSIS

Overview

The title of this book directly identifies its subject and purpose. The images on the front cover illustrate clinical examples of NCCLs as well as a large profile sectioned view of an affected tooth.

Both of the editors are highly qualified dentists working in university settings. They have both dedicated a substantial amount of their professional life to NCCLs and CDH and have produced significant contributions to the body of knowledge on the subject. The editors have collaborated with other international experts in the field—a large number of them from Brazil—to create a well-supported tool for dental professionals. The coauthors are all dentists; many are professors, coordinators, researchers, and directors, and there are some students as well, all from a variety of dental-related departments. Many authors have postgraduate credentials including master's and doctoral degrees.

The table of contents allows expedient navigation to the appropriate chapters and is divided into 3 logical sections. The introduction section includes a chapter on the history, prevalence, and etiology of NCCLs and CDH, as well as a chapter on anatomical considerations, specifically enamel, dentin, and periodontium. The second section focuses on the mechanism of action, with chapters on stress, friction, and biocorrosion. The final section addresses the diagnosis and treatment of NCCLs and CDH, with chapters on morphologic characteristics of NCCLs; clinical analysis and diagnosis of CDH and NCCLs; nonrestorative protocols including occlusal, chemical, and laser therapies; and restorative protocols, addressing adhesive bonding, material, and technique. The last chapter examines surgical protocols, periodontal therapy, and root coverage. The book also contains a future perspectives page, an appendix, and an index. Breaking down the chapter titles into bulleted subcategories, such as at-risk populations and preventive

treatment options, might increase readability and improve navigation to specific areas of interest.

Visually, the book effectively uses a variety of high-quality full-colour clinical images as well as illustrations, tables, charts, graphs, and electron microscope views to support the text. This book is well organized, highlighting key factors of the conditions in an easily read and appealing columned format with titles and subtitles. Each chapter draws on extensive references, listed at the end of the chapters. This format helps the reader to confirm the relevance of the resources as they proceed through the text. Although the text is highly referenced, some of the literature cited is very old. For example, there are references from the 1990s, 1980s, and even the 1960s and 1950s. While some of those references are used legitimately when reporting historical methods, the value of research, it must be remembered, diminishes with age.

Content

The glowing forewords by Dr. Kois and Dr. Baratieri are impressive and leave the reader with very high expectations for the book. The introduction to this text highlights its purpose and the relevance of the topic, and outlines the learning expectations for the reader. The first chapter introduces an interesting history of the discovery and diagnosis of NCCLs along with the many accounts of their etiology, helping the reader to understand the depth and complexity of the conditions and their multifactorial elements. All chapters end with a summary, which, although very short, reiterates the main topics of the chapter. Clinical case studies are well documented in the treatment section of the text.

With over 80 contributing authors, there is risk of content repetition and formatting inconsistency. For example, some chapters have an introduction that explains the relevance of the chapter to the overall text, while other chapters lack this subtle link. Although they increase the visual appeal of the book, many of the tables and charts provide unhelpful or incomplete information. Limitations within the current research have led to an unreasonable range in reported prevalence rates of NCCLs and CDH: from 5% to 85%, which is vague and meaningless. It would have been helpful for the authors to comment on these shortcomings or suggest alternative methods of measuring the lesions in order to obtain reliable data for analysis in the future. One topic that was briefly identified for future investigation was the possibility of saliva testing to assist in preventing NCCLs. More information on prevention methods and approaches would be valuable. The authors briefly outline possible clinical studies to pursue in order to further advance the understanding, prevention, diagnosis, and treatment options of the topic.

Although the authors stress the importance of determining the etiology of the lesions, there is limited information on diagnostic techniques when compared to the extensive details in the treatment sections of the text. This imbalance reduces the perceived value of etiology diagnosis. With such a prevalent condition, the authors recognize the need for public health awareness and reduction of risk factors; however, there is no plan outlined or suggestion on how to realize this objective. Although the text stresses that prevention is key, the content is lacking.

As a dental hygienist, I would have liked more in-depth information on appropriate self-care techniques and language to use when instructing clients. Because this text is intended for an international market, specific oral hygiene products are not listed. A discussion of the efficacy of electric toothbrushes in controlling plaque versus their role in NCCLs would be valuable as well. Furthermore, information on at-home fluoride use is limited in this book. A chart or brief summary of the benefits and usage of materials at the conclusion of the chapter on restorative protocols would make it easier to compare the products discussed.

CONCLUSION

Highly accomplished authors have succeeded in creating a specialized book on a topic relevant to dentistry. This book is well researched and covers all aspects of NCCLs and CDH, including history, prevalence, etiology, anatomical considerations, mechanisms of action, diagnosis, and a variety of treatment modalities.

High-quality clinical images, tables and charts, case studies, and supporting research all contribute to this book's ability to effectively address the target audience of dental professionals, students, and instructors. Minor changes in content of the book to expand on prevention and hygiene-specific topics could increase its relevance to the dental hygiene profession.

The book succeeds in increasing the reader's awareness of contributing factors of noncarious cervical lesions and cervical dentin hypersensitivity, assisting in developing skills for prevention and management. This text has extensive treatment details, which are of limited use to dental hygienists. Nonetheless, it is an informative read, and fundamental knowledge of the subject will assist in office protocol and client education. Most critically, as practitioners, we must move away from primarily treating symptoms and move towards properly addressing their cause(s). The major take-away from this text is the importance of diagnosing etiology prior to treating symptoms. Overall, it provides a systematic approach to the recognition and treatment NCCLs and CDH for the dental profession.

Laura Brown, BDSc, RDH, works as a structure content and research specialist (for an electronic health records company) in Calgary, Alberta, Canada.

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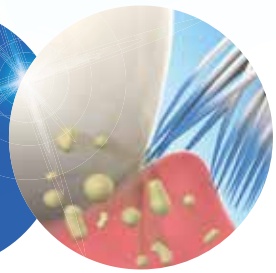
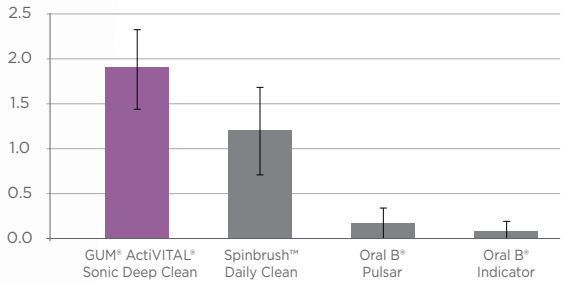
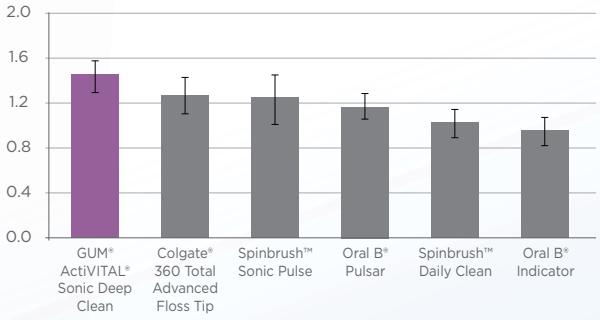


Subgingival Access Efficacy (mm)



Interdental Access Efficacy (cm)



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- Risk assessment and management
- Access to care and unmet needs
- Capacity building of the profession

and must be of the following types:

- Original research articles
- Literature/narrative reviews
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CJDH Looks Forward to Hearing from You!

Une invitation pour les auteurs

Le *Journal canadien de l'hygiène dentaire* (JCHD) invite les auteurs à soumettre des manuscrits en anglais ou en français pour apporter une contribution importante à l'ensemble des connaissances de l'hygiène dentaire et pour faire progresser la base scientifique de la pratique. Les manuscrits doivent traiter d'un des thèmes du *Programme de recherche en hygiène dentaire 2015–2018 de l'Association canadienne des hygiénistes dentaires* (http://files.cdha.ca/profession/research/DHResearchAgenda_FR.pdf) qui suit :

- L'évaluation et la gestion du risque
- L'accès aux soins et les besoins non comblés
- La mise en valeur du potentiel de la profession

et doivent faire partie des types suivants :

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- Revues systématiques
- Revues de la portée
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- Exposés de position
- Lettres à la rédactrice

Veuillez consulter notre document ***Lignes directrices pour les auteurs*** afin d'obtenir de l'information détaillée sur les éléments essentiels de chaque type de manuscrit, y compris le style qu'il faut suivre pour citer les références. Ces lignes directrices et notre ***Code d'éthique*** qui régissent le statut d'auteur, les conflits d'intérêts, l'éthique de la recherche et l'inconduite scolaire sont accessibles en ligne au www.achd.ca/jchd. Toutes questions préalables à votre soumission et toutes soumissions finales doivent être transmises à l'adresse : journal@achd.ca.

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October 27-30, 2018 | Vancouver, BC
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2018 AAP Dental Hygiene Symposium

Saturday, Oct. 27 | 8 a.m. - 5 p.m.
Lunch included | $149 per person | 7.75 CE credits

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New evidence in perio-systemic interactions
Brian L. Mealey and Mia L. Geisinger
Thanks to OraPharma for sponsoring this session

Using the new classification of periodontal and peri-implant diseases in case management
Kenneth S. Kornman
Reactionary panel: Ann Battrell (ADHA), Mandy Hayre (CDHA), and Leslie Winston (Proctor & Gamble)
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The critical role of the hygienist in interdisciplinary care
Nancy Adair

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