



American  
Dental  
Hygienists'  
Association

# Journal of Dental Hygiene

December 2019 • Volume 93 • Number 6

- Enhancing Allied Dental Health Students' Understanding of Poverty through Simulation
- Use of Social Media for Out-of-Class Communication to Enhance Learning: A pilot study
- Similarities and Differences of International Educational Experiences of Dental Hygienists
- Autism Spectrum Disorder: Techniques for dental radiographic examinations
- Eating Competence and Oral Health in Supplemental Nutrition Assistance Program Eligible Populations
- 2019 Dentsply Sirona/ADHA Graduate Student Clinician Research Abstracts
- 2019 American Dental Hygienists' Association Annual Conference Poster Presentation Abstracts

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## Statement of Purpose

The Journal of Dental Hygiene is the refereed, scientific publication of the American Dental Hygienists' Association. The JDH promotes the publication of original research related to the profession, education, and practice of dental hygiene and supports the development and dissemination of a dental hygiene body of knowledge through scientific inquiry in basic, applied and clinical research.

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### Thank you for your Service!

Rebecca Wilder, RDH, MS



I am extremely honored to serve in the role of Editor of the *Journal of Dental Hygiene*. The *Journal* is a source of pride for the American Dental Hygienists' Association (ADHA). The editorial staff spend countless hours to bring the very best peer-reviewed research publication to our members and to the professional community at large. I would like to express my gratitude to the many authors who submit their research manuscripts to us and trust that we will provide a fair, evidence-based review of their work.

In order to provide authors with a fair and balanced review, our reviewers, who give of their time and expertise voluntarily, must not only read the manuscript, but also look at them with a critical eye. This is not meant in a negative sense, but they must use their professional judgment to evaluate the research methodology, the conclusions and their contribution to our scientific base. We rely on science to advance the dental hygiene profession and the *Journal* is one measure of our progressive movement. Our reviewers are the backbone of the *Journal of Dental Hygiene* and we should all applaud them for their service!

We also have reviewers who are not officially part of the editorial review board. Their time and commitment to the dental hygiene profession is to be commended. Most of these individuals are reviewers of other professional publications and some serve as editors of dental journals. We appreciate their time and expertise.

I would like to publically thank Sue Bessner, Director of Professional Development, Tyler Dempsey, Research Coordinator, and Ann Battrell, Executive Director of ADHA, who are all so supportive of the *Journal* and what it represents. Finally, I want to personally thank Cathy Draper who serves as the managing editor of the *Journal of Dental Hygiene*. She works tirelessly for our reviewers, authors and the editor!

The 2019 *Journal of Dental Hygiene* Editorial Review Board is listed below along with this year's guest reviewers. Thank you again for your time, knowledge and commitment to the growth and advancement of the dental hygiene profession. All of us at the *Journal of Dental Hygiene* look forward to working with each of you to continually improve **OUR** Journal!

Sincerely,

Rebecca S. Wilder, RDH, MS

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

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## Enhancing Allied Dental Health Students' Understanding of Poverty through Simulation

Lattice D. Sams, RDH, MS; Lewis N. Lampiris, DDS, MPH; Tiffanie White, RDH, MS;  
Alex White, DDS, DrPH

### Abstract

**Purpose:** Poverty impacts the daily lives of over 40 million Americans. Allied dental health students need to be aware of the oral health barriers experienced by individuals with limited resources. The purpose of this exploratory descriptive study was to evaluate the impact of a poverty simulation exercise (PSE) on students' understanding of daily challenges faced by low-income families.

**Methods:** A total of 34 second-year dental hygiene students and 23 dental assisting students (n=57) participated in a 3-hour Missouri Association for Community Action poverty simulation exercise (PSE). Participants completed a survey immediately following the PSE to determine the degree of change in understanding challenges faced by low-income families. Upon completion of all scheduled community practicum/rotations, participants completed a second survey exploring whether the PSE changed their levels of understanding of the challenges faced by actual low-income families and their impact on oral health.

**Results:** Fifty-five dental hygiene and dental assisting students completed both surveys for a response rate of 96% (n=55). A majority of the respondents (87%, n=46) rated the PSE as extremely valuable in preparing them to understand challenges faced by low-income families and 85% (n=47) indicated encountering families living in situations similar to their role in the PSE. A majority of participants (89% n=48) indicated having a better understanding of how poverty effects oral health status and its impact on access to dental care. In addition, students indicated that they became less judgmental and more empathetic toward low-income families.

**Conclusions:** Results from this study demonstrate that a PSE was effective in eliciting change in allied dental health students' affective perceptions regarding poverty and helped improve their understanding of challenges faced by low-income populations.

**Keywords:** allied dental health education, dental hygiene education, access to care, dental public health, health attitudes

This manuscript supports the NDHRA priority area, **Professional development: Education** (educational model)

Submitted for publication: 3/21/19; accepted: 7/25/19

### Introduction

The code of ethics of the American Dental Hygienists' Association (ADHA) states that dental hygiene professionals should promote access to dental hygiene services for all, supporting justice and fairness in the distribution of healthcare resources.<sup>1</sup> This same concept is reflected in the American Dental Assisting Association's policy, which states that their organization is committed to providing access to oral healthcare services for all individuals.<sup>2</sup> In both statements, there is an important focus placed on all individuals which includes those from diverse backgrounds, experiences, and socio-economic levels. Students enrolled in dental assisting

(DA) or dental hygiene (DH) programs work with diverse patients as they progress through the curriculum, including those currently living in poverty. The United States (U.S.) Census defines poverty using income thresholds, which vary by family size and composition;<sup>3</sup> a family of four earning \$24,849 or less a year is considered impoverished.<sup>3</sup> In 2016, 40.6 million Americans were reported as living in poverty.<sup>3</sup>

DA and DH students in their second-year are required to rotate through a wide range of community-based dental facilities during their course of study at the University of North Carolina at Chapel Hill (UNC). Settings include local

health department dental clinics, federally qualified health centers, correctional institutions, Veteran's Administration and community hospitals, local private practice dental offices, preschool, elementary, and middle schools, senior citizen centers, and assisted living or long-term care facilities. Through these rotation experiences, DA and DH students will likely work with and treat low-income patients and families. Discovering and implementing educational approaches to help students become cognizant of the economic challenges and hardships that low-income patients experience is an important step to helping them develop a clearer picture of how social factors influence patient health decisions.

Yang et al. wrote that, given the rising number of U.S families living below the poverty level, health professional students need to develop and become aware of the barriers and stress factors faced by low-income patients.<sup>4</sup> Health professional students need to be able to move beyond stereotypes and generalizations and examine the reasons why low-income patients may not be able to continue with treatment recommendations or complete a treatment plan. In addition, Noone et al., emphasized the goal of learning activities related to poverty in health education is to help change perceptions from a negative categorization to a more positive understanding and perspective.<sup>5</sup> Simulations have been shown to help learners acquire new knowledge, and to better understand conceptual relations and dynamics.<sup>6</sup> Gaba defines simulation as a technique which replaces or amplifies real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner.<sup>6</sup> Fanning et. al. demonstrated that adults learn best when they are actively engaged in the process, participate, play a role, and experience not only concrete events in a cognitive fashion, but also transactional events in an emotional fashion. Learners must be able to make sense of the events experienced in terms of their own world. The combination of an active experience, particularly when accompanied by intense emotions, may result in long-lasting learning<sup>7</sup>

The Missouri Community Action Poverty Simulation (MCAPS) has been used across health profession disciplines for both undergraduate and graduate level students to help them understand poverty.<sup>4,5,8-10</sup> Evidence suggests that participants who have completed a simulation using MCAPS demonstrated changes in their knowledge and attitudes regarding poverty, experienced heightened awareness of the realities of living in poverty, and were able to identify factors contributing to poverty.<sup>10-15</sup> Using simulations to assist future health care providers in cultivating their ability to reason, tap into their emotional intelligence and improve their skills has been shown to be an exceptional learning modality that can be used to facilitate change.

Dental assisting and second year dental hygiene students attending the UNC Chapel Hill Adams School of Dentistry participated in a MCAPS exercise with the goal of providing the students with an opportunity to gain a deeper understanding of the impact of poverty on health and health-related behaviors for low-income families. The aim of this replicated study<sup>8</sup> was to determine whether DA and DH students' understanding of the daily challenges faced by families identified as low-income was changed as a result of a poverty simulation exercise (PSE) and whether they found the experience valuable.

## Methods:

This exploratory descriptive study was determined exempt from further review by the University of North Carolina, Chapel Hill Office of Human Research Ethics (study #16-2886). In January 2017, 34 second year DH and 23 DA students were required to participate in a 3-hour Missouri Association for Community Action Poverty Simulation (CAPS) exercise. Using methodology replicated from a previous study,<sup>8</sup> students participated in the simulation experience before beginning their mandatory 3-week practicums and weekly spring rotations.

The PSE was designed for participants to role-play the lives of low-income families ranging from single parents trying to care for their children to senior citizens trying to maintain their self-sufficiency on Social Security.<sup>16</sup> The PSE experience included a registration process, simulation experience, and debriefing session. During the registration process, participants were randomly assigned their new identities and families (Figure 1). These identities were based on family profiles created by the Missouri Community Action Network (MCAN). Once assigned their roles, participants reported to their simulation homes labeled with their new family names. Homes were set up in the center of the room surrounded by resource centers (Figure 2). At each home site, families received a packet of information, providing background



*Figure 1: Participants randomly assigned family identities based on family profiles created by Missouri Association for Community Action*



*Figure 2: Participants arranged in family units, reviewing their packets that provided background information of each family member's responsibilities and expectations.*

information on each family member's responsibilities and expectations. The packet also included identification documents, specific items the family needed to keep in their possession, money for various costs including bills that needed to be paid, and transportation passes to move from resource to resource throughout the exercise.

The PSE was facilitated by 4 MCAN trained facilitators, with the primary facilitator acting as the town mayor. The remaining co-facilitators assisted with the resource centers and answered any questions participants had throughout the experience. The primary facilitator provided instructions, ground rules, defined terms, and allowed for the family units to open and read through their packets before the start of the simulation. Community resources, which the families needed to utilize in order to meet the objectives of the PSE, were also introduced and described prior to starting the simulation. Resources included for profit, nonprofit and governmental organizations. PSE resource units included the social service office, mortgage/rent collector, supercenter (Food-o-rama), employment agency and interfaith services. The PSE occurred over one hour of time. For the purpose of the simulation the time was divided into four 15-minute weeks and three 3-minute weekends, representing one month in the life of the family. During the 15-minute weeks, the main goal was to provide the necessities of their family and maintain shelter.<sup>16</sup> Participants had to make sure they attended work or school, paid bills, provided childcare for children, and had some form of transportation. The 3-minute weekend allowed the resource centers the opportunity to regroup and gave families a moment to discuss steps to take for the upcoming week.

A debriefing session took place immediately following the PSE. Facilitators asked the DH and DA students reflective questions regarding the PSE. Questions used to guide discussion included asking how participants felt about the issues they encountered and whether they discovered any emotions and attitudes regarding the challenges and barriers faced by low-income families as a result of the simulation. The debrief session allowed the group the opportunity to express their feelings and build off each other's answers during the open discussion. Following the debrief session, a support specialist familiar with the PSE read a verbal consent script to the participants to complete the paper survey. Participants were informed that the completion of the survey implied consent and that participation was entirely voluntary. The survey instrument was identical to one used in two previous studies that sought to evaluate the impact of a PSE on student understanding<sup>4,8</sup> and consisted of eight items. Five statements asked the participants to focus on their level of understanding of low-income patient challenges

prior to and following the simulation. Each before and after item was rated on a scale of 1 (no understanding) to 5 (almost complete understanding). Participants were also asked to rate the value of the simulation exercise on a scale of 1 (no value) to 10 (extremely valuable) in preparing them to understand the challenges faced by patients who have limited incomes/resources during their rotation. The final two questions were open-ended; "In your opinion, what do you think was the best part of the activity?" and "Please list any suggestions you have to improve this activity." Surveys were returned to an unmonitored drop box in the same room as the PSE.

Participants received a second survey following their community practicum and rotations in April 2017. Data was collected for the DH and DA groups separately due to differing schedules. The same support specialist read the verbal consent script to participants. Following the verbal consent, the post-rotation survey consisting of the same five items regarding understanding levels of low-income populations, was delivered. Participants were asked to reflect using a scale of 1 (no understanding) to 5 (almost complete understanding) on their level of understanding of the challenges facing low-income patients following their practicum and/or community rotation experiences. Participants returned their surveys to an unmonitored drop box. Descriptive statistics were calculated and summarized using Statistical Package for the Social Sciences (IBM SPSS®, Armonk, NY) software.

## Results

Fifty-seven DH and DA students participated in the PSE. Following the simulation and debrief, 55 students completed the survey (n=55) for a response rate of 96%. Three months following the PSE and upon completion of all community rotations, 55 students completed the second survey (n=55) for a response rate of 96%. Incomplete surveys were received from several participants during the first and second survey; questions that the individuals responded to were included in the analysis. Findings from the post-simulation survey showed that 40% (n=22) of participants believed or thought they had a moderate to complete understanding of the financial pressures faced by low-income families prior to participating in the PSE. Responses to the follow-up question regarding the participants level of understanding the financial pressures of this population as a result of the PSE indicated that the majority of the participants (91%, n=49) felt they had a moderate to complete understanding of their financial stress. Statements reported in the open-ended portion of the survey provided insight regarding participants feelings about the experience. One respondent reported that the PSE provided the ability "to see how much stress income puts on families". Another respondent wrote how



the PSE allowed them “to see how the parents of low-income families worked to keep their head above water, to keep life going.”

Following the simulation, a majority (87%, n=48) felt they had a moderate to complete understanding of difficult choices people with low resources must make each month when stretching limited income. In reflecting on their level of understanding regarding the difficulties in improving one’s situation and becoming more self-sufficient on a limited income prior to the PSE, less than half (42%, n=23) thought they had little to no understanding following the PSE, while 100% (n=55) of respondents felt they had a moderate to complete understanding.

Positive increases were also identified when looking at levels of understanding in relationship to emotional stressors and frustrations created due to lack of resources. Prior to the simulation, 67% (n=37) of respondents thought they had a moderate to complete understanding. However, post simulation 98% (n=53) indicated a moderate to complete understanding (Table 1). One participant wrote, “Although poverty can’t be replicated for real, this showed some of the stress that it can put on someone.” Another stated, “The actual act of going through the day and life in poverty, made you realize the challenges. I knew they existed but didn’t realize how limiting they were.”

**Table I. Post survey questions following community rotations**

	<b>Moderate to complete understanding % (n=55)</b>	<b>Little to no understanding % (n=55)*</b>
During your practicum or community rotations to what extent were you able to gain a better understanding of the obstacles low-income families face that may impact their ability to obtain dental care.	<b>80%</b>	<b>20%</b>
During your practicum or community, rotations to what extent were you able to gain a better understanding of the effects of poverty on the oral health status of low-income families.	<b>89%</b>	<b>11%</b>
How much effect, if any, did the poverty simulation have on your ability to be more empathetic toward the low-income patients you served during your practicum or community rotations	<b>80%</b>	<b>20%</b>
How much effect, if any, did the poverty simulation have on your ability to be less judgmental toward the low-income patients you served during your practicum or community rotations	<b>81%</b>	<b>19%</b>

\*some survey questions were left blank by the respondents

A majority of the respondents, (89%, n=47), felt the PSE was moderately to extremely valuable in preparing them to understand the challenges faced by the patients with limited incomes that they would likely see in future practicum experiences and rotations. Only 6% (n=3) felt neutral towards how the PSE had prepared them and 6% (n=3) responded that the PSE had little to no value in preparing them to care for future patients living in poverty. When looking at the sum of respondent’s perceptions before and after the PSE, the overall impact of the experience showed a positive increase in understanding by an average of 5 units.

Three months after completing the PSE, and after completing their community practicum and rotations, students completed a second questionnaire. There were slight increases in the levels of understanding of the financial challenges of poverty (Figure 3). A majority (85%, n=47) of participants indicated encountering families living in situations similar to those portrayed during the PSE. Of those surveyed, 89% (n=48), reported that during the practicums or community rotations they gained a moderate to complete understanding of the effects of poverty on the oral health status of low-income families, while 11% (n=6) revealed having little to no understanding. When asked about the effect of the simulation exercises’ ability to increase their level of empathy towards the low-income patients served during their practicum or rotations, over three-fourths, (80%, n=44) felt that they became moderately to completely empathetic.

The PSE also had a positive effect on (81%, n=44) participants’ ability to be less judgmental toward the low-income patients served during their practicum or community rotations. Over three fourths of the participants, (76%, n=41) found the PSE to be valuable in helping to prepare and understand the challenges faced by patients with limited incomes/resources encountered during their practicums or rotations. One respondent wrote, “It was a wonderful way of understanding how people strive to live in day to day life. It was overall an eye opener for people who do not experience these things.”

Regarding the value of the PSE in relationship to practicums and community rotations suggest that participants who may have experienced poverty themselves felt that some participants did not take the PSE seriously. One participant wrote, “This isn’t new to me, my mother raised 3 kids on her own while my dad was on drugs. It was nice to see others come and try to see how people in poverty live/grew up. But I felt others thought it was a waste of time. Some laughed and did not take it seriously.” Another wrote, “I feel that my own experiences as a member of a low-income family helps me understand others. I felt that some students, who perhaps do not share these experiences, took the simulation as a game.” In contrast another respondent wrote, “The simulation was very valuable for me. It opened my eyes to the struggle people face trying to improve their socioeconomic status. It’s not as simple as I once thought.” An additional comment stated, “I think it was very helpful to have the simulation because during rotations we will see certain situations and will know how to approach them.” (Table II)

**Table II. Select open-ended responses post-simulation and post community rotation**

Post Simulation	In your opinion, what do you think was the best part of the activity?	<p>The actual act of going through the day and life of a person in poverty really made you realize the challenges. I knew they existed but didn’t realize how limiting they were.</p> <p>The “realness” of the simulation. Although poverty can’t be replicated, this showed some of the stress that it can put on someone.</p>
	Please Provide any additional comments you have about this morning’s Poverty Simulation.	<p>I found it very eye opening</p> <p>I appreciate this simulation because my family is low-income, and it makes me appreciate everything they have done for me.</p> <p>I think it’s so important for people who haven’t experienced poverty first hand to understand and hope to make them less judgmental.</p>
Post Community Rotation	Please share any additional thoughts or comments about the value of the poverty simulation in relation to your practicum or community rotations	<p>This simulation was very valuable for me. It opened my eyes to the struggle people face trying to improve their socioeconomic status, it’s not as simple as I once thought.</p> <p>I think it was very helpful to have the simulation during rotations we see certain situations and must know how to approach them.</p> <p>I think it is an exercise that all healthcare professionals should complete</p>

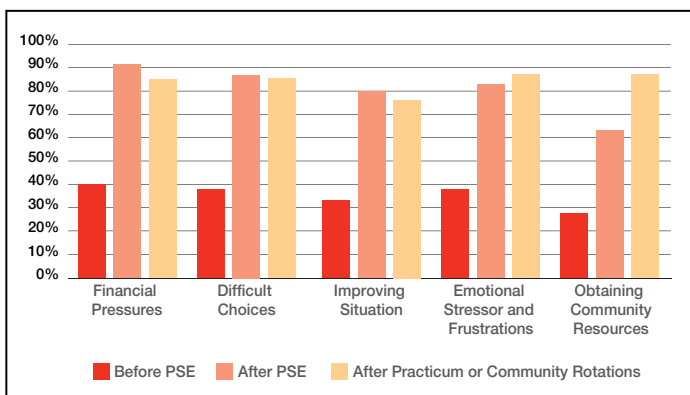
## Discussion

The purpose of this study was to increase DH and DA students’ understanding of the daily challenges faced by families living with low incomes. Results confirmed that the participants’ level of understanding changed substantially in all categories following the PSE (Figure 3). When comparing results from this study to a previous study focusing on dental students, a similar percentage of students in both studies reported that the PSE was moderately to very valuable<sup>8</sup> (Figure 4). Participants in both studies displayed an increased understanding of the financial pressures, difficult choices, difficulty in improving one’s situation, emotional stressors and the impact of community resources experienced by low-income families.

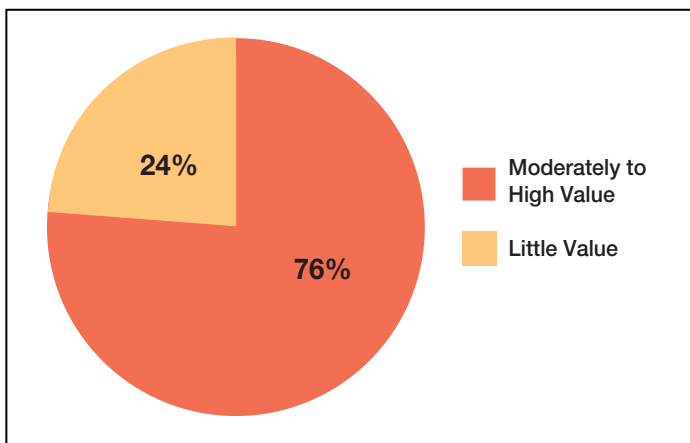
Unlike previous studies, this study included a second evaluation of the PSE after students returned from their community rotations, two months following the initial poverty simulation. Results suggest the knowledge and impact gained from the initial PSE continued to influence the participants far beyond the day of the simulation and levels of understanding remained high or increased in some categories.

Several other studies with a focus on the use of simulation to teach about poverty were noted as being effective in causing significant changes in knowledge and attitudes in relation to poverty.<sup>11-14,17</sup> Disciplines effected by these simulation studies included nursing, social sciences, health and human services, as well as others.<sup>11</sup> It is noteworthy that these studies also used the same MCAPS kit utilized in this study and increases in participant knowledge and attitudes in several categories are similar to findings previously cited in the literature.

Findings from this study capture the goal of simulation when improving practice as described by Zigmont et al. In simulation, the learner moves from comprehension, to application, and analysis; bringing all aspects of the experience together.<sup>18</sup> Allied dental health students and practicing clinicians taking part in simulations such as the MCAPS should be able to take their learning to a higher level. Through the PSE, participants learn not only based on the



**Figure 3. Changes in level of understanding**



**Figure 4. Poverty Simulation value in preparing to understand the challenges faced by patient who have limited income/resources that you saw during the practicum or community rotations.**

exposure received from working within their roles and family problems that arise in the “simulated world” but they are also able to transfer their feelings and use the knowledge and empathy gained to help them work through real life clinical situations. In the Zigmont et al. study, it was also found that learner competencies in analytical and knowledge application were more evident following simulation experiences.<sup>18</sup>

Oral health disparities continue to persist in the U.S. Both the dental hygiene and dental assisting professions can act as key stakeholders in helping to close the gaps that still exist. Incorporating immersive simulation exercises that initiate change in attitudes, and increase awareness on issues, can be beneficial additions to the DH and DA curriculum. Increased understanding of struggling families unable to afford the basics of life, can influence healthcare providers’ perceptions and decisions when providing care.

Limitations of this study include not identifying within the

questionnaire any mixed experiences with poverty brought to the experience by the participants. Several of the students grew up in poverty and knew the challenges people face. Another limitation of the study is that the PSE lasted only one hour. Subsequent discussions on socio-economic status and its impact of dental care may help to increase understanding and change perceptions following the simulation. Future research should focus on how simulation experiences focusing on poverty also connect with greater understanding of diversity/inclusion and levels of cultural competency. Incorporating questions on cultural competency during the debrief section of the PSE to stimulate discussion could demonstrate the need for additional cultural competency training or activities.

### Conclusion

Results from this study demonstrated that a PSE was effective in eliciting change in allied dental health students’ affective perceptions regarding poverty and raised their understanding of challenges faced by low-income populations. Understanding the impact and barriers impoverished families and individuals face is of importance for all dental health providers across all settings.

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## Use of Social Media for Out-of-Class Communication to Enhance Learning: A pilot study

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### Abstract

**Purpose:** Higher education teaching has been traditionally delivered through a lecture format, limiting the opportunities for interpersonal communication between faculty and students. The purpose of this study was to determine whether entry-level dental hygiene (DH) students and faculty perceive social media (SM) applications as an effective out-of-class communication (OCC) tool for enhancing learning in a dental hygiene program.

**Methods:** A cross-sectional, comparative research design was used for this pilot study. An investigator-designed, paper survey was administered to a convenience sample of entry-level DH students and faculty from nine dental hygiene programs in Utah, Idaho, Oregon, Washington, and California. Data were analyzed using descriptive and inferential statistics ( $p=0.05$ ).

**Results:** A total of 418 students and 149 faculty members met the eligibility criteria; 325 DH students ( $n=325$ ) and 77 faculty completed the surveys ( $n=77$ ) for a combined response rate of 70.9%. While most faculty and DH students agreed SM could enhance learning for OCC, their level of comfort using these applications varied. Both faculty and DH students use SM applications for questions about assignments, clarification on lecture topics, and feedback on assignments. Statistical significance was found for the frequency of using SM applications for OCC ( $\chi^2=16.92$ ;  $df=4$ ;  $p=.002$ ). Learning management systems were used and preferred most by both groups followed by Facebook. Statistical significance was found between both groups when ranking electronic devices for OCC.

**Conclusion:** Dental hygiene students and faculty differ in their frequency and levels of comfort in using SM for out-of-class communication. Additional research related to the phenomenon of social media and communication to enhance learning in dental hygiene should be explored.

**Keywords:** social media, education methods, dental hygiene education, curriculum, dental hygiene students

This manuscript supports the NDHRA priority area, **Professional development:** Education (educational models).

Submitted for publication: 5/4/19; accepted: 8/8/19

### Introduction

Teaching methods in higher education have traditionally been delivered through a mass lecture format, limiting the opportunities for interpersonal communication between faculty and students.<sup>1</sup> The quality and quantity of communication between students and faculty in higher education has been associated with student success and retention in dental hygiene programs.<sup>2</sup> Interactions and communications among faculty and students can increase student motivation, engagement, satisfaction in academic and non-academic life, student persistence in academic pursuit, and in the facilitation of teacher immediacy and trust.<sup>3</sup>

Traditionally, student-faculty communication has been face-to-face during office hours or via the telephone. However,

the introduction of the Internet and other technological advances has increased the options of communication tools, including social media which is popular among the digital natives and millennial students.<sup>4</sup> Social media (SM) is defined as “a communication medium that is devoted to or characterized by interaction between participants or consumers of the medium.”<sup>4</sup>

Optimal teaching and learning is dependent upon effective communication between the teacher and student. Dobransky and Frymier found that students who participated in out-of-class communication (OCC) with faculty during a course reported higher levels of cognitive learning and a more favorable perception of overall learning.<sup>5</sup> Conventional faculty

office hours have not been fully utilized by students, and an increasing number of students are requesting more options for OCC with faculty. Evidence in the differences between perceived expectations and comfort levels of educators and students concerning use of SM in higher education has been found in the literature.<sup>4</sup> This difference in comfort and use of SM between students and faculty has been labeled the social media-based communication gap.<sup>4</sup> As technology continues to advance, more options for OCC tools using social media have emerged.

Roblyer et al. concluded that faculty use SM primarily for personal reasons, and found that only 15% of faculty reported using SM to communicate with students and nearly one-third of the faculty expressed uncertainty about SM applications being useful for educational purposes.<sup>6</sup> In another study assessing dental school faculty members' use and preference of SM applications, Arnett et al. concluded that SM sites were both underdeveloped and underestimated in terms of their potential educational value to the profession.<sup>7</sup> Use of SM use may enrich learning in dental education by illustrating curricula by offering students additional mechanisms to collaborate with faculty and fellow students; enhancing the quality of homework; increasing the retention and application of knowledge and skills; instilling the value of active participation and self-directed learning; and providing a platform for more frequent interdisciplinary collaboration and the development of communities of learners.<sup>7</sup>

DiVall and Kirwin's findings from a mixed observation and qualitative study of pharmacy students corroborated the results of Roblyer et al. regarding students' perceptions of SM as an OCC tool.<sup>6,8</sup> The pharmacy course utilized a learning management website and a class specific Facebook page. Identical information was available on the learning management site and the Facebook page and student preferences were evaluated. Observational results showed that students were more likely to be exposed to course content through the Facebook page than the learning management website and a post-course survey indicated that 86% of the students found the course Facebook page to be beneficial.<sup>8</sup> Similarly, undergraduate business students in another study indicated that the course Facebook group page stimulated them to acquire resources from teachers and other classmates, ask for solutions to assignments, and/or provide comments to other students and to the instructor. Perceived ease of use was cited as the critical factor influencing student acceptance of the course Facebook page.<sup>9</sup>

A systematic review of the benefits and challenges of SM use in medical education identified student engagement as one

of the main benefits of SM use.<sup>10</sup> Increased opportunity for feedback, increased communication from peers and faculty to students, enhanced collaboration, professional development, career networking and advancement, and resource sharing were also identified as benefits. Technical issues and varying levels of student participation were challenges of SM use in educational settings along with privacy concerns, policy restrictions, and time requirements from both the student perception and faculty perception.<sup>10</sup>

Beebe et al. found that a variety of technologies are being incorporated into dental hygiene programs to supplement educational strategies.<sup>11</sup> Both faculty and students reported increased access to learning resources as an advantage, while faculty also reported increased student engagement.<sup>11</sup> Students reported that technology facilitated communication with instructors and classmates.<sup>11</sup> Barriers due to technical difficulties identified in the systematic review<sup>10</sup> were also reported by nearly three quarters of both the faculty and students.<sup>11</sup>

Some dental hygiene programs have established policies prohibiting SM communication between faculty and students.<sup>12</sup> Among the dental hygiene directors queried by Henry and Pieren regarding whether their programs' code of conduct policy specifically addressed SM, nearly all (96%) programs had a code of conduct policy, however only 36% specifically mentioned SM.<sup>12</sup> Of those indicating that SM was not currently included in their code of conduct policy, over half (55%) stated they were considering adding SM to the policy.<sup>12</sup> Determining SM trends and patterns by faculty and students for OCC may influence and guide SM policy formation in dental hygiene programs.

The Uses and Gratification Theory (UGT) and the Technology Acceptance Model (TAM) as they relate to SM use for OCC provides a theoretical framework for understanding SM use for OCC. The UGT supports the use of technology as a means for OCC research by examining the "how and why" individuals select and use specific media to satisfy their communication needs. The UGT defines the role of the individual as one who actively seeks, selects and uses media in order to achieve gratification by accomplishing a goal or fulfilling a need. When expectations are met or exceeded, recurrent use of the media leads to habitual use.<sup>13</sup> Quan-Haase and Young applied the UGT to new media options introduced by developing technology.<sup>13</sup> The ongoing relevance of the UGT persists as technology advances and increases the options for media use in educational programs, by exploring the motives behind why individuals will choose and use specific media.

Similar to the U&G theory, the Technology Acceptance Model (TAM) presents two important factors that influence how technology is accepted and used.<sup>9</sup> First, the technology must be perceived as useful. The perceived usefulness refers to the expected positive benefits of technology use as the determining factor of the intention to use, and has been positively associated with adoption of SM in an educational setting.<sup>9,14-15</sup> Arrigoni et al. stated that when choosing communication tools, it is important to consider the usability of the communication tools and their potential and purpose.<sup>16</sup> Second, technology must be perceived as easy to use. The ease of use factor is a strong predictor determining the acceptance of technology, especially in the early adoption phase.<sup>9</sup> The TAM presents two factors that support the “how and why” of media and technology of the UGT. Using the TAM and the UGT, a deeper evaluation of student and faculty perceptions concerning SM use as an OCC tool can be evaluated.

The purpose of this pilot study was to determine if entry-level dental hygiene students and dental hygiene faculty perceive using SM applications as an OCC tool can enhance learning in a dental hygiene program.

## Methods

This cross-sectional, comparative research study evaluated entry-level dental hygiene students’ and dental hygiene faculty members’ social media utilization and preferences for OCC to enhance learning. Variables tested included: learning, entry-level dental hygiene students, dental hygiene faculty, social media applications, and electronic devices.

An investigator-designed survey was constructed based on the literature to evaluate the hypotheses. A report by comScore cited the most popular SM applications by adults, including digital natives or millennial students (individuals born between 1980-2001, aged 18-24 years)<sup>17</sup> which represents average entry-level dental hygiene students. For the purpose of this study, the top four SM applications that were both collaborative and facilitate communication between two parties were selected for this questionnaire included Facebook, Facebook Messenger, Twitter and SnapChat. Learning management systems (LMS) were also included in the questionnaire as educational institutions have used LMS to facilitate communication and enhance learning between faculty and students. In addition, the types of electronic devices used to access SM applications for OCC were also studied. The Pew Research Center studied the types of devices that affect how adults interact and communicate with each other and spend their time, and identified the cellular or smartphone as the most popular device.<sup>18</sup> Desktop, laptop,

and tablet computers were additional devices owned by adults that facilitate communication through SM applications.<sup>18</sup> Considering this information, the survey included items related to electronic device type (smartphone, desktop computer, laptop computer, and tablet). Abbreviations SM and OCC were written out fully on the survey.

Validity, using a Content Validity Index,<sup>19</sup> was tested by five dental hygiene educators, who were not participating in the study and all items were rated as being either relevant or very relevant. The survey was also evaluated for reliability by another cohort of dental hygiene experts using the test/retest procedure. The research protocol was deemed exempt by the Human Subjects Research Committee at Idaho State University (IRB -FY2017-227).

A convenience sample of dental hygiene students and faculty from nine entry-level dental hygiene programs in Utah, Idaho, California, Washington, and Oregon were invited to participate. The dental hygiene programs were located in community colleges offering associate degrees and in four-year university settings offering either associate or baccalaureate degrees.

Students were required to be enrolled in a dental hygiene program as either a first- or second-year student at the time the survey was completed to be eligible to participate. Students who had graduated, were enrolled in a degree completion or a graduate program, or were expecting to enroll in a dental hygiene program at a future date were not eligible to participate. Eligibility requirements for dental hygiene faculty included being employed as full time, part-time, or adjunct and teaching a didactic course or in the clinic setting with a license as a Registered Dental Hygienist (RDH), Doctor of Dental Surgery (DDS), or Doctor of Medicine in Dentistry (DMD).

Paper surveys were mailed to a designated survey administrator at each participating dental hygiene program. The survey administrator distributed the survey to eligible, dental hygiene students and faculty according to written instructions to ensure uniformity in administration at each participating site. The survey packet included a cover letter, an informed consent statement, and questionnaires. After participants completed the survey, the completed questionnaires were mailed back to the principal investigator in a return postage-paid envelope. Data was entered manually into SPSS Statistics 24 software (IBM; Armonk, NY) . Descriptive and inferential statistics were utilized for data analysis, significance was established at  $p=0.05$ .

**Table I. Demographic information**

Dental hygiene students (n=321)*		
Gender	n	%
Male	18	5.5%
Female	303	93.2%
Age		
17-22 years	94	28.9%
23-28 years	145	44.6%
29-34 years	52	16.0%
35+ years	30	9.2%
Student Year		
Freshman	0	0%
Sophomore	23	7.1%
Junior	144	44.3%
Senior	154	47.4%
Faculty (n=77)		
Gender	n	%
Male	7	9.1%
Female	70	90.9%
Age		
20-30	6	7.8%
31-40	16	20.8%
41-50	25	32.5%
51-60	19	24.7%
61-70	8	10.4%
70+	3	3.9%
Years teaching		
0-9	48	62.3%
10-19	21	27.3%
20-30	5	6.5%
30+	3	3.9%
Education level		
Bachelor's	30	39%
Master's	35	45.5%
Doctorate	8	10.4%
Teaching position		
Full-time	34	44.2%
Part-time	14	18.2%
Adjunct	29	37.7%

\*4 students did not provide demographic information

## Results

A total of 418 students and 149 faculty members met the eligibility criteria; 325 students (n=325) and 77 faculty completed the surveys (n=77) for a combined response rate of 70.9%.

The majority of students and faculty were female; most students were younger than 34 years of age while most faculty were older than 41 years of age. A majority of the faculty (62%) had been teaching for less than 10 years and most were registered dental hygienists. Table I provides a summary of demographic data for both students and faculty.

Respondents were asked how learning was enhanced by using SM for OCC. Most students and faculty were similar in their viewpoints on how SM enhanced learning. One exception was under the question “facilitates acquisition of new knowledge.” For this item, a higher proportion (55.8%) of faculty members selected this option as compared to students (35.7%), which was statistically significant ( $p = .001$ , Table II).

Students and faculty were asked to rate how comfortable they were using SM as an OCC tool. Four hundred participants responded to this survey item (Table III). Pearson Chi Square was used to determine significant difference in the comfort level of entry-level DH students and faculty using SM as an OCC tool and the results were not statistically significant ( $p = .36$ ).

Respondents were given options to choose how SM was currently being used for OCC. Both faculty and DH students selected “questions about assignments,” “clarification on lecture topics,” and “feedback on assignments” as their top three choices for this survey item (Table IV). Pearson Chi Square results were statistically significant for “questions about

**Table II. Enhanced learning using social media for out-of-class communication**

Learning Enhanced Responses	DH Students		Faculty		$\chi^2$	df	P*
	n	%	n	%			
Ready access for students and faculty to communicate	257	79.1	59	76.6	0.22	1	.64
Increases engagement in course	165	50.8	34	44.2	1.09	1	.30
Encourages active thinking	142	43.7	35	45.5	0.08	1	.78
Facilitates connections between the course and personal life	135	41.5	27	35.1	1.08	1	.30
Facilitates acquisition of new knowledge	116	35.7	43	55.8	10.57	1	.001*
Ability to ask for feedback is increased	223	68.6	51	66.2	0.16	1	.69
Ability to give feedback is increased	212	65.2	49	63.6	.07	1	.79
Increases communication options between students and faculty	231	71.1	62	80.5	2.81	1	.09
I do not think learning is enhanced	17	5.2	3	3.9	.24	1	.63

\* For a familywise error rate of .05 to be maintained, the criterion for each test to be statistically significant would be a p value of .006 or less (.05/9 is the Bonferroni adjustment). This is the only test that met the criterion; therefore, this test is statistically significant. The degree of association was  $\phi = .16$ , and the effect size is small (.10-.30 range).



**Table III. Comfort level for using social media**

	DH students		Faculty	
	n	%	n	%
Very Uncomfortable	71	21.8	18	4.0
Uncomfortable	21	6.5	6	8.0
Somewhat Comfortable	56	17.2	19	25.3
Moderately Comfortable	85	26.2	17	22.7
Very Comfortable	92	28.3	15	20.0

$\chi^2= 4.34$ ;  $df=4$ ;  $p=.36$  (Phi Coefficient = .10)

tests,” “questions about assignments,” and “I do not use SM” ( $p = .001$ ). While more DH students use SM for questions about tests and assignments than faculty, more faculty noted that they did not use SM for OCC with students.

Respondents were asked to identify their frequency of use of SM applications for OCC (Table V). Most students and faculty indicated they use SM 10 or more times per semester. Pearson Chi Square showed these responses were statistically significant ( $\chi^2 =16.92$ ;  $df =4$ ;  $p =.002$ ). Cramer’s phi coefficient was .21 representing a small effect size. The locus of the difference appears to be the percentage of the “do not use” responses and the percentage of the “10+ times per semester” responses between students and faculty.

**Table IV. Usage of social media for out-of-class communication**

Uses of Social Media	DH Students		Faculty		$\chi^2$	df	P'
	n	%	n	%			
Feedback on tests	133	40.9	21	27.3	4.91	1	.03
Questions about tests	152	46.8	18	23.4	13.96	1	.001*
Feedback on assignments	186	57.2	36	46.8	2.76	1	.10
Questions about assignments	223	68.6	34	44.2	16.15	1	.001*
Clarification on lecture topics	195	60.0	39	50.6	2.24	1	.14
Advising	90	27.7	11	14.3	5.95	1	.02
Informal communication	95	29.2	20	26.0	.32	1	.57
Use social media for out-of-class communication between students and faculty, but not all	115	35.4	19	24.7	3.21	1	.07
I do not use social media for out-of-class communication between students and faculty	31	9.5	22	28.6	19.70	1	.001*

\*9 tests were conducted to compare the two groups across the survey questions options; for a familywise error rate of .05, the Bonferroni adjusted criterion of each test should be  $p <.006$ . Based on this criterion, three tests were statistically significant as indicated by\*.

Dental hygiene students and faculty were asked to rank the SM applications they use for OCC. Learning management systems was used most frequently by both groups ( $n=223$ , 71.5% for students;  $n=51$ , 68.9% for faculty) followed by Facebook ( $n=68$ , 22.1% for students;  $n=11$ , 15.5% for faculty). Twitter, SnapChat, and Facebook Messenger were least used in comparison (data not shown). Findings were statistically significant between all groups at the  $p <.001$  level with the exception of the Twitter group as shown in Table VI. The major difference indicated the faculty members did not use any of these SM applications in comparison to the students.

**Table V. Frequency of social media use for out-of-class communication**

Frequency	DH Students		Faculty	
	n	%	n	%
1-3 times per semester	37	11.4	7	9.6
4-6 times per semester	45	13.9	10	13.7
7-9 times per semester	32	9.9	7	9.6
10+ times per semester	178	54.9	29	39.7
Do not use Social Media for Out-of-Class Communication	32	9.9	20	27.4

$\chi^2= 16.79$ ;  $df=4$ ;  $p=.002$  (Phi Coefficient = .21)

Respondents were asked to rank the SM applications they prefer to use for OCC. Results were similar between faculty and DH students (Table VI). Learning management systems were preferred most often by DH students ( $n=221$ , 70.6%) and faculty ( $n=54$ , 74.0%) followed by Facebook (DH students  $n=64$ , 20.6%; faculty  $n=9$ , 13.2%). All other

**Table VI. Social media applications used for out-of-class communication**

Application	Social Media Used			Social Media Preferred		
	$\chi^2$	df	<i>p</i>	$\chi^2$	df	<i>P</i> *
Facebook	25.44	5	.000*	11.96	5	.035
Twitter	11.82	5	.037	8.30	5	.140
SnapChat	26.24	5	.000*	16.69	5	.005*
Facebook Messenger	22.47	5	.000*	7.82	5	.167
Learning Management System	46.24	5	.000*	26.61	5	.000*

\*Statistically significant at the Bonferroni adjusted criterion of .05/5 =.01.

**Table VII. Type of electronic device used for out-of-class communication**

Device	$\chi^2$	df	<i>P</i> *
Smartphone	76.04	4	.000*
Laptop computer	47.18	4	.000*
Desktop computer	80.39	4	.000*
Tablet	16.06	4	.003*

\*Bonferroni adjusted criterion for statistical significance.05/4=.0125; all tests were statistically significant.

categories were “do not prefer” for faculty except for the “learning management system.” Statistical significance was found between SnapChat and LMS most likely due to the large difference in the number of students who do not prefer SnapChat compared to faculty, and due to the number of faculty preferring LMS as compared to faculty who do not prefer it at all.

Dental hygiene students and faculty ranked the electronic devices used most frequently for OCC (Table VII). DH students ranked the smartphone as their first choice (n=181, 58.6%) while the laptop was a second choice for electronic device use (n=146, 47.4%). Faculty identified the laptop as their first choice for electronic device use (n=26, 35.6%), and desktop was their second choice (n=24, 32.9%).

## Discussion

This study examined dental hygiene students and faculty perceptions whether the utilization of SM applications as an OCC tool would also enhance learning. Results from this study indicated both faculty and DH students see the relevance of SM for increasing course engagement, encouraging active thinking and providing ready access for communication. Faculty participants felt that the use of SM

facilitated acquisition of new knowledge and only about five percent of DH students and faculty felt that SM for OCC did not enhance enhanced learning. These findings support those of Samuels-Peretz et al. who studied faculty and students in six different college-level courses in ten disciplines using SM.<sup>20</sup> Their results showed students agreed SM facilitated higher order, integrative, and reflective learning, and the faculty perceptions of learning was highly correlated with those of the students.<sup>20</sup>

A majority of students in the Samuels-Peretz et al. study, reported using SM tools in their courses several times per week.<sup>20</sup> This finding corresponds with results from this study which showed DH students were using SM applications in their courses ten or more times per semester. One-third of the dental hygiene faculty were using SM applications as part of their courses as frequently as students. However, 27.4% of faculty indicated not using any SM applications at all and nearly 10% only used SM 1-3 times per semester. These results suggest there is a SM communication gap between the faculty and the DH students, or a reflection of clinical dental hygiene faculty survey participants not using SM applications in their teaching role. Esteve del Valle et al. suggested another reason for lack of faculty use of SM applications may be a lack of technology support.<sup>21</sup>

A majority of DH students in this study indicated being very comfortable or moderately comfortable (54.5%) in using SM for OCC, however the faculty respondents had greater variation in their comfort levels. Open ended comments provided by DH students to explain a “very uncomfortable” (21%) response were incongruent with that selection, indicating that some respondents may have mismarked or misread the comfort scale. Examples of these comments include “using for a long time,” “easily accessible,” “faster,” “easy to use,” “grew up with technology and social media,” “continually use it,” “love it,” “I know how to navigate and use a computer and Internet,” are examples of responses indicating that the respondent may be comfortable using SM as opposed to the “very uncomfortable” choice selected. Dental hygiene students’ comfort level and frequency of use identified in this study parallel the “ease of use” and “perceived usefulness” of technology associated with the Technology Acceptance Model.<sup>9</sup> The ease of use represents an underlying factor as to why students select SM for OCC, which also

corresponds with the Uses and Gratification Theory which explains media choice for needs fulfillment.<sup>13</sup>

Use of electronic devices for OCC differed between DH students and faculty in this study. Faculty reported using either a laptop or desktop, while DH students used smartphones most often for OCC. One explanation for this difference is that the educational institution might be providing laptop or desktop technology for work-related use, and faculty may prefer to use smartphones for personal use. Dental hygiene student demographics indicate they are a younger cohort and more likely to gravitate toward smartphone technology; a finding supported by a study of nursing students in an undergraduate program.<sup>22</sup>

Several limitations to this pilot study must be noted. A convenience sample was used of faculty and DH students from dental hygiene programs in the western United States and the results cannot be generalized to the entire population. In addition, the survey was self-designed, however it was generated from the literature and validity was established using a Content Validity Index. An assumption was made that the participants would understand the term social media so it was not defined as part of the directions to the respondents. Some faculty commented they did not believe that a LMS was an example of social media. The literature supports LMS as a social media application;<sup>20, 23</sup> a definition of social media application in the survey directions may have clarified this. However, by including a broad selection of SM applications, this study exposed a difference in beliefs among DH students and faculty concerning which applications are considered SM. Additional research is needed to explore this difference. Furthermore, demographic variables were not correlated with the defining variables of the study.

Additional research related to SM and OCC in dental hygiene education is needed. In particular, it is important to examine the impact of university policies on social media and how they influence faculty members' use of SM and ability to use SM for OCC with students. Samuels-Peretz suggests that the integration of SM into college courses can support deeper learning.<sup>20</sup> However, if university policies stringently limit the use of SM, faculty may interpret these policies as prohibitive to SM use as a learning tool. Qualitative research could be conducted to further explore faculty perceptions of their expertise and comfort with SM applications, and make comparisons based on generational demographics. Esteve del Valle et al. suggest institutions desiring to encourage future adoption and use of SM in teaching to enhance learning should utilize more experienced instructors for input, and provide technology offerings to further support SM use.<sup>21</sup> This study

also demonstrated there were differences between faculty and DH students in SM use and preferences. Expanding this study to include a larger and more demographically diverse student population may provide further insight on distinctions between DH students and faculty regarding SM use, experiences, preferences and perspectives to guide future education and training on integrating SM technology into the dental hygiene curriculum.

## Conclusion

Social media as an out-of-class communication tool is perceived as contributing to optimal learning and teaching. Dental hygiene students and faculty differ in their frequency and levels of comfort in using SM for out-of-class communication. Additional research related to the phenomenon of social media and communication to enhance learning in dental hygiene should be explored.

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# Similarities and differences of international educational experiences of dental hygienists

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### Abstract

**Purpose:** Better understanding of dental hygienists' educational experiences may contribute to a more globally integrated dental hygiene (DH) profession. The purpose of this study was to assess similarities and differences of the educational experiences of dental hygienists who had completed DH programs in a broad spectrum of countries.

**Methods:** Dental hygienists, educated in DH programs outside of the United States (US), were surveyed regarding their educational experiences in various subject areas/courses and their clinical skills. The International Federation of Dental Hygienists distributed study information, link for the informed consent, and 28-item survey to their member country House of Delegates representatives, along with a request to forward the survey information to their association members. Additionally, DH faculty at programs outside of the US were identified and invited to participate. Descriptive statistics were used to analyze the data.

**Results:** A total of 513 dental hygienists from 22 countries outside of the US agreed to participate. More than half of all respondents, from over half of the countries, reported holding a baccalaureate degree. Nearly all respondents from all 22 countries reported having courses in periodontology and dental anatomy. Reviewing health histories, scaling using hand and/or ultrasonic instrumentation and the application of fluoride via trays or varnish, were the most common clinical skills, reported by nearly all respondents from almost all countries.

**Conclusion:** Understanding the similarities of DH educational experiences, such as the emphasis on preventive therapy and maintenance of periodontal health, with educational content delivered at the university level, may facilitate greater global collaboration and a more unified workforce.

**Keywords:** dental hygienists, dental hygiene education, dental hygiene curriculum, health promotion, professional development

This manuscript supports the NDHRA priority area **Professional development: Education** (educational models).

Submitted for publication: 2/20/19; accepted:12/7/19

### Introduction

Prevention of oral diseases and promotion of oral health are essential to the well-being of the global population. Preventive oral health care, along with the need for and value of dental hygiene (DH) services, has been gaining importance internationally.<sup>1,2</sup> By providing preventive and therapeutic services, the DH workforce has been shown to have a positive impact on a populations' oral health worldwide. The important role dental hygienists play in supporting oral health was established in the foundational studies of Axelsson and Lindhe, who demonstrated reductions in caries and periodontal disease associated with dental hygienists delivering regularly repeated oral hygiene instructions and

a dental prophylaxis, including scaling and root planning, during the 1970's in Sweden.<sup>3</sup> The need for DH professionals to deliver these services has been recognized by an increasing number of countries.<sup>1,2</sup> Belgium recently granted official recognition to dental hygienists, becoming the twenty-sixth European country to recognize the DH profession.<sup>4</sup> The International Federation of Dental Hygienists (IFDH), an international organization, is uniting DH associations from around the globe in their common cause of promoting oral health. Current membership in the IFDH includes associations from 31 countries, of which 13 are outside of Europe. One of the IFDH's goals is to "promote and

coordinate the exchange of knowledge and information about the profession, its education, evidence-based research, and best practice.”<sup>5</sup> Activities, such as the biannual International Symposium on Dental Hygiene, facilitates collaboration with DH professionals from around the world.

Global integration and collaboration within the DH profession is challenging without more extensive knowledge of the educational experiences of dental hygienists throughout the world.<sup>2,6,7</sup> Collaboration in educating healthcare providers at the international level currently exists in medicine and nursing. The Global Health Service Partnership (GHSP), a collaborative effort with the Peace Corps and Seed Global Health, is focused on strengthening the quality of medical and nursing education and delivery in locations with a high burden of disease and a shortage of qualified health care professionals.<sup>8</sup> Medical and nursing educators serve alongside fellow educators in the host country for a period of one year with the goal of sharing educational and clinical best practices.<sup>8</sup> The DH profession has not achieved the same level of globalization as the medicine and nursing.<sup>6,7</sup> A partnership similar to GHSP, may help facilitate the collaboration of international DH educators and dental hygienists in establishing DH education programs in countries, that would benefit from an expanded DH workforce. Dental hygienists establishing these new education programs may use their own experiences as a foundation for the development of these programs, and variations of their experiences are unknown.

There is a gap in the literature regarding whether dental hygienists educated in countries located around the world, gained their knowledge in similar educational content and through a similar level of instruction. It is also not known whether dental hygienists educated throughout the world gained clinical competencies in similar skills and tasks. The purpose of this study was to assess the similarities and differences of educational experiences of dental hygienists who had completed DH education programs across a broad range of countries.

## Methods

This quantitative, cross-sectional study was approved by the Institutional Review Board of the University of California, San Francisco. The target population was dental hygienists who had completed entry-level DH educational programs in countries outside of the United States (US), and possessed a minimal fluency in the English language. While some countries describe the professional as an “oral hygienist,” for the purposes of this study the term “dental hygienist” will be used exclusively.

A 28-item survey was developed to obtain detailed information about the respondents’ educational experiences. Survey items consisted of five categories: general information, including country of the DH program attended (6 items); entrance requirements (5 items); types of required classes/subject areas (4 items); clinical skills competencies (8 items); demographic information (5 items). Content validity was determined by feedback from 11 dental hygienists who had graduated from DH programs outside of the US and from officers of the IFDH. Pilot testing for comprehension and clarity was conducted by students and faculty from the University of California Master of Science program in DH. Revisions were made based on feedback. Internal validity was maximized by utilizing simple English terms to decrease bias based on English language fluency.

The International Federation of Dental Hygienists distributed study information, a link for the informed consent, and a 28-item survey to their member country House of Delegates representatives, along with a request to forward the survey information and invitation to participate to their association members. Additionally, DH faculty members at programs outside of the US were identified and invited to participate. Study materials consisted of an introductory message, a link to the informed consent along with the survey, administered by a research software program (Qualtrics®; Provo, UT). DH faculty members were asked to answer the survey based on their own experiences as a DH student in their respective education programs, and not the program of their current employment.

Data were collected and all responses were collated. Frequencies (percentages) of responses to each survey item were calculated and data were displayed by country. The cross-tabulation tool, used to determine relationships between survey items: degree granted and licensing type and degree granted and research project required, was included in the research software. Cross-tabulation analysis, also known as contingency table analysis, was used as the statistical test for these survey items, since the reported data were categorical. A chi-square statistic was generated, using a two-dimensional table, which recorded the frequency of respondents reporting the specific characteristic. Statistical analysis determined whether the observed relationships between survey items could have occurred by chance. A *p*-value of 0.05 was chosen as the level of statistical significance.

## Results

A total of 513 dental hygienists from 22 countries outside of the US agreed to participate (Table I). Most respondents

**Table I. Respondents and respective country (n=513)**

Country	Abbreviation	n
Australia	AU	26
Canada	CA	55
China	CH	2
Czech Republic	CZ	53
Denmark	DK	5
Finland	FI	121
Ireland	IE	1
Japan	JP	2
Jordan	JO	1
Latvia	LV	14
Lithuania	LT	22
Malta	MT	10
Netherlands	NL	31
New Zealand	NZ	17
Norway	NO	5
Pakistan	PK	1
Portugal	PT	2
Saudi Arabia	SA	32
South Africa	ZA	17
Spain	ES	14
Sweden	SE	34
United Kingdom	GB	48

reported entering their DH program between the ages of 18-22 years (Table II) and were predominately female. The average reported DH class size ranged between 16-30 students and were most frequently affiliated with a dental school located within a university. Programs in institutions, such as community colleges, technical institutes/vocational schools, or colleges of allied health, were less frequently reported. The degree most frequently awarded upon completion of the DH program was the baccalaureate, and in half of the participating countries, the number of respondents with baccalaureate degrees exceeded 50%. The number of respondents receiving diplomas varied; for example, 87.5% of the respondents from Canada received diplomas. The average number of years needed to complete a DH education program was reported to be two or three years for most countries. Saudi Arabia was the only country where completing the program with a degree required more than four years.

Respondents agreed that completion of secondary school at the minimum had been required to enter their respective

DH program (Table III). Most of the respondents reported that dental assisting experience, observing a practicing dental hygienist in a clinical setting, or the completion of specific prerequisite courses, was not required for entrance to their DH program. In countries requiring post-secondary school level prerequisites, the most common prerequisite was biology, followed by chemistry (Table IV).

Four categories were developed for the courses content areas included in the DH program curricula: dental sciences, research, clinical skills with joint classroom learning, and miscellaneous topics. Dental anatomy and periodontology were the most frequently identified dental science courses, with 90% or more of the respondents from nearly all countries having taken them. More than three quarters of respondents from nearly all 22 countries reported taking additional dental sciences, however cariology and general pathology were reported by fewer than half of the respondents from six countries. The distribution of course content areas is shown in Table V.

Respondents reported that the research-related subject areas were included at lower frequencies than the dental sciences. These lower frequencies of research related subjects were reported from countries where the majority of respondents were granted diplomas, not degrees. Cross-tabulation analysis indicated that respondents, who had received a baccalaureate degree, were more likely to have conducted a research project during their DH program than those who had received a diploma ( $p = 0.05$ , degrees of freedom=5, and chi square=38.44). Dental materials and radiology were the most common topics in the category of “clinical skills with joint classroom learning.” Pain management was variable. Under the miscellaneous category, providing dental hygiene care for patients with systemic diseases, professional ethics, and public/community health were the subject areas most frequently acknowledged by over half of the respondents. Dental jurisprudence was reported by fewer respondents.

Reviewing the health history, applying fluoride trays and/or varnish, scaling using hand instrumentation, and scaling with an ultrasonic scaler were the most common clinical skills reported across all countries and the majority of respondents reported being competent with these skills (Table VI). Other clinical skill competency areas included providing dietary and tobacco cessation counseling, exposing radiographs, and applying sealants. Low numbers of respondents reported competencies in bacterial testing, administering antimicrobials locally, applying silver diamine fluoride, and using a laser. The ability to perform simple tooth extractions and placing restorations was reported by

**Table II. Student demographics and program characteristics (n=513)**

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
<b>Student age range upon entering DH program</b>	n=26	n=51	n=2	n=39	n=5	n=104	n=1	n=2	n=1	n=10	n=22	n=9	n=29	n=16	n=4	n=1	n=2	n=26	n=17	n=8	n=30	n=46
< 18	4%	2%	0%	3%	0%	1%	0%	0%	0%	10%	5%	11%	3%	6%	0%	0%	0%	0%	0%	0%	0%	0%
18-22	23%	57%	0%	64%	60%	64%	100%	100%	100%	30%	77%	33%	79%	56%	25%	0%	100%	85%	82%	25%	30%	48%
23-27	54%	31%	50%	10%	20%	23%	0%	0%	0%	30%	18%	22%	7%	25%	25%	0%	0%	8%	12%	13%	60%	48%
28-32	12%	2%	50%	5%	0%	4%	0%	0%	0%	20%	0%	0%	0%	6%	0%	0%	0%	4%	0%	50%	7%	4%
> 32	8%	8%	0%	18%	20%	8%	0%	0%	0%	10%	0%	33%	10%	6%	50%	100%	0%	4%	6%	13%	3%	0%
<b>Gender of the majority of the DH class cohorts</b>	n=26	n=51	n=2	n=37	n=5	n=102	n=1	n=2	n=1	n=10	n=22	n=9	n=29	n=16	n=4	n=1	n=2	n=15	n=17	n=7	n=30	n=47
Male	0%	0%	50%	0%	0%	3%	0%	0%	0%	10%	0%	22%	0%	0%	0%	100%	0%	7%	0%	0%	0%	0%
Female	100%	100%	50%	100%	100%	97%	100%	100%	100%	90%	100%	44%	100%	100%	100%	0%	100%	93%	100%	100%	100%	100%
Usually an equal #	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>Number of students enrolled in the DH class</b>	n=26	n=51	n=2	n=38	n=5	n=100	n=1	n=2	n=1	n=9	n=22	n=9	n=27	n=15	n=4	n=1	n=2	n=26	n=17	n=7	n=28	n=47
1-15	15%	2%	50%	26%	20%	14%	100%	0%	100%	11%	9%	100%	0%	0%	25%	0%	0%	50%	35%	29%	4%	64%
16-30	50%	39%	0%	74%	40%	81%	0%	50%	0%	89%	82%	0%	48%	20%	50%	100%	50%	50%	47%	71%	50%	34%
31-45	19%	47%	50%	0%	0%	5%	0%	50%	0%	0%	9%	0%	4%	60%	25%	0%	50%	0%	18%	0%	39%	2%
> 45	15%	12%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%	48%	20%	0%	0%	0%	0%	0%	0%	7%	0%
<b>DH program institutional affiliation</b>	n=24	n=50	n=2	n=39	n=5	n=99	n=1	n=2	n=1	n=10	n=19	n=8	n=31	n=18	n=4	n=1	n=2	n=33	n=17	n=6	n=26	n=44
College of Allied Health	0%	2%	0%	18%	0%	16%	0%	0%	0%	0%	37%	12%	16%	0%	0%	100%	0%	39%	0%	0%	8%	0%
Community college	0%	46%	0%	10%	0%	3%	0%	0%	0%	0%	21%	0%	0%	0%	0%	0%	0%	0%	0%	33%	4%	0%
Technical institute or vocational school	25%	8%	50%	10%	0%	12%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	0%	2%
University w/out a dental school	33%	0%	0%	8%	0%	7%	0%	0%	0%	0%	5%	0%	7%	28%	25%	0%	0%	12%	6%	0%	35%	9%
University w/dental school	42%	40%	50%	41%	100%	41%	100%	100%	100%	100%	26%	63%	74%	72%	75%	0%	100%	81%	94%	0%	54%	66%
Other	0%	4%	0%	13%	0%	20%	0%	0%	0%	0%	11%	38%	3%	0%	0%	0%	0%	6%	0%	17%	0%	23%
<b>Degree received upon completion of DH program</b>	n=26	n=48	n=2	n=31	n=4	n=79	n=1	n=2	n=1	n=10	n=19	n=9	n=26	n=16	n=4	n=1	n=2	n=24	n=15	n=3	n=27	n=44
Associate	0%	0%	50%	7%	25%	4%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%
Bachelor	73%	2%	50%	29%	50%	56%	0%	100%	100%	0%	90%	56%	39%	69%	75%	0%	100%	100%	40%	33%	56%	30%
Certificate	0%	2%	0%	0%	0%	17%	0%	0%	0%	11%	0%	0%	4%	6%	0%	0%	0%	0%	0%	0%	26%	5%
Diploma	12%	88%	0%	55%	25%	6%	100%	0%	0%	78%	5%	44%	58%	25%	25%	100%	0%	0%	60%	67%	7%	66%
Masters	0%	0%	0%	3%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%
Other	15%	8%	0%	7%	0%	11%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%
<b>Years required to complete DH program</b>	n=26	n=49	n=2	n=31	n=4	n=82	n=1	n=2	n=1	n=9	n=19	n=9	n=26	n=16	n=4	n=1	n=2	n=24	n=15	n=5	n=27	n=46
1 year	0%	14%	0%	0%	0%	2%	0%	0%	0%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	7%	15%
2 years	19%	55%	0%	0%	0%	4%	100%	0%	0%	78%	0%	0%	35%	25%	25%	100%	0%	0%	60%	100%	22%	44%
3 years	81%	29%	50%	97%	100%	55%	0%	0%	0%	11%	84%	100%	31%	75%	75%	0%	100%	4%	40%	0%	70%	41%
4 years	0%	2.0%	0%	3%	0%	38%	0%	100%	100%	0%	16%	0%	35%	0%	0%	0%	0%	42%	0%	0%	0%	0%
> 4 years	0%	0%	50%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	54%	0%	0%	0%	0%

few respondents with the exception of those coming from Australia, New Zealand, and the United Kingdom. Respondents from Denmark, Finland, Norway, and Sweden were more likely to be competent in placing fillings. Administration of nitrous oxide was the least common skill mastered by any of the respondents. The number of respondents who reported competency in administering local anesthesia varied significantly from zero (Jordan, Pakistan, Portugal, Spain) to 100% (Denmark, Ireland, Norway, Sweden).

Upon completion of their educational programs, respondents from all but two countries (Denmark and Ireland) reported being required to pass a licensing examination prior to practicing DH (Table VII). Either a written examination or a combination of both a written examination and a clinical component on a patient was the most common format. The relationship between requirement of licensing examinations and the type of degree upon completion of the program was considered to be significant by cross-tabulation analysis ( $p=0.01$ , degrees of freedom=10, chi square=23.50). Saudi Arabia was the only country, in which the majority (over 90%) of the respondents reported being required to participate in an internship or residency program following the completion of their DH program.

### Discussion

This study surveyed dental hygienists who had completed entry-level DH education in a broad range of countries outside of the US. Participants reported a number of similarities across their educational experiences. Respondents' knowledge of educational content, such as periodontology, was mostly at the baccalaureate level of instruction and they had achieved competency at similar skills and tasks, such as hand and ultrasonic scaling and the application of fluoride. The emphasis on preventive therapy and maintenance of periodontal health was similar throughout the world.

Most of the respondents in this study reported obtaining a baccalaureate degree upon completion of their entry-level DH program. Based on the studies by Johnson, the number of baccalaureate programs has increased from 1987 to 2006, demonstrating a gradual shift from diploma programs which had previously been the predominant type of educational format.<sup>2</sup> The proportion of respondents in this study with baccalaureate degrees versus diplomas may not reflect the current increase in baccalaureate degree programs, as the respondents may have completed their DH education prior to this shift.<sup>2</sup> Since 2002, all the DH programs in the Netherlands have become 4-year baccalaureate degree programs,<sup>9</sup> however only 39% of the respondents from the Netherlands in this study reported having received a baccalaureate degree upon completion of their education. The data collected in this study may be a conservative estimate of the current number of dental hygienists being educated at the baccalaureate level. Currently Australia, Czech Republic, Denmark, Finland, Japan, Lithuania, Netherlands, New Zealand, Norway, Portugal, Saudi Arabia and Sweden offer baccalaureate degree programs as the sole or predominant type of DH educational program.<sup>2,10</sup>

However, in Canada, the number of diploma programs in community colleges had increased, while baccalaureate ones in universities had declined.<sup>12</sup> Those data support our findings, in which the majority of respondents from Canada reported having attended a diploma program lasting two years. A comparable trend has been observed in the US, with significantly greater numbers of associate degree programs,<sup>13</sup> which can be considered to be similar to diploma programs in terms of hours and instruction content. This length of study has been a great concern for the DH profession in North America. The American Dental Hygienists' Association (ADHA) has policy supporting the establishment of



**Table III. Entrance requirements of DH program (n=513)**

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
<b>Minimum level of education required</b>	<b>n=24</b>	<b>n=51</b>	<b>n=2</b>	<b>n=30</b>	<b>n=4</b>	<b>n=85</b>	<b>n=1</b>	<b>n=2</b>	<b>n=1</b>	<b>n=8</b>	<b>n=20</b>	<b>n=9</b>	<b>n=27</b>	<b>n=15</b>	<b>n=4</b>	<b>n=1</b>	<b>n=2</b>	<b>n=25</b>	<b>n=15</b>	<b>n=6</b>	<b>n=27</b>	<b>n=45</b>
None required	0%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%
Some years at secondary school	0%	2.0%	0%	7%	0%	6%	0%	0%	0%	13%	0%	11.1%	0%	7%	0%	0%	0%	4%	0%	17%	22%	11%
Completion of secondary school	88%	50%	50%	67%	100%	79%	100%	100%	100%	25%	90%	67%	89%	93%	75%	100%	100%	76%	93%	33%	74%	62%
Some years at technical institute	0%	4%	0%	0%	0%	1%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	11%
Some university courses	4%	32%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	2%
Completion of a university degree	0%	0%	50%	20%	0%	2%	0%	0%	0%	13%	5%	11%	0%	0%	25%	0%	0%	0%	7%	0%	0%	0%
Other	8%	12%	0%	3%	0%	11%	0%	0%	0%	50%	0%	11%	11%	0%	0%	0%	0%	0%	0%	17%	7%	13%
<b>Experience in dental assisting</b>	<b>n=26</b>	<b>n=50</b>	<b>n=2</b>	<b>n=31</b>	<b>n=5</b>	<b>n=87</b>	<b>n=1</b>	<b>n=2</b>	<b>n=1</b>	<b>n=8</b>	<b>n=19</b>	<b>n=9</b>	<b>n=29</b>	<b>n=16</b>	<b>n=4</b>	<b>n=1</b>	<b>n=2</b>	<b>n=25</b>	<b>n=14</b>	<b>n=6</b>	<b>n=29</b>	<b>n=46</b>
Yes	23%	16%	0%	19%	0%	6%	0%	0%	100%	38%	5%	11%	0%	6%	0%	100%	0%	8%	0%	33%	7%	17%
No	77%	84%	100%	81%	100%	94%	100%	100%	0%	63%	95%	89%	100%	94%	100%	0%	100%	92%	100%	67%	93%	83%
<b>Observing a practicing DH in a clinical setting</b>	<b>n=24</b>	<b>n=49</b>	<b>n=2</b>	<b>n=32</b>	<b>n=5</b>	<b>n=86</b>	<b>n=1</b>	<b>n=2</b>	<b>n=1</b>	<b>n=7</b>	<b>n=18</b>	<b>n=9</b>	<b>n=29</b>	<b>n=15</b>	<b>n=4</b>	<b>n=1</b>	<b>n=2</b>	<b>n=25</b>	<b>n=14</b>	<b>n=6</b>	<b>n=29</b>	<b>n=43</b>
Yes	8%	16%	0%	31%	0%	9%	0%	0%	100%	43%	33%	11%	3%	13%	0%	100%	0%	20%	0%	50%	0%	42%
No	92%	84%	100%	69%	100%	91%	100%	100%	0%	57%	67%	89%	97%	87%	100%	0%	100%	80%	100%	50%	100%	58%
<b>Completion of specific pre-requisite courses</b>	<b>n=25</b>	<b>n=49</b>	<b>n=2</b>	<b>n=27</b>	<b>n=5</b>	<b>n=82</b>	<b>n=1</b>	<b>n=1</b>	<b>n=1</b>	<b>n=8</b>	<b>n=18</b>	<b>n=9</b>	<b>n=28</b>	<b>n=13</b>	<b>n=4</b>	<b>n=1</b>	<b>n=2</b>	<b>n=23</b>	<b>n=15</b>	<b>n=5</b>	<b>n=25</b>	<b>n=44</b>
Yes	48%	63%	0%	22%	40%	1%	100%	0%	0%	50%	33%	78%	29%	15%	50%	100%	0%	48%	27%	40%	36%	57%
No	52%	33%	100%	78%	60%	99%	0%	100%	100%	50%	67%	22%	71%	85%	50%	0%	100%	52%	73%	60%	64%	43%

**Table IV. Required prerequisite courses at post-secondary school level for DH program entrance\* (n=513)**

	AU	CA	CZ	DK	FI	IE	LV	LT	MT	NL	NZ	NO	SA	ZA	ES	SE	GB
<b>Basic sciences</b>	<b>n=12</b>	<b>n=31</b>	<b>n=6</b>	<b>n=2</b>	<b>n=1</b>	<b>n=1</b>	<b>n=4</b>	<b>n=6</b>	<b>n=7</b>	<b>n=8</b>	<b>n=2</b>	<b>n=2</b>	n=11	n=4	n=2	n=9	n=25
Anatomy	17%	36%	83%	0%	0%	100%	75%	33%	14%	13%	0%	0%	82%	0%	100%	0%	12%
Biochemistry	8%	7%	50%	0%	0%	0%	0%	33%	0%	0%	0%	0%	55%	0%	0%	11%	4%
Biology	67%	77%	50%	0%	0%	100%	100%	83%	100%	100%	50%	0%	73%	100%	50%	22%	96%
Chemistry	27%	68%	33%	100%	0%	0%	25%	83%	71%	88%	0%	0%	64%	0%	0%	44%	28%
Microbiology	0%	7%	67%	0%	0%	0%	50%	33%	14%	13%	0%	0%	46%	0%	0%	0%	0%
Physics	8%	10%	0%	100%	0%	0%	25%	17%	43%	0%	0%	0%	64%	50%	50%	0%	16%
Physiology	8%	19%	50%	0%	0%	0%	25%	17%	0%	0%	0%	0%	55%	0%	50%	0%	0%
<b>Social studies</b>																	n=16
Psychology	0%	48%	84%	0%	0%	0%	50%	33%	14%	13%	0%	0%	46%	0%	0%	0%	0%
Sociology	0%	26%	33%	0%	0%	0%	25%	33%	0%	13%	0%	0%	9%	0%	0%	11%	0%
<b>Miscellaneous</b>																	n=16
Computer science	0%	0%	50%	0%	0%	0%	50%	33%	29%	0%	0%	0%	73%	0%	50%	0%	0%
English	33%	77%	83%	100%	0%	100%	50%	33%	43%	13%	50%	0%	91%	75%	0%	56%	40%
Mathematics	17%	36%	0%	100%	0%	100%	0%	33%	43%	38%	0%	0%	55%	100%	0%	89%	32%
Classes Not Listed	17%	26%	33%	0%	0%	0%	0%	17%	29%	0%	0%	100%	18%	0%	0%	11%	8%

\*Question: Is the completion of specific courses at post-secondary school level required to entering your dental/oral hygiene program?  
If all respondents from a country or region responded “no” to this question, they are not represented.

the baccalaureate degree as the minimum entry-level for DH practice<sup>14</sup> due to the challenges of achieving increased scope and depth of educational content in a two-year curriculum. Advanced opportunities for DH practice along with the complex health needs of the current aging population demand more thorough scientific knowledge, especially in terms of the relationship between oral and systemic health.

In general, baccalaureate education provided at the university level of instruction, focuses on increasing students’ knowledge base and critical thinking skills. These findings were demonstrated in a Canadian study where the majority of the respondents who had earned a baccalaureate degree following a diploma reported that their baccalaureate education improved their abilities in critical thinking, problem solving, and use of research.<sup>15</sup> Graduates completing baccalaureate DH programs may be better prepared to use research to make evidence-based clinical decisions in their DH practices. The longer time-frame of these programs has allowed for increased breadth and depth of educational content, facilitating the broadening scope of practice and relaxing restrictions on DH practice.<sup>2</sup>

The most common core subject areas/courses, periodontology and dental anatomy/tooth morphology, reflect the educational content of the proposed IDFH<sup>1</sup> and the European Federation of Periodontology (EFP) guidelines.<sup>16</sup> The courses proposed by these organizations do not preclude integration of the subject areas and low response rates in certain courses does not necessarily mean that the respondents did not gain knowledge in these subject areas. For example, the low number of respondents indicating having taken a cariology course may have been because the content had been integrated into other courses, such as oral biology, dental hygiene science, or preventive dentistry. Accordingly, general pathology concepts may have been integrated into an oral pathology course, as evidenced by higher response rates indicating having taken a course in oral pathology.

The prevalence of research methodology courses in most curricula may be due to the increasing length of most programs, from two to three years, as well as the increased number of baccalaureate programs.<sup>10</sup> Longer baccalaureate programs allow more opportunity to incorporate research skills into the curriculum.<sup>1</sup> Time and critical thinking skills are needed to develop competence in searching for scientific evidence, critically appraising it, and implementing the findings into clinical practice. These evidence-based principles have been shown to be practiced by US graduates of baccalaureate programs more frequently than by those completing certificate or associate degree programs.<sup>17</sup> When comparing the differences between one and two years of DH education in Sweden, Ohrn found that dental hygienists with two years of education were more active in achieving evidence-based practice than graduates from one-year programs.<sup>18</sup> In this study, respondents from Canada and Czech Republic receiving diplomas did not report a research methodology course requirement.

Historically, dental hygienists have had a major role in promoting the oral health of the public, so it was not surprising that respondents from all of the participating countries reported having taken one or more public/community health courses. Likewise, coursework on DH care for patients with systemic disease would be expected to be a common DH program component, especially considering the global focus on the relationship between oral and systemic diseases. This topic may also have been included as part of periodontology, a course included in the majority of programs. Law in dentistry was not indicated by many respondents but this may have

**Table V. Courses or content areas included in the DH program curriculum (n=513)**

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
<b>Dental Sciences</b>	<b>n=26</b>	<b>n=49</b>	<b>n=2</b>	<b>n=30</b>	<b>n=4</b>	<b>n=81</b>	<b>n=1</b>	<b>n=2</b>	<b>n=1</b>	<b>n=9</b>	<b>n=19</b>	<b>n=9</b>	<b>n=26</b>	<b>n=15</b>	<b>n=4</b>	<b>n=1</b>	<b>n=2</b>	<b>n=24</b>	<b>n=15</b>	<b>n=5</b>	<b>n=27</b>	<b>n=46</b>
Cariology	73%	40%	100%	80%	100%	100%	100%	100%	100%	67%	47%	44%	92%	73%	100%	0%	100%	38%	47%	40%	100%	80%
Dental anatomy	100%	100%	100%	100%	75%	100%	100%	100%	100%	100%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
General anatomy	73%	82%	100%	97%	75%	85%	100%	100%	100%	44%	95%	56%	54%	87%	100%	100%	100%	58%	53%	80%	78%	96%
General pathology	46%	71%	100%	70%	75%	42%	100%	50%	100%	22%	63%	89%	73%	87%	100%	0%	100%	38%	47%	60%	78%	85%
Head/neck anatomy	100%	93%	50%	90%	75%	100%	100%	100%	100%	67%	84%	78%	92%	93%	100%	100%	100%	75%	100%	80%	74%	100%
Oral biology	81%	82%	100%	90%	75%	75%	100%	100%	100%	67%	84%	67%	96%	100%	100%	100%	100%	100%	100%	60%	100%	98%
Oral histology	89%	88%	50%	90%	75%	63%	100%	50%	100%	100%	84%	89%	92%	100%	75%	100%	100%	67%	87%	40%	96%	96%
Oral pathology	96%	96%	100%	77%	75%	58%	100%	100%	100%	56%	79%	78%	100%	100%	100%	0%	100%	100%	100%	80%	100%	96%
Periodontology	100%	98%	100%	100%	100%	99%	100%	100%	100%	100%	95%	100%	92%	93%	100%	100%	100%	75%	100%	80%	100%	100%
Pharmacology	80%	96%	100%	97%	100%	88%	100%	100%	100%	67%	100%	44%	69%	93%	100%	100%	100%	96%	73%	80%	89%	85%
<b>Research</b>																						
Research methodology	54%	45%	50%	43%	75%	86%	100%	100%	100%	67%	84%	67%	54%	93%	75%	0%	100%	88%	53%	20%	100%	54%
Statistics	73%	35%	50%	37%	50%	64%	0%	100%	100%	44%	84%	44%	50%	60%	50%	0%	100%	63%	40%	80%	96%	33%
<b>Clinical skills with joint classroom-based learning</b>																						
Dental materials	85%	84%	50%	77%	75%	100%	100%	100%	100%	89%	90%	56%	96%	87%	100%	100%	100%	100%	100%	80%	85%	78%
Dental assisting/four-handed dentistry	19%	14%	50%	37%	25%	69%	100%	100%	100%	56%	47%	67%	15%	33%	0%	100%	0%	63%	73%	80%	22%	37%
Pain management	73%	49%	0%	27%	75%	86%	100%	100%	0%	11%	79%	44%	35%	73%	100%	100%	0%	58%	53%	80%	74%	65%
Radiology	96%	96%	50%	87%	100%	98%	100%	100%	100%	78%	90%	67%	100%	100%	100%	0%	100%	100%	100%	80%	100%	94%
<b>Miscellaneous Topics</b>	<b>n=22</b>	<b>n=49</b>	<b>n=2</b>	<b>n=30</b>	<b>n=4</b>	<b>n=81</b>	<b>n=2</b>	<b>n=2</b>	<b>n=1</b>	<b>n=9</b>	<b>n=19</b>	<b>n=9</b>	<b>n=26</b>	<b>n=15</b>	<b>n=2</b>	<b>n=1</b>	<b>n=2</b>	<b>n=24</b>	<b>n=15</b>	<b>n=5</b>	<b>n=27</b>	<b>n=46</b>
DH care for patients with developmental disorders and special needs	85%	82%	0%	80%	75%	94%	100%	100%	100%	78%	84%	89%	77%	93%	100%	100%	100%	96%	93%	40%	93%	89%
DH care for patients with systemic diseases	80%	78%	0%	83%	100%	96%	100%	100%	100%	78%	84%	89%	85%	93%	100%	100%	100%	96%	100%	60%	93%	91%
Educational methodology	35%	43%	0%	60%	75%	61%	100%	50%	100%	67%	79%	44%	39%	40%	100%	0%	100%	67%	87%	60%	67%	41%
Law in dentistry	58%	25%	50%	43%	75%	61%	0%	100%	0%	44%	79%	33%	31%	60%	100%	0%	0%	21%	67%	60%	74%	48%
Pediatric dentistry	73%	45%	50%	70%	75%	89%	100%	100%	100%	100%	66%	56%	65%	73%	100%	0%	50%	92%	93%	60%	89%	85%
Professional ethics	85%	94%	100%	77%	75%	90%	100%	100%	100%	89%	100%	78%	62%	93%	100%	0%	100%	79%	100%	60%	96%	78%
Public/community health	92%	98%	0%	67%	75%	94%	100%	100%	100%	78%	100%	89%	50%	87%	100%	100%	100%	100%	100%	60%	85%	87%

been due to the overlapping subject area with professional ethics or public/community health, or the lack of importance of the legislative regulation of the DH profession and practice. Johnson reported that professional regulation through government agencies varies according to a country's historical ties and that statutes as related to accountability and autonomy have varying influence on the delivery of DH care.<sup>2</sup>

Educating patients in the prevention of oral diseases has been a primary focus in DH education worldwide. Preventive measures, such as fluoride treatments and application of sealants, were clinical skills that most respondents reported having mastered during their DH program. They are also tasks that all dental hygienists need to be educated to perform, according to the proposed curricular guidelines, developed by the education committee of the IFDH<sup>1</sup> and by the EFP's recommendations for DH education and training.<sup>16</sup> In a study of eight countries by Inukai, items related to the prevention of dental caries including topical fluoride application and pit and fissure sealants, were a common component of clinical education.<sup>19</sup>

In addition to preventive clinical skills, respondents reported learning educational content in oral health guidance/education. Respondents who felt competent in dietary counseling, tobacco cessation counseling, and screening for oral cancer reflect the current global emphasis on counseling for risk behavior modification and public health promotion. The use of behavioral interventions, such as motivational interviewing, were reported by one-third of Swedish DH respondents in a study by Liss et al., and significantly more dental hygienists with a 3-year education, as compared those with a shorter education, worked with tobacco cessation.<sup>20</sup> Clinical training of preventive skills appears to relate to scope of practice; preventive skills were reported to be part of the scope of practice in all eight of the countries Inukai studied.<sup>19</sup> Newer technologies, such as bacterial testing and laser therapy, and the application of caries therapeutic agents, such as silver diamine fluoride, were reported by few respondents, possibly because they may not have reached common usage.

Respondents from all countries reported scaling using hand instrumentation as one of the most common clinical skills respondents had become competent in during DH education. It is also one of the most common treatment procedures performed in DH practice.<sup>19</sup> Emphasis on periodontal therapy also relates with the data that most all respondents took a course in periodontology. The removal of supragingival and subgingival hard deposits has been traditionally the major therapeutic service provided by dental hygienists. However, in a study by Virtanen et al., Finnish educators stated that the training in their programs seldom extends beyond basic periodontal treatment and maintenance care and that more extensive training in periodontics would allow greater utilization of dental hygienists' skills in treating periodontal diseases.<sup>21</sup> The number of respondents indicating competency scaling with an ultrasonic scaler was similar to hand instrumentation. These data confirm the results of a Canadian survey of new graduates: most respondents perceived being well prepared in hand and ultrasonic scaling as a significant outcome of their DH educational experiences.<sup>22</sup>

A high percentage of respondents reported the provision of fillings as a clinical competency; this may reflect the number of respondents who are dually trained as dental therapists or dental nurses. In some countries, such as Australia, dual education programs have been developed to combine the roles of DH and dental therapy and to allow these practitioners to perform diagnostic, preventive, and restorative services.<sup>10,23,24</sup> In the countries where respondents had been taught and licensed to provide fillings, these respondents also reported competence in administering local anesthesia. Respondents

**Table VI. Required clinical skill competencies to complete the DH program (n=513)**

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
<b>Non-clinical or risk assessment procedures</b>	<b>n=26</b>	<b>n=49</b>	<b>n=2</b>	<b>n=30</b>	<b>n=4</b>	<b>n=78</b>	<b>n=1</b>	<b>n=2</b>	<b>n=1</b>	<b>n=9</b>	<b>n=19</b>	<b>n=9</b>	<b>n=26</b>	<b>n=15</b>	<b>n=4</b>	<b>n=1</b>	<b>n=2</b>	<b>n=24</b>	<b>n=15</b>	<b>n=5</b>	<b>n=27</b>	<b>n=45</b>
Review of health history	96.2%	98%	100%	70%	100%	84.6%	100%	100%	100%	88.9%	84.2%	88.9%	100%	93.3%	100%	100%	100%	95.8%	100%	60%	96.3%	95.6%
Screening for oral cancer	88.5%	79.6%	100%	60%	75%	73.1%	100%	0%	0%	55.6%	78.9%	44.4%	84.6%	80%	100%	0%	100%	70.8%	93.3%	60%	74.1%	88.9%
Testing for bacteria	30.8%	20.4%	100%	60%	25%	67.9%	0%	50%	0%	44.4%	26.3%	0%	53.8%	26.7%	75%	0%	50%	20.8%	40%	20%	77.8%	6.7%
Providing diet counseling	84.6%	93.9%	100%	90%	75%	94.9%	100%	100%	100%	100%	52.6%	88.9%	69.2%	73.3%	75%	0%	100%	79.2%	93.3%	60%	92.6%	97.8%
Providing tobacco cessation	80.1%	75.5%	100%	73.3%	75%	94.9%	100%	50%	100%	100%	52.6%	66.7%	57.7%	80%	100%	100%	100%	66.7%	86.7%	80%	92.6%	89.1%
<b>Prevention</b>																						
Administering chlorhexidine or other antibacterial rinses	88.5%	65.3%	50%	96.7%	100%	100%	100%	50%	0%	100%	100%	88.9%	84.6%	93.3%	100%	100%	100%	100%	100%	60%	88.9%	95.6%
Exposing of radiographs	92.3%	95.9%	100%	50%	75%	74.4%	100%	0%	100%	88.9%	84.2%	22.2%	96.2%	93.3%	100%	100%	100%	91.7%	100%	60%	100%	91.1%
Fluoride application (trays)	88.5%	98%	100%	83.3%	50%	53.8%	100%	50%	100%	77.8%	94.7%	55.6%	92.3%	73.3%	100%	100%	100%	95.8%	100%	80%	66.7%	44.4%
Fluoride application (varnish)	92.3%	77.6%	100%	83.3%	100%	100%	100%	50%	100%	100%	94.7%	88.9%	96.2%	100%	100%	100%	100%	95.8%	100%	40%	100%	100%
Sealant application	92.3%	95.9%	50%	43.3%	100%	88.5%	100%	100%	100%	88.9%	94.7%	66.7%	84.6%	93.3%	100%	100%	100%	95.8%	100%	60%	85.2%	100%
<b>Treatment</b>																						
Administering local anesthesia (injections)	92.3%	40.8	50%	6.7%	100%	79.5%	100%	0%	0%	11.1%	89.5%	66.7%	76.9%	86.7%	100%	0%	0%	87.5%	86.7%	0%	100%	82.2%
Local delivery of antimicrobials	11.5%	8.2%	50%	10%	25%	20.5%	0%	0%	0%	44.4%	42.1%	0%	42.3%	6.7%	75%	0%	50%	16.7%	40%	20%	11.1%	55.6%
Administering nitrous oxide	3.8%	6.1%	0%	3.3%	0%	6.4%	0%	0%	0%	0%	15.8%	0%	3.8%	6.7%	0%	0%	0%	4.2%	13.3%	20%	3.7%	4.4%
Air polishing	23.1%	42.9%	100%	90%	100%	71.8%	0%	100%	100%	66.7%	94.7%	55.6%	53.8%	60%	75%	100%	100%	70.8%	46.7%	40%	51.9%	26.7%
Applying silver diamine fluoride	7.7%	4.1%	0%	16.7%	25%	16.7%	0%	100%	0%	22.2%	21.1%	0%	11.5%	6.7%	25%	0%	50%	8.3%	26.7%	0%	11.1%	0%
Applying topical anesthetic gel	69.2%	57.1%	100%	76.7%	75%	91.0%	100%	0%	0%	88.9%	94.7%	66.7%	46.2%	93.3%	100%	100%	50%	79.2%	86.7%	20%	85.2%	82.2%
Extracting teeth	50%	2.0%	50%	3.3%	0%	2.6%	0%	0%	0%	11.1%	10.5%	0%	11.5%	73.3%	25%	0%	0%	0%	0%	0%	0%	48.9%
Placing fillings	50%	24.5%	50%	3.3%	50%	65.4%	0%	0%	0%	11.1%	15.8%	0%	50%	66.7%	25%	0%	0%	4.2%	46.7%	0%	55.6%	48.9%
Providing laser therapy	0%	2.0%	50%	10%	25%	1.3%	0%	0%	0%	11.1%	21.1%	0%	0%	0%	0%	0%	0%	12.5%	0%	20%	0%	2.2%
Scaling using hand instrumentation	92.3%	100%	100%	100%	100%	96.2%	100%	100%	100%	100%	94.7%	100%	100%	100%	100%	100%	100%	100%	100%	40%	100%	100%
Scaling with an ultrasonic scaler	92.3%	91.8%	100%	90%	100%	96.2%	100%	100%	100%	100%	84.2%	100%	92.3%	100%	100%	100%	100%	100%	100%	60%	100%	97.8%
Soft tissue curettage	19.2%	34.7%	50%	50%	25%	32.1%	0%	0%	100%	55.6%	57.9%	88.9%	42.3%	20%	75%	100%	0%	83.3%	53.3%	40%	33.3%	22.2%
Teeth whitening	46.2%	36.7%	50%	90%	50%	88.5%	0%	0%	100%	44.4%	89.5%	22.2%	11.5%	80%	50%	100%	100%	70.8%	66.7%	40%	33.3%	4.4%
<b>Miscellaneous</b>																						
Dental assisting/four-handed dentistry	23.1%	10.2%	100%	30%	25%	60.3%	100%	100%	100%	44.4%	47.4%	66.7%	15.4%	33.3%	0%	100%	0%	50%	66.7%	60%	18.5%	37.8%

from countries allowing for independent practice also reported developing this competence. However, dental hygienists practicing independently may have their ability to administer local anesthesia restricted by regulations requiring dentists to be present during the administration or preventing the purchase of the anesthetic<sup>25</sup>. Administering nitrous oxide was the least common clinical skill competency. Perhaps, this may be due to strict drug laws in certain countries restricting the use of nitrous oxide and its possible misuse as a recreational drug.<sup>25</sup>

Licensing and requirements for a post-graduate residency not only varied from country to country, but also within the countries. Based on the cross-tabulation results, the requirement of passing a licensing exam was significantly related to the type of degree awarded; greater numbers of baccalaureate degree graduates were not required to take a licensing exam. Accordingly, Canada had a high number of respondents who graduated with a diploma and who were required to take a licensing examination. A licensing requirement may have been established to ensure dental hygienists are sufficiently competent to practice after the completion of the shorter programs. Longer programs, usually awarding a baccalaureate degree, would allow for greater depth and breadth of learning needed for evidence-based, comprehensive DH care. Post-graduate residency programs were not a requirement to practice in most countries with the exception of Saudi Arabia. Nearly all respondents from this country were required to complete a residency program; data relating to the more than four years required to complete their DH education.

A limitation of this study was that the survey was written and distributed only in the English language. Therefore, respondents unable to read or understand English fluently may have experienced difficulties answering the survey. Larger numbers of respondents were also from countries with English as their primary language, such as Australia, Canada, United Kingdom, or that have English as a prerequisite course at a post-secondary school level prior to entering the DH program. Future studies should consider translating the survey into each country's native language.

The IFDH distributed the survey to the delegates from each member country with the request that the delegates forward the survey to the members of their association. However, some delegates may not have the means to distribute the survey to their membership, such as the email addresses of their members. This would have resulted in fewer or no respondents from that country. Another limitation was that respondents completed their DH education over a wide range of years. Since the curricula may have changed over time, responses may not have been reflective of the current curriculum. Additionally, respondents who are both dental therapists and dental hygienists may have responded to the survey items based on skills related to both types of practitioners.

**Table VII. Licensing requirements prior to practicing DH (n=513)**

	AU	CA	CH	CZ	DK	FI	IE	JP	JO	LV	LT	MT	NL	NZ	NO	PK	PT	SA	ZA	ES	SE	GB
Required to pass a licensing exam prior to practicing	n=25	n=49	n=2	n=30	n=4	n=77	n=1	n=2	n=1	n=9	n=19	n=8	n=26	n=15	n=4	n=1	n=2	n=24	n=15	n=4	n=27	n=45
Yes	16%	78%	100%	43%	0%	26%	0%	100%	100%	89%	63%	50%	42%	13%	50%	100%	100%	38%	33%	50%	30%	9%
No	84%	22%	0%	47%	100%	62%	100%	0%	0%	11%	26%	50%	39%	80%	50%	0%	0%	58%	60%	50%	59%	78%
I don't know	0%	0%	0%	10%	0%	12%	0%	0%	0%	0%	11%	0%	19%	7%	0%	0%	0%	4%	7%	0%	11%	2%
Type of licensing exam required	n=3	n=38	n=0	n=12	n=0	n=19	n=0	n=2	n=1	n=8	n=11	n=4	n=10	n=2	n=2	n=1	n=0	n=9	n=5	n=2	n=7	n=9
Written exam only	33%	74%	N/A	8%	N/A	37%	N/A	100%	0%	0%	0%	0%	0%	0%	0%	0%	N/A	56%	0%	0%	14%	0%
Clinical exam w/ patient	0%	16%	N/A	8%	N/A	5%	N/A	0%	0%	13%	0%	0%	0%	0%	0%	0%	N/A	0%	0%	50%	0%	0%
Clinical exam w/ mannequin teeth	0%	0%	N/A	0%	N/A	5%	N/A	0%	0%	0%	9%	0%	0%	0%	0%	0%	N/A	0%	0%	0%	0%	0%
Written exam + clinical exam w/ patient	33%	11%	N/A	50%	N/A	21%	N/A	0%	100%	88%	91%	100%	70%	0%	100%	100%	N/A	33%	100%	50%	57%	56%
Written exam + clinical exam w/ mannequin teeth	33%	0%	N/A	17%	N/A	11%	N/A	0%	0%	0%	0%	0%	0%	0%	0%	0%	N/A	0%	0%	0%	0%	0%
Other	0%	0%	N/A	17%	N/A	21%	N/A	0%	0%	0%	0%	0%	30%	100%	0%	0%	N/A	11%	0%	0%	29%	44%
Required to complete an internship or residency	n=25	n=49	n=2	n=26	n=4	n=71	n=1	n=2	n=1	n=9	n=17	n=7	n=24	n=15	n=4	n=1	n=2	n=22	n=14	n=3	n=27	n=44
Yes	0%	2%	100%	50%	0%	10%	0%	0%	0%	67%	24%	57%	4%	13%	25%	0%	0%	91%	14%	67%	19%	5%
No	100%	98%	0%	50%	100%	90%	100%	100%	100%	33%	77%	43%	96%	87%	75%	100%	100%	9%	86%	33%	82%	96%

**Conclusion**

The findings of this study suggest that the global education of dental hygienists has many similarities. Most respondents reported receiving education, emphasizing preventive therapy and maintenance of periodontal health, with educational content at the university level. Understanding that other countries emphasize similar educational standards of courses and clinical skills within their educational programs may help to create a global standardization of the DH profession. Global collaboration may be able to facilitate the international exchange of dental hygienists or DH students and to promote the establishment of the DH profession in countries that are underserved in respect to oral health needs.

Despite differences in legal, cultural, educational, and health care delivery systems, a unified workforce of highly educated and clinically skilled dental hygienists would facilitate the prevention of oral diseases and the promotion of oral health, which is essential to the well-being of the global population.

**Acknowledgements**

The authors would like to express their appreciation to the International Federation of Dental Hygienists (IFDH) for disseminating the survey to the representatives of each member country's association. We also want to thank the IFDH officers who assisted with survey development, the representatives who forwarded the survey to the members of

their association, and all the dental hygienists who responded to the survey.

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# Autism Spectrum Disorder: Techniques for dental radiographic examinations

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### Abstract

Autism spectrum disorder (ASD) is associated with maldevelopment of the brain that leads to impaired communication and social interaction skills, possible cognitive decline, and an inability to cope with environmental stimuli. Affected individuals may also exhibit a myriad of stereotypic and maladaptive behaviors. With the increasing prevalence of ASD in the United States, oral healthcare professionals (OHCP) will encounter greater opportunities for patient interactions. There is limited information in the literature regarding ASD and dental radiography. The task of taking diagnostically acceptable radiographs on ASD-affected patients may be hindered by a lack of cooperative behavior, communication difficulties, and an incapacity to understand instructions. This report will review various ASD-related characteristics, comorbidities, and an assortment of general behavior guidance techniques (Picture Exchange Communication System, visual scheduling, social stories, first-then board, voice control, tell-show-do, electronic media devices, nonverbal communication, and desensitization). Guidelines for applying basic and advanced techniques for dental radiographic examinations will be discussed with the goal of improved patient interactions and positive outcomes.

**Keywords:** autism, autism spectrum disorder, dental management, radiology

This manuscript supports the NDHRA priority area **Client level: Oral health care** (clinical guidelines).

Submitted for publication: 1/16/19; accepted 7/26/19

### Introduction

Autism spectrum disorder (ASD) is a group of complex developmental conditions arising from central nervous system perturbations leading to declines in social interaction and communication skills (verbal and nonverbal), behavioral norms, sensory processing, and possibly cognitive performance.<sup>1,2</sup> Degree of impairment varies from high-functioning autism to severe involvement.<sup>3</sup> The prevalence of ASD within the United States has increased from 1.3% to 1.7% among children aged 4 years from 2010 to 2014. Prevalence also varies geographically, ranging from as low as 0.9% to 1.0% in Missouri to 2.0% to 2.8% in New Jersey.<sup>4</sup> Early detection and intervention are key regimens for optimal learning and applicable behavioral guidance. Pooled data indicate that males are affected 2 to 3 times more frequently than females although this gender predilection may underrepresent some high-functioning females who are often diagnosed later in life.<sup>5</sup> It has been determined that genetic factors play some role in the pathogenesis of ASD

while the impact of various environmental contributions has been inconclusive.<sup>6</sup>

Oral healthcare professionals (OHCP) may be faced with increased challenges in rendering clinically acceptable radiographs in individuals with ASD. However, there is limited information in the literature regarding helpful behavioral modifications when taking radiographs on this cohort. In a pilot study of 20 autistic patients, Lowe and Lindemann reported a 50% success rate of completion of an initial oral examination including bitewing radiographs yet information regarding their treatment protocol had not been disclosed.<sup>7</sup> The task of taking diagnostically acceptable radiographs on ASD-affected patients may be hindered by their difficulties with understanding instructions, lack of cooperative behavior, and other communication difficulties. The objective of this report is to provide a useful template of basic and advanced guidance techniques to employ during dental radiographic examinations for individuals with ASD.

## Discussion

### General features of autism

#### *Stereotypical behavior*

Individuals with ASD often manifest central nervous system (CNS) alterations (language expression, cognitive and sensory processing, executive dysfunction), and frequent engagement in repetitive or inappropriate behavior, any of which, could hinder the completion of healthcare provider tasks and promote an unsuccessful and possible negative clinical experience. Individuals affected with ASD may also exhibit reduced tendencies to engage in a wide range of interests (Table I).<sup>5</sup> ASD is also associated with anxieties and diminished coping skills to a variety of stressors, particularly regarding new experiences and surroundings, unfamiliar people, disruptions to routine behavior, anticipation of treatment; excess stimulation, and separation of objects that provide solace and familiarity (Table II). Various sensory hypersensitivities (visual, aural, olfactory, touch) may also impede the implementation of healthcare measures.

**Table I. Autism spectrum disorder characteristics**

Manifestations	Outcomes
Altered cognition, executive dysfunction	Difficulties with: time management, completion of tasks, articulation
Perception alteration	Difficulties with organizing and interpreting sensory information
Language alteration	Dominant usage of nonverbal communication, delayed speech/language, echolalia
Self-stimulatory behaviors	Hand-flapping, rocking, spinning, repetition of words and phrases
Impaired social interaction	Avoidance of eye contact
Unusual responses to sensory processing	Physical withdrawal/hiding/pulling away, blocking of stimuli with arms or hands, hyperactivity, excessive fear, anxiety, agitation, easily frustrated
Malbehavior	Flight or fight, hitting, kicking, biting, tantrums, self-injury/self-harm, severe gagging, frequent vomiting
Need for sameness in daily routine	Resistance to change/easily distressed

**Table II. ASD stressors and behavioral effects**

Stressors	Intensification of ASD symptoms
Unpredictability encounter	Anxiousness, increased social avoidance
Disruption of daily routine/ritual	Uneasiness, fear, agitation
Interruption of preferred repetitive behavior	Stereotypical behaviors (flapping, spinning)
Overstimulating environment	Flight or fight response, malbehavior
Separation of comfort items	Anxiety, malbehavior

Self-stimulatory behavior, often initiated to alleviate extreme anxiety, may serve as a coping mechanism to counteract an overwhelming sensory environment.<sup>8-11</sup> This may be observed as various repetitive actions (stimming) and may include hand-flapping, rocking, body spinning, obsessive handling of an object, and echolalia (repetitive and meaningless language).<sup>12</sup> Patients with ASD may exhibit aggressive behavior, have a tendency for self-injury, and may resist establishing eye contact. Positive predictors for cooperation with autistic individuals take into consideration their reliance on nonverbal communication, minimal use and comprehension of language, and their inability to read and follow multistep instructions.

#### *Sensory processing impairment*

Sensory processing refers to actions in the CNS that determine interpretation of feedback from the body and environment.<sup>9</sup> Atypical hyper- or hyposensitivities may be associated with ASD. Determining whether the patient is a hypo-responder (one who seeks sensory input) or a hyper-responder (one who avoids sensory input) is important when strategizing guidance techniques. Sensory defensiveness, a consequence of over-responsivity in individuals with a low-threshold to sensations, may lead to averting or overreacting to environmental stimuli. Individuals who experience tactile defensiveness when touched by others may demonstrate impulsive “flight or fight” behaviors, as opposed to the “fight or flight” seen in a typical physiologic response; in addition to emotional outbursts, anxiety, anger, and self-injury (head banging).<sup>13</sup> Observation of the patient’s body language is critical in assessing their comfort. Early signs of distress include gaze avoidance, severe gagging or vomiting. Other avoidance actions include withdrawal, cowering, hiding, crying, and blocking the stimuli (covering ears or eyes).

## Comorbid Conditions

ASD is associated with a diversity of comorbidities, most notably epilepsy and sleep disturbances.<sup>12,14,15</sup> For individuals who experience seizure activity, it is important to determine the specific type, existence and manifestation of a prodrome, seizure frequency and most recent episode. An estimated 86% of children diagnosed with ASD experience sleep deprivation almost daily.<sup>15</sup> Disrupted and insufficient sleep may negatively affect daytime behavior, leading to lethargy, irritability, or poor coping skills. ASD is also associated with increased incidences of anxiety, depression, obsessive-compulsive disorder, psychosis, gastrointestinal disturbances, immune compromise, substance abuse, eating disorders, and oppositional behavior.<sup>5</sup> Moreover, commonly prescribed medications for management of anxiety and stereotypic ASD-related behaviors (antipsychotics, antidepressants, anticonvulsants) may increase the risk for serious allergic reactions such as angioedema leading to swelling of the tongue and throat.<sup>16</sup> Additional oral side effects include xerostomia and the subsequent risk for dental caries and periodontal disease.<sup>16</sup>

## Clinical management techniques for patients with ASD

Due to social and communication impairments, individuals with ASD are often less able to respond appropriately to directions, prompting the basic guidance techniques outlined in Table III. In order to decrease patient anxiety and negative behavior, efforts should be undertaken to gain successful conveyance of information and instructions by providing anticipated and simplified multistep activities to address the patient's desires, feelings and preferences.<sup>11,17</sup>

**Table III. Basic clinical management techniques**

<b>Verbal communication:</b> Pre-visit pictures and instructions, voice control, tell-show-do, electronic media devices and video peer modeling, social stories
<b>Nonverbal communication:</b> Picture Exchange Communication System, visual support/schedule, first-then board (FTB)
Positive reinforcement, desensitization
Sensory distraction: sunglasses, earplugs
Wearing weighted objects (swaddling)
Parental/caregiver: presence or absence, assistance in operatory

The individual's unique communication challenges will determine the type and extent of information interchange. Healthcare practitioners should ask the parent/caregiver about any useful words or phrases for improving communication and consider use of pre-visit pictures,

instructions, voice control, and tell-show-do. Another helpful method is the utilization of social stories, (personalized, easy short narrations and illustrations) to simplify comprehension and preparation of appropriate responses to specific situations or events. When an individual is particularly apprehensive or uncooperative, holding personal comfort objects such as a favored toy or stuffed animal, squishy or squeeze ball may be consoling. One should also carefully weigh the consequences of separating these items from the patient. Some individuals may be calmed by allowing the use of an electronic screen media device to watch or listen to favorite video games and movies. It is also advantageous to ask the parent/caregiver regarding any stereotypic manifestations such as, "what type of behavioral problems does the patient have and how have you handled the situation?"

Video peer modeling (viewing a procedure on a video) and visual supports may be useful to explain anticipated behavior with a specific activity. Visual supports, substitute words and phrases with pictures and symbols, as exemplified by the Picture Exchange Communication System, visual schedules, and social stories. The Picture Exchange Communication System facilitates communication through pictures for individuals with minimal or no verbal capabilities. This method is widely used in the home and classroom and may be modified by using pictures with phrases to build visual schedules for patients with ASD. Visual scheduling is a systematic technique to improve learning and communication, particularly for incomprehensible language or echolalia.<sup>11</sup> Social stories are typically individualized short narrations and illustrations written in a child's perspective to prepare appropriate responses to specific situations or events.

Positive reinforcement is important to promote the repetition of desired outcomes. Verbal reinforcers (rewards) may include positive voice modulation and appropriate physical demonstrations of praise. For example, communicating a direct response such as "Thank you for sitting still" is preferable to saying "Good job."

Nonverbal communication methods necessitate use of a visual support and schedule, sensory distraction (redirecting attention), and relying on the assistance of the parent/caregiver. To increase patient comprehension and compliance of planned activities, it may be helpful to use the first-then board (FTB) method, a fundamental language base that visually provides step-by-step instructions and sequencing of upcoming events.<sup>17</sup> The "first" picture is characteristically a skill-building activity that the OHCP would want an individual to perform whereas the "then" activity symbolizes an exchange for patient compliance, leading to a reward.



Hypo-responders may be comforted by swaddling or by applying deep pressure to the chest and abdomen.<sup>9,10</sup> Individuals who are hyper-responders may be overly sensitive to bright light, certain sounds or loud noise, touch, pressure, texture, taste, smell, and proprioceptive body movement.<sup>9,12,13,18,19</sup> Desensitization gradually acquaints an anxious individual with aspects of a perceived unpleasant stimulus (object or place) to diminish emotional responsiveness.<sup>20</sup>

## Dental radiographic management techniques

### Preparation for the dental visit

Prior to the dental appointment, the OHCP should seek parent/caregiver input to consider the best approach to affect the patient’s ability to self-regulate and adapt to change, sit or stand for a predetermined length of time, tolerate others touching their mouth with gloved hands, and follow a simple instruction. At the start of the dental visit, OHCP should assess the patient’s anxiety level and ability to cope, and anticipate whether there may be challenges to the overall dental visit, particularly taking radiographs. Individuals with ASD have a strong need for continuity, as even small changes in routine may easily provoke undesirable behavior.<sup>23</sup> Other impediments to dental care include hyperactivity and resistive movements. Early recognition of stereotypic behaviors and an individual’s potential triggers may lessen protest behaviors such as crying, refusing to open the mouth, and aggression, any of which are usually consequent to fear and the need for self-protection.

Dental management should incorporate basic clinical techniques with modification strategies specifically relevant to the desired task (Table IV). Patients who have been uncooperative or overwhelmed by the dental experience, may benefit desensitization as a pre-visit activity. An example of a desensitization activity would be a “radiographic practice kit” for home use containing a disposable receptor

holder. The patient could rehearse holding the receptor in their mouth while the parent/caregiver counts aloud as a distractor or use a sand or liquid motion timer as a visual incentive to denote the time interval of the practice and actual radiographic activity. Visually, the liquid timer may also have a calming effect.

Patients may be comforted by applying a one or two weighted blankets or radiographic aprons on their chest and abdomen. Sunglasses should be available for patients affected with photosensitivity from operatory lighting. Auditory sensory processing impairments are also common with ASD. Creating a calm, quiet environment is important to those patients who have an intolerance to loud or shrill noises; intermittent sounds, such as bells or timers, may be distressing or even painful. Soft foam earplugs may ameliorate the high-pitched sound arising from panoramic devices. Occlusal and lateral jaw projections have a shorter exposure time and no automated moving parts and may serve as a suitable alternative. Motion of the panoramic receptor and x-ray source might be distracting and trigger an abrupt change in patient behavior.

Recently, handheld dental x-ray devices have gained in availability and usage. They offer increased portability and are specifically designed to allow the operator to remain chairside during the taking of radiographs on fearful or challenging patients. State laws may vary individually and OHCP would be advised to check their own regulatory agencies regarding permissibility and standards.<sup>21</sup>

On subsequent dental appointments, the risk of overwhelming patients with ASD may be reduced by maintaining similarity, scheduling them with the same OHCP on the same day, operatory, and dental chair.<sup>23</sup>

### Visual schedule

Use of a visual schedule provides instructions to follow during a radiographic procedure and might include pictorials

**Table IV. Dental radiographic management techniques**

<b>Basic behavioral techniques</b>
Ascertain triggers of undesirable behavior and manifestations of stereotypic behavior
Use of 2 radiographic aprons to swaddle the patient
Watching videos to redirect attention when taking radiographs
Video peer modeling for familiarization to dental tasks
Use of a visual schedule and first-then-board to display dental pictorials
Use of dental social stories
Sensory distraction aids: earplugs when taking intraoral and extraoral radiographs
Schedule dental appointments at same day and time
Radiographic “practice kit”
<b>Advanced behavioral techniques</b>
Nitrous oxide/oxygen analgesia
Anxiolysis
IV sedation
General anesthesia
Protective stabilization (restraints)

of the patient wearing a radiographic apron, placing hands on their stomach, opening their mouth, biting on a bite block, and listening to the sound of the “beep” emitted from the x-ray source. Inclusion of the FTB method may also motivate the patient to cooperate with these activities. To improve understanding, it may be helpful to show the patient an illustration of a visual schedule. An example is “first” sitting in the dental chair draped with a radiographic apron, and “then” play video games (Figure 1).



**Figure 1A.** First-then-board (FTB): Child sitting in dental chair draped with x-ray apron.



**Figure 1B.** First-then-board (FTB): Child sitting engaging in rewarding activity.

### **Visual incentives**

Many individuals with ASD have an inherent preference for visual stimuli.<sup>16</sup> Use of portable electronic screen media for communication and visual teaching may serve as a distractor to improve coping skills and reduce the fear of the radiographic examination, minimizing patient movement for improved image quality and ensuring patient safety.<sup>22</sup>

### **Social stories**

Use of a social story may be helpful to communicate the desired tasks needed to conduct the radiographic examination. Social stories may be facilitated by using pictures and narratives such as “when I go to the dentist I will sit in a big chair that goes up and down,” “keep my hands on my stomach,” “sit quiet in a chair,” “open my mouth wide for the hygienist or dentist to look at my teeth,” “bite down on the toy block” (radiographic receptor holder), “get a prize when I am all done,” “say goodbye,” and “go home.”

### **Advanced behavior guidance**

The American Academy of Pediatric Dentistry has recognized clinical circumstances when a dental radiographic examination may be indicated but a diagnostic image may not be readily obtainable.<sup>24</sup> Patient noncompliance may be attributable to fear, excessive anxiety, hyperactivity, repetitive behavior, physical disability, anatomic malformation, lack of comprehension of the requested task, or sensory hypersensitivity.<sup>12,19,25-28</sup> When utilization of basic behavioral guidance techniques has been unsatisfactory, pharmacologic intervention may

be necessary including the use of nitrous oxide/oxygen analgesia, anxiolysis, sedation and general anesthesia.<sup>24,29</sup> In select cases, protective stabilization with physical restraints may be considered however this practice remains controversial or objectionable.<sup>24,30</sup>

### **Oral and maxillofacial impediments**

A variety of oral anomalous features may pose challenges with radiographic examinations on patients with ASD including macroglossia, impaired tongue function, mouth breathing, drooling, malocclusion (high-arched palate, maxillary overjet), and hypergag reflex. Para-functional habits (bruxism, tongue thrusting, nonnutritive chewing) and atypical oral habits (mouthing, chinning, biting others, self-biting) also occur in this population and may potentiate the need for behavioral management strategies.<sup>12</sup>

Mouthing, the habitual manipulation of non-food items in the mouth, and may result in fractured or mobile teeth, posing a problem biting on the radiographic bite block or receptor holder. Chinning refers to an individual’s tendency to press the chin into an object or person’s extremity, often resulting in increased pressure to the mandible to relieve the symptoms of exfoliating teeth, gingival inflammation, or dental caries. Another concern with treating patients with ASD, particularly those that are poor communicators, is the increased risk of the OHCP being bitten.<sup>12</sup>

### **Conclusion**

Oral healthcare providers will be faced with an array of clinical challenges in providing comprehensive care for the growing number of individuals with ASD, particularly in the acquisition of dental radiographs. Unique patient needs, communication barriers, and atypical sensory issues along with appropriate behavioral techniques must be taken into consideration for successful patient outcomes with radiographic imaging. Anticipation of the patient’s level of cooperation prior to acquiring dental radiographs should include an assessment by the dental hygienist and other dental staff members. Modification of radiographic techniques with patients with ASD may reduce stressors and increase cooperation resulting in diagnostically adequate imaging and improved clinical outcomes.

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# Eating Competence and Oral Health in Supplemental Nutrition Assistance Program Eligible Populations

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### Abstract

**Purpose.** To determine the association of eating competence and Mediterranean diet adherence with oral health and to examine if they lessen any impact of food insecurity on oral health of SNAP-eligible persons.

**Methods.** Free clinic patrons (n=93) in Pennsylvania evaluated oral health nutrition education via an online survey. The Satter Eating Competence Inventory, Mediterranean diet and USDA Food Security scores were compared to tested measures of oral health as assessed by self-report.

**Results.** Respondents noted food insecurity (33%), food selection (32%), and oral health problems that interfered with life satisfaction (30%), and unafforded dental care (60%). Mediterranean diet adherence was associated with annual dental visits (82% vs. 46%,  $p=.026$ ). Competent eaters had greater food security and less frequently reported oral health issues interfering with life satisfaction (13% vs. 43%;  $p=.002$ ) or avoiding particular foods (18% vs 45%;  $p=.006$ ). These relationships remained significant controlling for low-income ( $p=.008$ ,  $p=.006$  respectively) but not when controlling for food security.

**Conclusions.** Competent eaters had fewer oral health issues except when controlling for food security, a considerable challenge to oral health.

**Keywords:** access to care, oral health, nutrition, food insecurity, eating competence, Mediterranean diet

This manuscript supports the NDHRA priority area **Population level: Access to care** (vulnerable populations).

Submitted for publication:10/31/18; accepted: 8/13/19

### Introduction

Concerns regarding oral health and barriers to care are well documented in Healthy People 2020, the national health-promotion and disease-prevention goals of the United States.<sup>1</sup> Poor dental/oral health outcomes are more prevalent among individuals with low and very low food security than among those with high food security.<sup>2,3</sup> Relationships between food security, socioeconomic status, nutrition behaviors and oral health are complex, however studying these relationships may provide insight needed to develop effective and sustainable nutrition education interventions, especially directed toward children and their parents. The evaluation of one such intervention, *Eating for Healthy Teeth and a Great Smile*<sup>4</sup> in a low-income venue provided an opportunity to examine the interface of oral health problems, income, food security, eating behaviors and attitudes.

Eating competence and the Mediterranean diet are two approaches to eating associated with health. The Mediterranean diet pattern, consisting of regular meals of fruits, vegetables,

fish, nuts, olives, wine, and fermented low-fat dairy products is associated with reduced health risks<sup>5</sup> and a greater health-related quality of life.<sup>6</sup> The Mediterranean diet has a known beneficial effect on oral and pharyngeal cancers,<sup>7</sup> but the impact of this diet on oral health has not been explored.

Eating competence has been defined as an intra-individual approach to food selection and eating behaviors focused on enjoyment, internal regulation of intake, food acceptance, and food resource management skills to plan, purchase, and prepare meals and snacks.<sup>8</sup> Interestingly, eating competence has emerged as a hallmark of health and well-being. For example, competent eaters have higher diet quality,<sup>9,10</sup> more healthful eating behaviors,<sup>11-13</sup> better sleep hygiene<sup>14</sup> food resource management skills,<sup>13</sup> and are more physically active.<sup>15</sup> Health metrics such as blood pressure and cholesterol levels are lower in competent eaters at risk for cardiovascular disease.<sup>16</sup> In addition, eating competent parents more frequently model behaviors and skills associated with encouraging fruit

and vegetable intake including greater in-home fruit and vegetable availability.<sup>17</sup> However, the association of eating competence with oral health has not been examined.

The purposes of this study were to determine the association of oral health issues with eating competence and with adherence to a Mediterranean diet and examine their impact on food insecurity and oral health.

## Methods

### Study design

This study used a cross-sectional survey research design and was given an exempt status by the Rochester Institute of Technology and The Pennsylvania State University Institutional Review Boards. Items about oral health practices were a prelude to viewing and then evaluating *Eating for Healthy Teeth and a Great Smile*,<sup>4</sup> a nutrition education program addressing eating and health behaviors that promote oral health. The theoretical underpinnings of the program follow the Self-Determination Theory of Motivation focusing on education and training that cultivates autonomy, relatedness, and competence about the target behavior.<sup>18,19</sup> The evaluation of *Eating for Healthy Teeth and a Great Smile*, which has been previously reported, included online review of a 2-minute video and responses to questions about usefulness, interest, readability, application of content, specific features and content as well as opinions on design, format, and graphics.<sup>20</sup> The video, which could be paused for review or watched multiple times, needed to be viewed once before the nutrition program evaluation items were accessible. Findings from the oral health practice items, which were viewed before the video, are the focus of this study.

Flyers and recruitment cards with study information and a link to access the study description and eligibility items were placed in five free community clinics serving low-income persons in central and northern Pennsylvania. Clinic patients had the option to view the program on a digital screen as they sat in the clinic waiting room before deciding to access the link to participate in the study. Clinic service use requires meeting an income eligibility requirement, which, depending on the clinic, ranges from less than 200% to 300% of the federal poverty guidelines. The inclusion criteria were as follows: (1) ability to speak and read English, (2) being a resident of Pennsylvania, (3) being 18 years of age or older, and (4) not studying to be or practicing as a nutritionist.

### Data collection

Data collection was completed using an online survey developed with the Qualtrics platform (Provo, UT).

Interested clinic patients clicked the study link and completed the eligibility screener. Eligible persons were able access to the online survey after they read the informed consent and agreed to participate. Following completion of the demographic, behavioral, and oral health items, participants were able to access and view *Eating for Healthy Teeth and a Great Smile*, which was embedded in the study survey before the program evaluation items.

### Survey measures

The survey set included questions about oral health and behavior, dietary behaviors, e.g., adherence to the Mediterranean diet, and eating competence, and demographics as required by the Supplemental Nutrition Assistance Program Education (SNAP-Ed) Educational and Administrative Reporting System.<sup>21</sup> Dental care, practices, and problems were assessed with items selected from five oral health surveys: National Health and Nutrition Examination Survey (NHANES),<sup>22</sup> Oral health questions from the National Health Interview Survey of the Centers for Disease Control and Prevention,<sup>23</sup> Oral Health Performance Measurement of the National Institute of Dental and Craniofacial Research,<sup>24</sup> Medical Outcomes Study Short Form-20,<sup>25</sup> and the Oral Salutogenic Score.<sup>25</sup> More specifically, two questions required affirmation of recent oral health problems such as toothaches, sensitive teeth, bleeding gums, missing teeth, loose teeth, and fillings. An additional three questions determined if dental/oral health issues affected daily life practices or made life less satisfying with response options from 1 (never) to 5 (very often). Nine oral health behaviors were examined: toothbrushing, flossing, family dentist, last dentist visit, smoking status, reasons for visiting a dentist, and reasons for not visiting a dentist. Toothbrushing frequency was measured with four response options ranging from more than once per day to every few weeks. Flossing and having a family dentist were reported as yes, no or don't know/not sure. Last dental visit was measured with four response options ranging from less than six months to more than three years ago. Three true/false questions about dental insurance, affordability of dental care, and fear of seeing a dentist were recorded as reasons for not visiting a dentist and affirmation on a list of dental concerns were denoted as reasons for visiting a dentist. Respondents also completed three questions about frequency of smoking and tobacco use.

Eating competence was assessed with the Satter Eating Competence Inventory 2.0 (ecSI 2.0™), a reliable measure with criterion validation, consisting of 16 Likert-scaled items that are summed to yield a score ranging from 0 to 48. Values 32 denote being eating competent. The ecSI 2.0™ has

4 subscales that sum to the total score: Eating attitudes and contextual skills (each 5 items, possible score 0 - 15); internal regulation and food acceptance (each 3 items, possible score 0 - 9).<sup>12</sup> Adherence to the Mediterranean diet was evaluated with the 14-item Mediterranean Diet Questionnaire with possible scores ranging from 0 (low) to 14 (highest adherence). Concurrent validity was established by comparison with outcomes from a food frequency questionnaire. Scores  $\geq 8$  denoted adherence to the Mediterranean diet.<sup>26</sup>

Food security was assessed with the validated 6-item short form of the United States Department of Agriculture Household Food Security Questionnaire, validated with findings from the 1995 Current Population Census. Affirmative responses about household food availability or affordability were summed to provide household raw food security score (possible range 0-6). Participants with scores denoted as high or marginal (score of 0-1) were classified as food secure; those in the low (score of 2-4) or very low (score of 5-6) categories were denoted as food insecure.<sup>27</sup> Respondents indicated their level of worry about money for food (from never to always). Respondents who used at least one assistance program or indicated they often or always worried about money for food were defined as low-income.

### **Statistical analysis**

Data were screened for duplicate Internet Provider and email addresses to assure unique, unduplicated online entries. Data were analyzed using SPSS 25.0 (IBM; Armonk, NY). For all analyses,  $p < 0.05$  was considered significant. Data were assessed for normal distribution and analyzed using descriptive statistics, measures of central tendency, means testing (e.g., independent t-tests), and additional analytic testing such as Pearson's correlation, chi-square and Fisher's exact tests when appropriate. Responses to questions about oral health impact on life satisfaction, job performance, and food avoidance were grouped into two categories as suggested by Huang and Park,<sup>3</sup> i.e., never, hardly ever vs occasionally, fairly often, and very often. General Linear Model (GLM) univariate analyses were used to compare means controlling for income status or food security as well as eating competence and Mediterranean diet adherence to gauge impact of food security on oral health. Bivariate and partial correlation analyses were performed with Pearson  $r$ .

## **Results**

### **Respondent characteristics**

The study link was accessed by 96 respondents; 93 respondents agreed to participate. They were from eight central Pennsylvania counties and were primarily white, females with

a mean age of  $41.2 \pm 12.3$  years (ranging from 18 to 71) who attended free clinics or a community clinic in Pennsylvania. With the exception of the Internal Regulation subscale items, the ecSI 2.0™ was incomplete for one respondent, which resulted in a sample size of 92 for total ecSI 2.0™ and three subscales. The Mediterranean Diet, Food Security scale, ecSI 2.0™ and subscale scores were all normally distributed. Internal consistency was demonstrated for the food security scale and ecSI 2.0™ with Cronbach alphas of 0.843 and 0.927, respectively. Few had eating practices that adhered to a Mediterranean diet plan and less than half were eating competent. The mean ecSI 2.0™ score was  $29.4 \pm 9.9$ , range from 2-48. The ecSI 2.0™ mean subscale scores were: Eating Attitudes  $10.3 \pm 3.4$ , range 1-15; Food Acceptance  $4.3 \pm 2.4$ , range 0-9; Internal Regulation  $6.2 \pm 2.2$ , range 0-9; and Contextual Skills  $8.6 \pm 3.8$ , range 0-15. Mean Mediterranean diet score was  $4.7 \pm 2.2$  with a range of 0-10. The Mediterranean diet score or adherence categories were not associated with ecSI 2.0™ score or being eating competent. However, adherence to the Mediterranean diet was positively correlated with the food acceptance ( $r = .23$ ,  $p = .035$ ,  $n = 82$ ) subscale score.

More than two-thirds of respondents were overweight or obese (72%). Although 65% fit the definition of low-income, only one-third (33%) were food insecure, i.e., they had low or very low food security. Of the 52% ( $n = 50$ ) who participated in one of 10 income-based assistance programs, 62% ( $n = 31$ ) participated in one or two programs and 26% ( $n = 13$ ) in three programs. Among assistance program participants, the programs most frequently denoted were SNAP (64%), medical assistance (48%), Low Income Home Energy Assistance Program (LIHEAP) (38%), food bank or food pantry (32%), and WIC (16%). Educational level was not related to food security, low-income status, or the perception that oral health status negatively impacted life satisfaction, or school/job performance. Respondent demographic characteristics are presented in Table I.

### **Oral health practices and food security**

Approximately 21% ( $n = 19$ ) were afraid of the dentist. Nearly two thirds (64%;  $n = 59$ ) did not have dental insurance. Dental care was not affordable for 60% ( $n = 55$ ). Oral health practices of respondents are shown in Table II. When asked if life was less satisfying in general because of teeth, mouth, or denture problems, 28 (30%) replied occasionally, fairly or very often, with 8 (9%) denoting very often. Difficulty with jobs or school attendance was attributed to problems with teeth, mouth, or dentures by 10 (11%) respondents. Almost one-third avoided particular foods because of problems with their teeth, mouth, or dentures.

**Table I. Respondent demographic and lifestyle characteristics**

		n (%)*
<b>Gender, female</b>	<b>n=89</b>	63 (71%)
<b>Race, ethnicity</b>	<b>n=88</b>	
White		85 (97%)
Black, African American		3 (3%)
Hispanic		1 (1%)
<b>Education</b>	<b>n=89</b>	
Did not complete high school		3 (3%)
High school graduate or GED		41 (46%)
Some post-secondary education/training		22 (25%)
4-year college degree		15 (17%)
Post graduate college		8 (9%)
<b>Body Mass Index</b>	<b>n=82</b>	
Underweight (<18.5)		2 (2%)
Normal (18.5 to 24.9)		21 (26%)
Overweight (25.0 to 29.9)		21 (26%)
Obese (≥ 30.0)		38 (46%)
<b>Eating Competent**</b>	<b>n=92</b>	39 (42%)
<b>Mediterranean Diet Adherence***</b>	<b>n=83</b>	
Low adherence (< 8)		72 (87%)
High adherence (≥ 8)		11 (13%)
<b>Food Security</b>	<b>n=77</b>	
Very low (5-6)		13 (17%)
Low (2-4)		12 (16%)
High/marginal (0-1)		52 (68%)
<b>Used at least one assistance program</b>	<b>n=93</b>	50 (54%)
<b>Low-income****</b>	<b>n=86</b>	56 (65%)
<b>Sometimes, often, or always worry about money for food</b>	<b>n=86</b>	41 (48%)
<b>Smoking/tobacco use status</b>	<b>n=92</b>	
Non-smoker/never used tobacco		45 (49%)
Former smoker/tobacco user		23 (25%)
Current smoker/tobacco user		24 (26%)

\* Numbers may not sum to 100 because of rounding or selecting more than one response

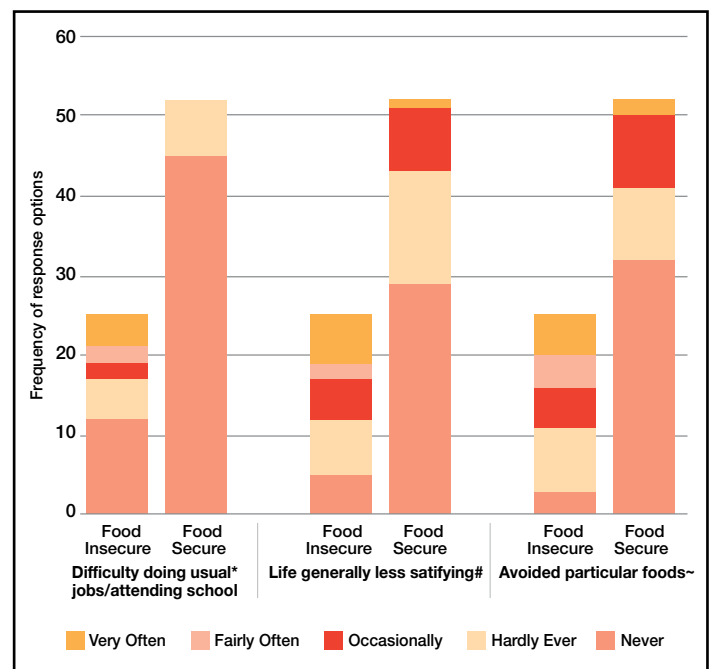
\*\*Satter Eating Competence Inventory 2.0 ≥ 32 ( ecSI 2.0™)

\*\*\*Possible score range 0–14

\*\*\*\* Low-income defined as prior use of an assistance program (e.g., WIC or Supplemental Nutrition Assistance Program) or often or always worrying about money for food.

Food insecurity was associated with having more oral health concerns. The greater the score indicating food insecurity the more frequently problems related to teeth, mouth, or dentures impacted being able to perform a job or attend school ( $r=.47, p<.001, n=77$ ), needing to avoid specific foods ( $r=.45, p<.001, n=77$ ), and overall satisfaction with life in general ( $r=.49, p<.001, n=77$ ). Comparing categories of food security and oral health impact affirmed these findings. Food insecure respondents, compared to being food secure, were significantly more likely to report occasionally, fairly or very often (compared to never or hardly ever) that problems with their teeth, mouth, or dentures led to difficulty doing a job or attending school, affected daily life practices, and led them to avoid particular foods (Figure 1). In addition, food insecure respondents were less likely than food secure respondents to indicate that they had no oral health problems in the previous six months (16% vs. 54%;  $p=.003$ ).

**Figure 1. Food secure versus food insecure challenges**



Chi square comparisons of never or hardly ever versus occasionally, fairly often or very often between food insecure (n=25) and food secure (n=52) respondents: \*  $p<.001$ , #  $p=.002$ , ~  $p=.002$

Problems with bleeding gums in the last six months were significantly higher for individuals defined as low-income (93%,  $p=.012$ ). It is also important to note that 25% of low-income respondents said this was a problem as compared to those who were not low-income (3%). Visiting the dentist for an exam, check-up or consultation was more common in those not low-income ( $p=.027$ ). Visiting the dentist for reasons other than a check-up was reported by 40% of the



**Table II. Oral health practices (n=93)**

		n (%)		
Family dentist?			Uncomfortable to eat food	
Yes (vs. no/don't know/not sure)		52 (56%)	Very often	4 (4%)
Last dental visit			Fairly often	6 (7%)
< 6 months ago		32 (34%)	Occasionally	18 (19%)
6 months to 1 year		15 (16%)	Hardly ever	18 (19%)
1 to 3 years		24 (26%)	Never	47 (51%)
> 3 years		22 (24%)	As a result of problems with teeth, gums, or dentures: Avoided particular foods	
Reasons for going to dentist*			Very often	9 (10%)
General exam, check-up, or consultation		64 (70%)	Fairly often	4 (4%)
Teeth cleaning or polishing		59 (64%)	Occasionally	18 (19%)
Cavities		36 (39%)	Hardly ever	20 (22%)
Chipped or broken teeth		20 (22%)	Never	42 (45%)
Gum disease		1 (1%)	Found life generally less satisfying	
Oral surgery		6 (7%)	Very often	9 (9%)
Other		3 (3%)	Fairly often	3 (3%)
Cannot afford dental care*		55 (60%)	Occasionally	17 (18%)
During the past 6 months**			Hardly Ever	25 (27%)
Jaw pain lasting >1 day		13 (14%)	Never	40 (43%)
Mouth sores		6 (7%)	Had difficulty doing usual jobs/attend school	
Difficulty eating/chewing > 1 day		7 (8%)	Very often	5 (5%)
Dry mouth for >1 day		12 (13%)	Fairly often	3 (3%)
No mouth problems		60 (66%)	Occasionally	2 (2%)
Problems during the past 6 months			Hardly Ever	14 (15%)
Missing fillings		10 (11%)	Never	69 (74%)
Bleeding gums		16 (17%)	Frequency of tooth brushing?	
Missing teeth		7 (8%)	More than once a day	46 (49%)
Loose teeth (not injury related)		2 (2%)	Once a day	45 (48%)
No teeth problems		40 (44%)	Every few days	2 (2%)
			Floss? yes (vs. no/don't know/not sure)	
			51 (55%)	

\*n=92, \*\* n=91

low-income sample compared with only 17% of those who were not low-income. Of those who noted an additional reason for a dental visit, 83% (n=27) were low-income.

**Food security and eating behaviors**

Food security was not associated with the Mediterranean diet score, but was negatively correlated with ecSI 2.0™ score ( $r=-.30, p=.009, n=76$ ). The ecSI 2.0™ scores were significantly higher ( $p=.049$ ) for those with high or marginal food security ( $30.4 \pm 9.5, n=51$ ) compared to those with very low food security ( $23.1 \pm 10.3, n=13$ ). The mean ecSI 2.0™ score of those

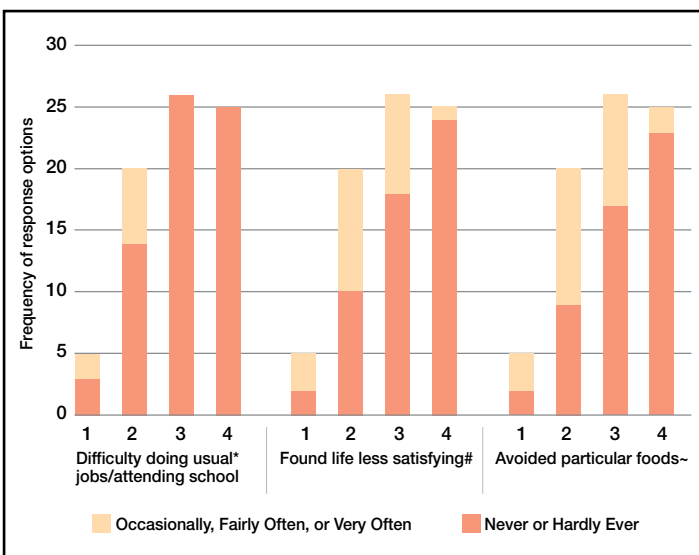
with low food security was  $28.8 \pm 7.9$  (n=12) and did not differ from high/marginal or very low food security categories. Eating attitude and internal regulation subscale scores also differed among food security levels. Mean EA subscale scores were  $10.8 \pm 3.4$  for marginal/high (n=51),  $9.0 \pm 2.5$  for low food security (n=12) and  $8.3 \pm 3.9$ , for very low food security n=13, ( $p=.029$ ); mean IR subscales scores were  $6.6 \pm 2.2, 6.1 \pm 2.0,$  and  $4.5 \pm 2.2$  for marginal/high (n=52), low (n=12), very low (n=13) categories, respectively ( $p=.008$ ). Low-income status was not associated with level of food security, eating competence, or adherence to a Mediterranean diet.

## Eating behaviors and oral health

Only 11 respondents (13%) met the criteria for adhering to the Mediterranean diet; they were more likely to have visited the dentist in the past year than those that didn't follow a Mediterranean diet (82% vs. 46%,  $p=.026$ ); no other differences in oral health practices or issues were identified.

Eating competence was associated with indicators of oral health. For example, cavities were noted as the reason for a dentist visit by more non-eating competent than eating competent respondents (51% vs 21%,  $p=.004$ ). Only 13% of eating competent respondents reported life to be less satisfying in general because of teeth, mouth or denture problems, compared to 43% of those not eating competent ( $p=.002$ ). Eating competent respondents were less likely to avoid particular foods because of oral problems (18% vs 45% not eating competent;  $p=.006$ ). These relationships remained significant when analyzed with a GLM controlling for low-income ( $p=.008$  and  $.006$ , respectively). However, when analyzed using a GLM controlling for food security, responses about these oral health impacts did not differ by eating competence status. The relationship with food security is shown in Figure 2. Of the 26 participants who were not eating competent, but food secure, none reported that their oral health occasionally, fairly or very often made doing their job or attending school difficult, whereas this level of dissatisfaction with their oral health was noted by 30% of the

**Figure 2. Eating competence and food security**



1. Eating competent and food insecure (n=5)
2. Food insecure and not eating competent (n=20)
3. Food secure and not eating competent (n=26)
4. Eating competent and food secure (n=25)

Fisher's Exact test comparison of never or hardly ever versus occasionally, fairly often or very often among the four groups: \* $p<.001$  # $p=.001$  ~  $p=.002$

20 who were not eating competent, but also not food secure. In addition, ecSI 2.0™ scores were inversely correlated with frequency of avoiding foods for oral health reasons ( $r=-.25$ ,  $p=.018$ ,  $n=92$ ), but this correlation did not remain significant after controlling for food security score.

## Discussion

Although eating competence has been shown to be related to several biobehavioral and well-being characteristics,<sup>5-14</sup> this is the first study to suggest the relationship between eating competence and oral health. Findings revealed eating competence was associated with self-reported better oral health and that higher satisfaction with life, job and school performance, and food avoidance were less frequently associated with issues with teeth, mouth, and dentures. As shown previously,<sup>28</sup> eating competence was significantly lower in food insecure participants. In fact, food security status was a factor in the response to a nutrition education intervention based on tenets of eating competence.<sup>29</sup> The current study affirmed the well documented relationship of food insecurity with oral health issues<sup>3,30</sup> but also revealed food security as a confounder of the relationship between eating competence and oral health issues.

Oral health problems were abundant in this sample of adults who exhibited an interest in evaluating a digital oral health nutrition program at free clinic venues. The incidence and severity of the oral health problems self-identified by the respondents support the provision of resources for preventive oral health education and treatment suggested by oral health professionals.<sup>31</sup> Although the definition of low-income included needs-based assistance program use and worry about money for food, both of which have been associated with food security in previous studies,<sup>9,32-33</sup> income status did not correlate with food security. The lack of association may be reflective of the fact that the sample, although recruited from clearly defined low-income venues, also participated in programs specifically designed to reduce food insecurity. As shown in Table I, more than two-thirds were food secure and nearly two-thirds were low income. The level of low and very low food security in the study sample (i.e., 33%) was higher than the nearly 12% reported nationally for 2017.<sup>34</sup> Thus, although providing oral health education and integrating this with an approach to enhance eating competence is supported, results suggest oral health professionals need to provide attention to food security. Oral health professionals are encouraged to display and demonstrate support for federal and state food assistance programs and local food pantries. Practices addressing both eating competence and food security include offering meal planning and budgeting

advice, ideas to enhance dietary variety on a budget and how to address eating contexts (e.g., eating as a family, turning off screens, food neutral mealtime conversation) to encourage regular meals and feeling relaxed about eating. In addition, oral health professionals may better serve patients by encouraging tenets of eating competence including portions based on internal regulation, enjoyment of eating, and tuning in and paying attention to eating.<sup>8</sup>

This study has several strengths. All responses were collected with surveys that had been validated or with items from other previously tested surveys and were face valid in similar samples. Recruitment activities did not focus on persons visiting a dentist or health care professional for oral health or dental issues, but rather on persons attending a health clinic who would evaluate a nutrition education program. The data collection method did not place additional burden on clinic staff or health care professionals. Social desirability bias was tempered because responses were not collected at the time of recruitment in front of a researcher or health care professional, but at the convenience of the participant online at the location of their choice. Lastly, the sample was from several communities in two regions of the state.

Study limitations include self-report, rather than observed or clinically documented responses with limited confirmation of respondent identity. Huang and Park<sup>3</sup> noted some discrepancy between self-report and clinical findings in their analyses of NHANES 2005-2008 data for adults 65 years and older. However, the objective measure was limited to tooth count which was the basis for defining chewing difficulty. Survey responses were collected solely online, thus the sample did not include those without online access or discomfort with providing information online. However, in the year of data collection (2015) 86% of adults in the United States used the Internet, with usage by 79% of those earning < \$30,000 per year.<sup>35</sup> This corresponds to a usage rate of 69% by a statewide Pennsylvania sample of males (N=101) in 2013 in which 88% had less than 2 years of college and 60% were participants in the Supplemental Nutrition Assistance Program.<sup>32</sup> Daily Internet use was reported by 77% in another statewide Pennsylvania sample (N=512) composed of all females with 77% without a 4-year college degree.<sup>12</sup> Internet usage in 2015 was high among US adults with only a high school education (78%) or some college (92%).<sup>34</sup> Since 71% of the sample graduated from high school or attended some college and 26% had higher educational levels, the requirement to use the Internet was not a significant limitation. Sample homogeneity (i.e., mostly females, not elderly, white, obese, and Pennsylvania residents only) limits generalization of findings to other populations. However, the sample had similar levels of obesity, educational attainment,

and eating competence to other statewide samples that were only male<sup>32</sup> or with 42% black, mostly obese/overweight (61%), all female and SNAP participants<sup>9</sup> or in all female with high food security, a very high level of education and younger.<sup>36</sup> In addition, sample obesity rates parallel those reported for the US.<sup>37</sup> Educational attainment levels were comparable to those reported for US adults aged 25 and older and in rural Americans aged 35-44 years.<sup>38</sup> These examples of sample representativeness temper concerns that responder identity was not able to be verified e.g., by phone calls or mail.

Another limitation was that recruitment was from free clinic venues and thus may represent a sample that has health issues, but is also able to seek help from health professionals; which may not be representative of the general population. Income data were not collected from participants because they were recruited from venues serving those with documented incomes indicating poverty. Therefore, a proxy for low-income was developed, i.e., often or always worrying about money for food or participating in an income-based assistance program. One could contend frivolous spending or unplanned expenses led to often or always worrying about money for food. However, the sample was recruited from venues serving those living in poverty, thus pointing to limited discretionary funds and tempering the likelihood funds were sufficient but money for food was lacking because of indiscriminate allocation. Finally, although adherence to the Mediterranean diet aligned with reported usage in the US within the past five years,<sup>39</sup> the limited number of adherent respondents suggests that conclusions about its relationship to oral health issues warrants further investigation.

## Conclusion

This observational study suggests that education and interventions that include an eating competence approach (i.e., regular meals, planning for feeding, enjoying meals, eating until satisfied, eating a variety of foods) may have the potential to improve oral health. Overall health concerns explicitly follow oral health issues. However, success of an eating competence focused approach must address food insecurity, a considerable challenge to oral health and (because overall health concerns explicitly follow oral health issues), consequently, the general health of such vulnerable populations.

## Acknowledgements

Partial funding was provided by the Pennsylvania Department of Human Services, PA Nutrition Education Tracks, US Department of Agriculture's Supplemental Nutrition Assistance Program Education.

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# 2019 Dentsply Sirona/ADHA Graduate Student Clinician Research Abstracts

The following abstracts are from the participants of the 2019 Annual Dentsply Sirona/ADHA Graduate Student Clinician's Research Program. The purpose of the program, generously supported by Dentsply Sirona for the past 12 years, is to promote dental hygiene research at the graduate level. Dental hygiene post-graduate programs may nominate one student to participate in the program and present their research at the Annual Conference of the American Dental Hygienists' Association. The following posters were presented during the ADHA Annual Conference held in Louisville, Kentucky, June 20-23, 2019.

\* Indicates poster presenter + Indicates award recipient  
++ Sigma Phi Alpha Student Journalism Award recipient

## The Efficacy of Brushing with Probiotics for the Reduction of Gingivitis

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**Purpose:** To evaluate the efficacy of brushing with probiotics on gingivitis.

**Methods:** This 3-week randomized, double-blind study included 34 adults (N=34) divided into two groups (n=17) for placebo-controlled evaluation of brushing with *Lactobacillus reuteri* probiotic drops, or placebo drops, added to toothpaste. Plaque accumulation and gingival inflammation data was recorded using an O'Leary Plaque Score (PS), and modified Löe-Silness Gingival Index (GI) at the beginning and end of the study.

**Results:** Analysis utilized Wilcoxon Signed Rank tests with statistical significance set at  $p < 0.05$ . Variables included differences between the probiotic (n=17) and placebo (n=17) groups' baseline and final data for PS and GI. Statistically significant differences were noted for GI of the placebo group as a whole ( $p = 0.001$ ), and females of the placebo group ( $p = 0.004$ ). Unanticipated results of the placebo group imply participation bias. No statistical difference was noted in PS for either group.

**Conclusion:** Results demonstrate once a day topical application of probiotics into the oral cavity is too infrequent to see a statistically significant difference in PS or GI. Similar studies indicate topical application of probiotics can reduce GI; and data collected suggests brushing as an application method may be effective. Application method and quantity of probiotic required to treat and manage oral diseases is currently undetermined. Future research employing brushing as an application method is needed to ascertain the effectiveness of this approach.

## Relative Dentin Abrasivity Toothpaste Survey: Are dental hygienists making evidence-based recommendations?

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**Purpose:** The purpose of this study was to assess practicing hygienists' knowledge of relative dentin abrasivity and to identify factors that influence toothpaste recommendations.

**Methods:** Data were collected through a web-based survey that was posted on Facebook® to practicing hygienists nation-wide (n=253). Analysis included descriptive statistics, Chi-square, and one-way analysis of variance to examine associations between years of experience, level of education obtained, and knowledge of relative dentin abrasivity (RDA).

**Results:** The response rate was 66% (n=167) and the majority of participants were female and worked in general practice. Participants with less education (Certificate or Associate's degree) had a higher knowledge score in response to four case study questions. In contrast, participants with a Bachelor's or Master's degree scored higher on the factors considered question. Participants with 6 to 10 years of experience had more RDA knowledge than participants with other experience levels. The maximum knowledge RDA score was 17, however the sample mean score was 12, which corresponds to a score of 70.6 of 100.

**Conclusion:** Based on the mean knowledge RDA score of 12, it appears most participants had inadequate RDA knowledge. This suggests that practicing hygienists are

unlikely to implement evidence-based recommendations for patients with exposed dentin. Continuing education on RDA for practicing hygienists and updates to pre-professional curriculum for students are needed.

### **An Evaluation of the Perceptions of Ohio Dental Hygienists Working with Underserved Populations Holding an Oral Health Access Supervision Program Permit**

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**Purpose:** The aim of this study was to evaluate dental hygienists in the state of Ohio who currently worked with underserved communities using their Oral Health Access Supervision Program (OHASP) permit to determine their perceptions of (1) what would be necessary to practice in non-traditional settings and (2) how to create a sustainable position to increase access to care to underserved populations in the state.

**Methods:** Qualitative methods were used for this study. Purposeful sampling occurred and an electronic survey was emailed to 95 dental hygienists in Ohio holding an OHASP permit. Interviews were conducted over the phone and an electronic recording device was used to record the conversation. Emerging patterns and themes were identified by the interviewer and data collection was terminated when no new themes had emerged.

**Results:** Out of the 95 individuals who were sent the survey, 52.3% participated in the initial survey. Ten percent of those who responded agreed to be interviewed. Four themes emerged: 1) Equipment and Collaboration, 2) Skill Sets Required, 3) Rewards and Motivations to Pursue, and 4) Challenges.

**Conclusion:** There continues to be a need for dental hygienists to pursue careers that provide dental care to underserved communities. Providing dental care for patients where they are located and exhibiting an empathetic and collaborative spirit is critical. While there continues to be challenges when pursuing this career path, professional organizations can play a role in influencing dental hygienists and their desire to pursue a career working with underserved populations.

### **An Assessment of Graduate Level Dental Hygiene Schools' Requirements Regarding Scholarly Inquiry and Research**

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**Purpose:** This research study was designed to examine how graduate dental hygiene programs in the United States are meeting the requirements of Scholarly Inquiry and Research.

**Methods:** A descriptive research study design was chosen for this study and deemed exempt by the UMKC IRB review board (#18-363). Graduate programs in the U.S. that award a terminal degree specific to Dental Hygiene (N=14) were invited to participate. Study questions were developed based on the ADEA competency for Scholarly Inquiry and Research. The survey was emailed to program directors via Qualtrics. Data were analyzed using SPSSv25. Descriptive statistics including frequencies and percentages were calculated. Exploration of relationships between variables were conducted using correlational analyses and t-tests.

**Results:** A response rate of 71% (10/14) was achieved. There was a significant difference in the number of minimum requirements for scholarly activity between programs with lower enrollments (M=4.43, SD=1.61) versus those with higher enrollments (M=2.00, SD=0);  $t(8)=2.51, p=.036$ . A negative correlation between submission of a manuscript to a peer reviewed journal and number of students accepted per year, ( $r(10) = -.655, p < .05$ ) indicates that students graduating from programs with larger enrollments are less likely to submit their work for publication.

**Conclusions:** All program directors reported requiring students participate in at least one of the scholarly activities listed in the document. Program size was the biggest variable in number of requirements, with schools that have smaller enrollments requiring their students to participate in over twice the number of scholarly activities as their larger counterparts.

## Screening Practices and Interventions by Pediatric Dentists in Texas to Address Childhood Obesity

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**Purpose:** Childhood obesity is emerging as a global epidemic threatening the health and well-being of children in the US. One in three children in Texas is considered overweight or obese; Texas ranks in the top 15 states for childhood obesity. The purpose of this study was to assess the childhood obesity screening and education practices of pediatric dentists in Texas.

**Methods:** Permission was granted by the Pediatric Oral Health Research and Policy Center to adapt a previously used survey. After TAMU IRB approval, a 20-question survey was mailed to a census sample of 548 pediatric dentists in Texas. Ordinal responses were analyzed using descriptive statistics. Open-ended comments were transcribed and analyzed by themes.

**Results:** The response rate was 21.7% (n=119). Texas pediatric dentists (75.2%, n=88) agree they have a role in promoting a healthy weight for children because of the impact of weight to general health. However, only 18.8% (n=22) offer childhood obesity information or healthy weight interventions. Sixty-three percent (n=74) report they would be likely to include obesity interventions in their practice if there was increased availability of patient education resources.

**Conclusion:** A majority of Texas pediatric dentists report routine performance of many procedures used to screen for obesity and are confident in their effectiveness to perform these procedures. However, results indicate there are gaps in the current delivery of services in the pediatric dental setting address the identification of childhood obesity.

## Dental Professionals and Students Willingness to Administer the HPV Vaccine

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**Purpose:** To determine the willingness of dental professionals in Michigan to administer the HPV vaccine, if allowed by law. Secondly, to assess their confidence in discussing HPV with patients as well as beliefs, barriers, and sites of referral regarding the vaccine. A third goal was to determine the knowledge levels of dental professionals and students regarding HPV and the vaccine.

**Methods:** A total of 623 dental professionals in Michigan, including dentists, hygienists, dental students, and hygiene students were surveyed about their attitudes regarding the HPV vaccine. Characteristics and experiences that most predicted their willingness to administer the vaccine were identified.

**Results:** A majority of all four professional groups were willing to administer the HPV vaccine if allowed by law. Dental professionals were fairly confident discussing HPV with patients and largely believed that it enhanced their patients' health. Willingness to administer it was greater among students and professionals with greater confidence and stronger beliefs. Licensed dental professionals were significantly more knowledgeable about HPV than students. Barriers to administering the vaccine included lack of training as well as liability concerns. Common sites of referral to receive the HPV vaccine are discussed as well.

**Conclusions:** Dental professionals are well positioned to become leaders in the prevention of HPV and HPV-related cancers. Results demonstrated the interest and willingness of dental professionals to recommend and administer the HPV vaccine. Training could further improve their confidence and willingness to administer the vaccine. Legislation allowing for dental professionals to administer the HPV vaccine would increase its accessibility to patients and improve population health.



## Occupational Stressors of Dental Hygienists in the United States

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**Purpose:** Demand of the work environment can cause stress. Stress can cause anxiety, depression, reduced productivity, job dissatisfaction, and health issues. Little attention has been placed on the stressors of dental hygienists. The purpose of this study was to examine occupational stressors related to personal, environmental, and physical stressors and their relationship to job satisfaction and burnout of dental hygienists.

**Methods:** Survey research was conducted with a convenience sample of practicing dental hygienists (n=763). The survey instrument consisted of 10 scales from the New Brief Job Stress Questionnaire and four questions related to burnout.

**Results:** Job satisfaction was affected by work overload, anxiety, depression, and emotional demands. Leaving clinical dental hygiene in the next year was affected by physical stress ( $p < 0.05$ ), and burnout was related to the emotional demands ( $p < .05$ ).

**Conclusions:** Dental hygiene has a significant emotional component to the profession and these emotional demands were more likely to lead to burnout and affect job satisfaction. Physical demands were related to dental hygienists leaving clinical dental hygiene. Attention needs to be paid to these stressors to enhance retention and job satisfaction of dental hygienists.

## Human Papillomavirus Related Oropharyngeal Cancer: The effect of a continuing education course on dental hygienists' knowledge, attitudes, and practices

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**Purpose:** The purpose of this study was to investigate the effect a continuing education (CE) course on dental hygienists' knowledge, attitudes, and practices regarding human papillomavirus related oropharyngeal cancer.

**Methods:** A two-group experimental posttest only design was used and exempt status was granted by the Idaho State

University Institutional Review Board (IRB-FY2018-323). Randomly selected licensed Florida dental hygienists were recruited by email and assigned to either an experimental or control group. A self-designed questionnaire was developed and validity and reliability was established. The experimental group received a one-hour web-based CE course. Six weeks later, the questionnaire was administered using the online platform Qualtrics®. Data were analyzed using descriptive statistics and analysis of variance (ANOVA). The level of significance was established at  $p=0.05$ .

**Results:** Out of 302 who initially agreed to participate, 133 completed the study for a response rate of 44.04%. The majority of the participants were middle-aged, graduated in the 2000s, and were in clinical practice working full-time. The Knowledge Score for the experimental group was 72.6% while the control group scored 58.4%. Results revealed statistically significant differences between the groups in terms of knowledge ( $F=33.81$ ,  $df=1$ ,  $p=0.00$ ) and attitudes ( $F=13.91$ ,  $df=1$ ,  $p=0.00$ ). No differences were found in examination procedures; however, statistically significant differences ( $F=7.47$ ,  $df=1$ ,  $p=0.007$ ) were noted for items related to HPV specific topics between the two groups.

**Conclusion:** Additional research is needed to appreciate what types of interventions would increase knowledge and practices about HPV-related OPC among dental hygienists.

## Care of HIV Positive Children: Pediatric HIV education in dental hygiene curricula in the United States

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**Purpose:** Dental hygiene students must be prepared to care for patients with special health care needs however the Commission on Dental Accreditation (CODA) lacks specific requirements regarding the care of pediatric patients with HIV (PP\_HIV). The purpose of this study was to evaluate the differences in instructional format regarding PP\_HIV and identified potential barriers to incorporating this topic in the curricula of entry-level dental hygiene programs in the United States (U.S.)

**Methods:** A 58-item online, cross-sectional, mixed methods survey was distributed to program directors of all the entry-level dental hygiene programs in the U.S. Questions included program demographics, instructional format, and program directors' perceptions regarding incorporating education about PP\_HIV in dental hygiene curricula. Data analysis included descriptive statistics and qualitative narrative responses.

**Results:** Of 335 DH programs in the U.S., 32% responded. The majority of programs (57%) did not offer education on oral care of PP\_HIV. Programs in private institutions (60%) and programs awarding an Associate's degree (44%) reported higher percentages of topic inclusion. Of the programs offering PP\_HIV education, the instructional setting was didactic courses (65%) and the educational formats were presentations designed by course instructors (89%) and textbook (49%). A major reason for not incorporating this topic was not having any PP\_HIV present to their clinics (30%).

**Conclusion:** Absence of an accreditation requirement and not treating PP\_HIV in the school clinic setting may be barriers to incorporating this topic in entry-level dental hygiene programs' curricula. Accreditation guidelines with details for instructional format may encourage broader inclusion within programs' curricula.

### **Interprofessional Collaboration among Students on Oral Health for Cancer Patients**

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**Purpose:** The purpose of this pilot study was to provide education to nursing and dental hygiene (DH) students on oral considerations during cancer treatment and evaluate changes in knowledge, confidence, and willingness to provide oral screening, counseling, and referrals for patients undergoing cancer therapy.

**Methods:** A mixed-methods design including all first-year DH and accelerated nursing (ABSN) students at the University of North Carolina at Chapel Hill (UNC) was used. Data was collected using baseline and post-intervention surveys and debriefing session. Students received a presentation regarding oral considerations and provision of screening, counseling, and referral for cancer patients. A control group (16 ABSN, 8 DH) was asked to complete an immediate post-survey; others were organized into small, mixed groups and evaluated an unfolding case study and post-survey completion. A debriefing session followed. Descriptive statistics were used to analyze the data.

**Results:** 93 matched surveys returned (61 ABSN, 31 DH). Baseline surveys revealed 82% (n=76) indicated no knowledge to complete oral health screenings, 68% (n=63) counseling, or 65% (n=60) referral; post-survey results denoted positive

changes to knowledge in screening (72%, n=67), counseling (81%, n=75) and referral (89%, n=83). Baseline confidence assessment revealed 22% (n=20) had confidence to complete oral screening, 25% (n=23) for counseling, and 47% (n=44) for referral. Post-survey results showed confidence increases to screen (75%, n=70), counsel (83%, n=77), and refer (91%, n=82). Baseline and post-intervention levels of willingness to screen, counsel, and refer were high. Results revealed 96% (n=89) had willingness to collaborate with other healthcare professions and 99% (n=92) agreed shared learning would help them become a more effective team member.

**Conclusion:** Educating students in an interprofessional collaborative learning environment can increase their knowledge, confidence, and willingness to provide screenings, counseling, and referrals for patients undergoing cancer therapies. Responses indicate a willingness and desire to collaborate with other disciplines to enhance patient care.

# 2019 Annual Conference Research Poster Abstracts

The following posters were presented during the American Dental Hygienists' Association Annual Conference held in Louisville, Kentucky, June 20 – 23, 2019.

\* Indicates poster presenter.

## Oral Health of Long-term Care Residents

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**Problem:** Data is lacking in Utah to demonstrate to stakeholders and legislators the dental need of long-term care residents. Residents of these facilities experience barriers to accessing and receiving oral health care including financial, the priorities of caregivers, reduced access to professional dental providers, and even resistance from the residents themselves.

**Purpose:** The purpose of this study was to conduct a surveillance of the oral health status of long-term care residents receiving oral health care. IRB approval was obtained from Dixie State University.

**Methods:** A cross-sectional surveillance study was designed to determine the oral health needs of residents in long-term care. The study consisted of a convenience sample (n = 218) from a potential of 300 residents who qualified and requested oral health care through the grant. Recommended oral health indicators from the Association of State and Territory Dental Directors were utilized to collect the residents' oral health data and assessment of patient reported needs. Descriptive statistics were utilized to describe the findings. For consistency in data collection, all dental professionals involved in the project were trained and calibrated through an online training module.

**Results:** During the year of 2018, a total of 218 residents living in 13 certified nursing homes participated in the surveillance. 128 were females and 90 were males. The average age of the resident was 66.9 years with the youngest resident 25 years-of-age and the oldest resident 99 years-of-age. 98% of the sample reported an annual income of less than \$20,000. Among the residents examined, 31% reported it had been more than 2 years since their last dental visit, 26% reported sensitive teeth, and 47% reported current dental pain or discomfort. Dental indicators included 44% with substantial oral debris, 34% with severe gingival inflammation, 52% with untreated tooth decay, 29% with root fragments, and 72% were in need of periodontal care.

**Conclusion:** This study demonstrates oral health needs for long-term care residents living along the Wasatch Front in Utah. Providing access to professional oral health providers and curbing barriers to care must be addressed for a population that has limited resources and mobility to seek care. Collaborative practice dental hygienists with direct Medicaid reimbursement could be an avenue to deliver preventive care needed for this vulnerable population. Residents participating in the surveillance were provided dental hygiene and restorative services. Funding furnished by a grant from Civil Money Penalty Funds.

## Re-evaluation Outcomes Following Nonsurgical Periodontal Therapy: A retrospective analysis

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**Problem:** Literature showing the integration of reevaluation procedures and stabilization phases of nonsurgical periodontal therapy (NSPT) is scarce. Reevaluation is considered a critical step following NSPT to determine patient response to treatment, but is often an overlooked aspect of individualized care. Research indicates therapeutic endpoints should be used as guidelines to determine control of disease activity, prognosis, recare intervals, and associated referrals.

**Purpose:** The purpose of this retrospective record review was to evaluate clinical outcomes measured at initial assessment and at reevaluation following NSPT. Specifically, the aim was to assess bleeding on probing (BOP) and clinical attachment levels (CAL) following NSPT as a means to direct prospective studies that may further define therapeutic outcomes and reevaluation procedures that enhance supportive periodontal care.

**Methods:** A secondary analysis of electronic dental records was conducted for patients who received NSPT followed by reevaluation at a university dental hygiene clinic from January through December 2018. For inclusion in the study, records specified a minimum of one quadrant of NSPT (indicated by

CDT codes D4341/D4342) and post-therapy reevaluation. Clinical outcomes were evaluated using frequency distributions and univariate analysis to identify changes in BOP and CAL at baseline assessment and again at reevaluation four to eight weeks post-therapy.

**Results:** A retrospective cohort of patient records were selected using student data from documented reevaluation appointments. From identified records (N=105), 61% (n=64) met inclusion criteria. Demographic data indicated 66% of patients were male (n=42), with 69% age 60 or younger (n=44). The majority of clinical reevaluations occurred at four weeks following NSPT (n=26; 41%). The majority of patients did not report smoking (n=57; 89%) or diabetes (n=55; 86%). Overall, results from pre and post treatment showed a 53% reduction in bleeding sites (N=2204; n=1031). A combined 60% of sites with 4-5mm CAL (N=2230; n=1840) and 6+mm CAL (N=633; n=387) showed a decrease in CAL. Sites with 1-3mm CAL showed a 17% increase (N=5293; n=6185) from pre and post treatment.

**Conclusion:** Consistent with the literature, findings indicate reductions in bleeding and CAL following NSPT. Due to limitations of the records review process, there was no means to assure calibration for recording CAL. Increases in 1-3mm CAL at reevaluation may be attributed to the reductions in 4-5mm and 6+mm CAL resulting in transition to the 1-3mm CAL range. Findings suggest integrating formalized reevaluation is an integral phase of NSPT. Further clinical research regarding reevaluation procedures, data collection methods, and clinical and therapeutic outcomes are needed.

### Dental Hygiene and Nursing Students' Perceptions of the Significance of an Interprofessional Collaboration Experience

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**Problem:** The benefits of interprofessional collaboration include improved patient-centered outcomes, fewer preventable errors, improved relationships with other disciplines, and reduced healthcare costs, for not only nurses, but also for other healthcare professionals and ultimately, the consumers.

**Purpose:** The purpose of this program was to ascertain the dental hygiene and nursing students' perceptions of the significance of interprofessional collaboration (IPC). The data from this program will be used to make any necessary revisions for future IPC experiences with other College of Health programs and/or university departments.

**Methods:** The IPC experience of the Clayton State University dental hygiene program occurred during the 2018 fall semester when the undergraduate nursing students visited the dental hygiene clinic to instruct the dental hygiene students on taking patients' vitals (blood pressure, pulse, respiration and temperature). This IPC experience occurred on a Tuesday with 13 dental hygiene students and 11 nursing students and again on the following Thursday with 14 dental hygiene students and 5 nursing students. Due to scheduling limitations, the dental hygiene students were unable to provide oral healthcare instructions for the nursing students.

A 16 item closed-ended questionnaire was developed and pilot tested by two faculty. IRB approval was not necessary as this was an educational experience (descriptive education IPC). After each IPC experience, the questionnaire was distributed to dental hygiene and nursing students and faculty. Based on the responses received by the convenience sample, the data will be used to prepare for future IPC experiences with other programs in the College of Health and/or across the campus.

**Results:** When asked if they thought IPC "contributes to integrating dental hygiene and nursing into the interprofessional care team", the response "agree/strongly agree" was 90.6% and 81.3% respectively. In regard to IPC "improving patient care for dental hygiene patients", 90.4% of the students indicated "agreed/strongly agree". However, in reference to IPC "improving patient care for nursing patients", only 60.5% indicated "agree/strongly agree". Finally, the responses for IPC "will improve the profile of dental hygiene as a member of the health care team" 95% of the responses indicated "agree/strongly agree".

**Conclusion:** During informal conversations, at the conclusion of the IPC experiences, students from both College of Health programs expressed their pleasure in participating in the IPC experience and felt it was a mutually professional learning experience. However, to better evaluate the process, this pilot program should be replicated because the dental hygiene students did not have time to teach oral health care to the nursing students.

## Dental Hygiene Students' Preferences of Ultrasonic Instruments

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**Problem:** Previous research shows magnetostrictive ultrasonic instrumentation is widely used in dental hygiene education and is more prevalent than the piezoelectric ultrasonic instrumentation. However, there is no research study that shows dental hygiene students' preferences of ultrasonic instrumentation when presented with both options to use magnetostrictive and piezoelectric for treatment following didactic and clinical education.

**Purpose:** The objective of this study was to evaluate dental hygiene students' preferences of ultrasonic scaling instruments to include magnetostrictive or piezoelectric following didactic and clinical education.

**Methods:** A convenience sample of second year dental hygiene students from Central Community College (n=14) was used for the study. Both the magnetostrictive and piezoelectric ultrasonic instrumentation are taught in the dental hygiene curriculum didactically and clinically. In addition, students purchase both ultrasonic units. A cohort study collected data from August 2017 to December 2017 from the course, DENH 2250 Clinical Dental Hygiene II, which is taught the first semester of the second year of the curriculum. The total number of patients (n=1,022) were treated by the fourteen second year dental hygiene students. A clinical electronic evaluation form allowed clinical faculty to "click" on the electronic form if ultrasonic instrumentation was used as well as the type of ultrasonic instrumentation

**Results:** Descriptive statistics indicated of the total number of patients (n=1,022), an ultrasonic instrument was used 4.98% (n=205) following didactic and clinical instruction in the dental hygiene curriculum. The magnetostrictive ultrasonic was used 51% (n=105) and the piezoelectric ultrasonic was used 48.8% (n=100) in the cohort study.

**Conclusion:** Results indicate that dental hygiene students have no preferences between the magnetostrictive and piezoelectric ultrasonic instruments.

## The Advanced Dental Hygiene Practitioner: An Exploration of the Patient Perspective of a Mid-level Dental Provider.

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**Problem:** Although Advanced Dental Hygiene Practitioners (ADHPs) are adequately educated and possess the skills to provide competent care, they cannot improve access to care unless patients are willing to take advantage of their services. The significance of this study is to provide information about the willingness among two diverse groups to receive services provided by an ADHP.

**Purpose:** The purpose of this study was to examine patient attitudes and opinions regarding the utilization of an ADHP.

**Methods:** This quantitative, non-experimental, cross-sectional study employed a descriptive group-comparison design by analyzing the differences between those with and without access to dental care and evaluated differences among respondents based upon their socioeconomic and demographic attributes. Convenience sampling was used to select participants. Data were collected from patients treated at an upscale family and cosmetic dental practice (n=40) in a large metropolitan area and at an inner-city safety net clinic (n=40) using a 17-item questionnaire. Differences between the two groups were evaluated based on their socioeconomic and demographic attributes. Independent samples *t*-tests, one-way ANOVA tests, and Chi-Square tests were used to analyze the data at a confidence interval of 95% ( $\alpha=.05$ ). IRB approval was obtained through East Tennessee State University, approval number c0815.6e.

**Results:** An independent samples *t*-test determined no significant differences in perceptions regarding responsibilities and skills of an ADHP between genders ( $p=0.219$  to  $0.956$ ). One-way ANOVA tests determined no significant difference in perceptions based upon each of the following: ethnicity ( $p=0.239$  to  $0.820$ ), education level ( $p=0.054$  to  $0.612$ ), and income level ( $p=0.140$  to  $0.658$ ). No significant differences were found between patients with access to dental care and those without when asked if they would be willing to receive restorative care from an ADHP based on an independent samples *t*-test ( $p=.307$ ). Further, a Chi Squared value was computed from a cross tabulation analysis of these two variables (overall willingness to receive care and willingness to receive restorative care) and no significant difference was

found ( $p=.643$ ). Despite diverse demographics, the data indicated overall positive support of the ADHP. Nearly 95 percent (94.9%) of the respondents indicated they would be willing to receive care from an ADHP if legislation permitted.

**Conclusion:** This research demonstrates a high level of support among potential patients from two diverse samples adding greater confidence in the future expansion and application of this role and its ability to impact the lives of those in need.

### Dental Hygiene Program Directors' Knowledge and Implementation of Objective Structured Clinical Examination (OSCE) Testing

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**Problem:** The Objective Structured Clinical Examination (OSCE) is universally recognized as the gold standard for the evaluation of clinical competence, often serving as a substitute for live patient examinations (LPE). Due to its proven reliability, the American Dental Association Board of Trustees voted to develop and adopt the Dental Licensure Objective Structured Clinical Examination (DLOSCE) in 2017, to replace LPE for dental licensure.

While the utilization of OSCE has been widely recognized in dental schools for nearly three-decades, there is a significant gap in literature specifically regarding the use of OSCE in dental hygiene programs. Additionally, little is known about the potential impact the DLOSCE might have on dental hygiene licensure examinations.

**Purpose:** The objectives of this study were to assess dental hygiene program directors' awareness of and attitudes about a DLOSCE, whether their curricula included OSCE assessments, and perceived barriers to utilizing OSCE assessments.

**Methods:** A cross-sectional study of 332 United States dental hygiene program directors obtained from the American Dental Hygienists' Association (ADHA) Entry-Level Dental Hygiene Program Directory was conducted. A 20-question, electronic survey was developed, analyzed by the University of Michigan Survey Research Center, and pilot tested. Descriptive statistics and chi square tests were employed to provide data. Significance was set at  $p<0.05$ . The study was determined exempt by the UM Institutional Review Board (HUM00147564).

**Results:** A response rate of 36% ( $n=121$ ) was achieved. Nearly 30% of respondents were unaware of the Task Force

on Assessment of Readiness to Practice recommendations to develop an alternative to the single-encounter, live patient licensure exam; 80% were in favor of the decision. Nearly 75% considered OSCE assessments to be valid and reliable methods to assess clinical competence. More than half of respondents reported not currently utilizing OSCE assessments in their curricula. Time (22%), perceived lack of best practices (21%), and lack of resources (18%) were reported as significant barriers. Program directors who currently implemented OSCEs in their curricula were more likely to agree that OSCEs were both valid and reliable assessments ( $p=0.05$ ).

**Conclusion:** The majority of Dental Hygiene program directors were in favor of eliminating the single-encounter, live patient examination in favor of an OSCE. However, more than half do not currently utilize OSCEs. Further studies should explore implementation of OSCEs in dental hygiene education, and how the DLOSCE might impact the current educational curricula and licensure of dental hygienists in the United States.

### New York State Dental Hygienist Perceptions of an Interdisciplinary Model of Care for Patients with Diabetes who have Periodontal Disease

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**Problem:** Dental hygienists (DHs) are well-positioned to work collaboratively with other healthcare providers in the early detection of diabetes, however, DHs' perception of their role working in the interdisciplinary model of care (IDMC) is not well-documented.

**Purpose:** The purpose of this study was to examine how New York State (NYS) DHs perceive their role in an IDMC. This study focused on how NYS DHs perceive the relationship between periodontal disease and overall health of patients with diabetes. In addition, this study explored NYS DHs' perception of including a diabetes risk assessment (DRA) in their dental hygiene process of care (DHPC).

**Methods:** Two instruments were used to collect data in this mixed-methods study. Quantitative data were collected through an anonymous 21-item original survey consisting of a 5-point Likert-type scale and demographic questions. Invitations were distributed via email to a cluster sample of 750 dental hygienist members of the New York Dental Hygienists' Association (NYDHA) LISTSERV. The Shapiro-Wilk test indicated the sample was not normally distributed; therefore, non-parametric tests were used. A Kruskal-Wallis

test was used to measure the association between perception and the independent variables: age, years of experience, and primary practice settings. A Mann Whitney test was used to measure perception and the variable: including a DRA with regard to personal experience with diabetes. Qualitative data were collected through face-to-face interviews using a convenience sample of three DH colleagues. All interviews were audio-recorded and transcribed. An inductive approach was used to code data and inform theme development.

**Results:** A total of 153 DHs completed the survey, a response rate of 19.6%. No statistically significant difference was found between age of DHs ( $p=0.115$ ), number of years practicing as a DH ( $p=0.077$ ), or a close relationship with someone with diabetes ( $p=0.794$ ) and perceptions toward an IDMC for patients with diabetes. No statistically significant difference ( $p=0.179$ ) was found between type of work setting and inclusion of a DRA as part of the patient assessment protocol. Analysis of the three face-to-face interviews revealed the following themes and sub themes: knowledge, roles (educator), and IDMC (support, qualities, and barriers).

**Conclusion:** Quantitative results were not statistically significant. However, qualitative results revealed DHs perceive their role as an educational resource for patients regarding the bidirectional relationship between periodontitis and diabetes. Given the positive views expressed by participants in this study toward an IDMC, it is likely DHs would include a DRA in their DHPC, given the time and support from their dentist-employer.

### Implementing Inter-Professional Education: Dental Hygiene and Physician Assistant Activity

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**Problem:** Current Commission on Dental Accreditation (CODA) standards for dental hygiene graduates include emphasis on the ability to communicate and collaborate with other health care team members in the provision of safe and effective oral health services.

**Purpose:** This project was designed to assess the knowledge of dental hygiene (DH) and physician assistant (PA) students about one another's professions, education and training and to improve the students' knowledge in oral pathology and the head-and-neck (intra- and extra-oral) portion of a physical exam.

**Methods:** Pre- and post-activity surveys of Likert-type scale questions were administered to the participants using

Survey Monkey® to determine changes in their knowledge of the opposite profession and confidence in performing examinations. On the day of the activity, faculty from both disciplines presented an overview of their professions and shared information on systemic conditions with oral manifestations. Students were randomly assigned to groups which included both PA and DH students. The groups were given 2 case patient simulations to role play. The cases included both medical history information and physical signs. After completing the patient history and demonstrating their discipline's method of patient head-and-neck examination, the students were instructed to determine differential diagnoses for each case.

**Results:** The review of survey results was limited to the participants who completed both pre-and post-activity surveys (19 of 28 DH and 38 of 41 PA). Comparison of the surveys revealed an increase in knowledge about both professions' education and training. Additionally, each group reported increased confidence in engaging the opposite profession in the management of patients. PA students reported an increase in confidence in exam techniques when evaluating the oropharynx. DH student results, however, showed no change in this area. Both groups reported an increase in identifying the lesions commonly found in HIV positive patients. In the pre-activity survey, only 50% of PA students agreed with the question "I know when and who to refer my patients to when faced with different oral pathology." Post activity, 100% of these students reported they agreed/strongly agreed with this statement.

**Conclusion:** This activity showed inter-professional activities are an effective means of educating health care students about others' professions and roles in the health care team. IPE activities can be utilized to enhance student learning in common subject areas and to facilitate communication and collaboration between various professional disciplines.

### Do Licensed Dental Hygienists Routinely Take Blood Pressure on Patients?

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**Problem:** In the United States over 103 million people have high blood (BP) pressure. The high prevalence of the disease among the American population is concerning and must be considered when treating dental patients. Dental practitioners can often be on the frontlines of prevention of hypertension by evaluating preoperative blood pressure readings, performing

risk assessments, and knowing when to consider medical consultation of a hypertensive patient in a dental setting. Patients see their dental professional more frequently than their medical professional. Routine blood pressure screening in the dental practice could help identify patients at risk for stroke and coronary artery disease.

**Purpose:** The purpose of this study was to assess the knowledge and practices of licensed dental hygienists in performing routine blood pressures (BP) screenings and pre/post BP when administering local anesthesia on their patients.

**Methods:** This cross-sectional study utilized a purposive sample of dental hygienists recruited through social media sites and RDH's attending the Massachusetts (MA) Dental Hygienists' Association Annual Conference (6772 RDH's in MA). The validated survey included 9 quantitative questions and 2 open-ended questions related to blood pressure practices and 7 demographic questions was electronically distributed through QualtricsXM™. Inferential statistics, using the Chi-square, were utilized for data analysis. Descriptive statistics were used for demographic questions. IRB approval, non-exempt status, was granted from MCPHS University.

**Results:** Of the 344 participants who completed the survey, 53.3% (n=187) of the participants reported routinely taking BP while 48.7% (n=158) do not. Statistical significance, with a high correlation, ( $\chi^2(1, 264)=95.49, p<.001, \phi=.60$ ), was shown when comparing taking routine BP and taking preoperative BP when administering local anesthesia. Statistical significance, with a moderate correlation, ( $\chi^2(1, 263)=22.92, p<.001, \phi=.30$ ) was shown on the following three criteria, when comparing taking a preoperative BP when administering local anesthesia and taking a postoperative BP when administering local anesthesia; the dentist taking BP at every visit and taking a preoperative BP when administering local anesthesia; and the relationship between the number of hygienists taking and not taking blood pressure with those that are or are not aware of the new blood pressure guidelines. Qualitatively, the two most common response for not taking BP were the dentist did not require it and not enough time.

**Conclusion:** Educational opportunities emphasizing the importance of routinely taking blood pressure and increasing dentist's awareness of the importance of routine BP could result in RDH's performing BP screenings more routinely.

## Oral Health Education and Promotion Activities in Early Head Start: A systematic review

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**Problem:** Early head start (EHS) programs offer complete child development services and support to low-income children <3 years and their families. The promotion of healthy oral hygiene habits for children and their families is critical during this time. Therefore, EHS programs should utilize oral health standards provided by the U.S. Department of Health and Human Services, Office of Head Start to promote oral health education and activities. Documentation in the literature of oral health education and promotion activities within EHS programs are scarce. Therefore, a systematic review was used to answer the question of, "What are the oral health education and promotion activities performed in EHS programs for staff, children, and caregivers?"

**Purpose:** The purpose of this study was to investigate oral health education and promotion activities performed in EHS programs for staff, children, and caregivers in the U.S.

**Methods:** A systematic review approach utilizing relevant databases such as CINAHL, PubMed, and Google Scholar with key terms: oral health, education, promotion, activities, early head start, and early childhood caries was performed. Inclusion criteria was peer-reviewed quantitative studies related to EHS oral health education and promotion activities from 2000 to 2018. Studies were assessed for eligibility using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (PRISMA). Two researchers independently evaluated the quality of studies using the Quality Assessment Tool for Quantitative Studies of Effective Public Health Practice Project. The tool evaluates selection bias, research design, intervention integrity, and data analyses of each article.

**Results:** The initial search yielded 363 total articles screened for eligibility. Five studies (n=2 observational and n=3 quasi-experimental designs) remained after the screening process and received the following ratings: strong (1), moderate (3), and weak (1). Participants in these studies were EHS staff and parents. Main outcome measures were oral health knowledge, attitudes and behaviors, oral health promotion, and oral health activities. A majority of the studies investigated the effectiveness of oral health education and promotion interventions among EHS staff members and parents. Two studies examined oral health activities guided by EHS teachers



for children and parents. These activities included oral health education, toothbrushing instructions, toothpaste use, dietary education, and assessment of dental health status.

**Conclusion:** Among the five studies evaluated, the interventions focused on increasing pediatric oral health knowledge and practice behaviors among EHS staff members and parents. Ongoing studies are needed to evaluate and document children-focused oral health activities within the EHS programs.

### A Study of Color-Blind Racial Attitudes in Dental Hygiene Students

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**Problem:** The percentage of racial minorities in America is projected to increase to approximately 50% of the population by the year 2050. Many healthcare professionals may be unaware of their own racist attitudes or stereotyping. Color-blind racial attitudes and biases have been linked to racial prejudice which has the potential to affect dental hygiene care to diverse patients.

**Purpose:** The purpose of this cross-sectional pilot study was to determine the color-blind racial attitudes of dental hygiene students in an entry-level baccalaureate program.

**Methods:** After IRB approval, the 20-item, Color-Blind Racial Attitudes Scale (CoBRAS) survey was sent to a convenience sample of all dental hygiene students (n=71), 41 first-year and 30 second-year. Four demographic questions: age, gender, race, and year in program, were also included. The CoBRAS instrument measures contemporary racial attitudes and stereotyping in three subcategories: Unawareness of Racial Privilege, Institutional Discrimination, and Blatant Racial Issues. Participants used a 6-point Likert scale ranging from strongly disagree (1) to strongly agree (6), to determine level of agreement or disagreement with the statements. Total scores on CoBRAS range from 20-120. Higher scores indicate higher levels of denial of racism.

**Results:** Of the 71 students invited to participate, 70 completed the survey for a 98.6% response rate. Demographic data revealed most respondents were women (98%), aged 18-29 (90%) and White (70%). Results revealed an overall average score of 64.89 on the questionnaire. T-tests were used to compare first and second-year student groups (overall score, "racial privilege," "institutional discrimination," "blatant racial issues",

age, race, gender), with no statistically significant findings for overall scores ( $p>0.05$ ), or any other subscale. The average score among both years of students in the category unawareness of White racial privilege was 28.86. For the construct related to institutional discrimination the average score was 21.51. Finally, blatant racial issues had a score of 14.5.

**Conclusion:** The average CoBRAS scores indicate most participants possess moderate levels of color-blind racial attitudes, suggesting most participants rejected the idea of racism. As color-blindness comes from a lack of awareness of White privilege, training in this area may foster improved interactions with diverse patient populations.

### Implications of cement-retained and screw-retained prostheses in dental implants and peri-implant disease: A systematic review

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**Problem:** In order to provide primary prevention of peri-implant diseases, it is imperative for the dental hygienist to understand the potential risk introduced by prosthetic type.

**Purpose:** The objective of this systematic review was to evaluate whether implant prosthetic type is a risk factor for peri-implant diseases.

**Methods:** MEDLINE (PubMed), COCHRANE and EMBASE were used to identify studies that assessed the impact on the role of cement-retained and screw-retained prostheses on peri-implant diseases. Key terms included cement-retained crowns, screw-retained crowns, peri-implant mucositis, peri-implantitis, and residual cement. Search limitations included human studies, comparison of the effects of cement-retained prostheses versus screw-retained prostheses, and articles published in the English language between 2011 and 2018. Exclusion criteria included study participants who had cardiovascular diseases, diabetes, or were smokers. Authors of studies that were unclear regarding the inclusion of participants with these conditions were contacted via e-mail for clarification. Duplicates were removed and 526 titles and abstracts were independently screened by three reviewers. Differences between the reviewers were discussed, and decisions were made to include or exclude the disputed articles. Articles with abstracts not relevant to the topic were removed.

**Results:** Sixty-three articles were identified; five were included in the analysis. A meta-analysis could not be performed due to

the heterogeneity of the studies. Included studies focused on peri-implant diseases in relation to cement-retained prostheses versus screw-retained prostheses. Four articles suggested that there is no significant difference between cement-retained and screw-retained prosthesis for dental implants and their effect on the peri-implant tissues. One article suggested a slight correlation between cement-retained prosthesis and peri-implant disease.

**Conclusion:** Limited evidence exists that compares cement-retained prostheses and screw-retained prostheses as contributing risk factors to the etiology of peri-implant diseases. The studies included in this review suggested that cement-retained prostheses are not a significant contributing factor for peri-implant disease when compared to screw-retained prostheses. Further clinical studies are necessary to explore the impact of prosthetic type on peri-implant diseases.

### Associations Between Dental Visit and Intake of Sugar-Sweetened Beverage and Plain Water Among United States High School Students

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**Problem:** Sugar-sweetened beverages (SSB), such as regular soda, fruit-flavored drinks, sweetened coffee/tea drinks, sports drinks, and energy drinks, are the leading sources of added sugars in the diet of U.S. youth. Frequent SSB intake is linked to adverse health consequences including dental caries, obesity, and type 2 diabetes. Drinking plain water (i.e., without caloric sweeteners) may improve diet and oral health and prevent weight gain, specifically when it is substituted for SSB. There is limited information on whether beverage intake is related to dental visit among U.S. adolescents.

**Purpose:** This cross-sectional study examined associations of SSB and plain water intake with dental visit among a nationally representative sample of U.S. high school students.

**Methods:** The 2017 national Youth Risk Behavior Survey data of 10,551 students (grades 9–12) were used. The outcome variable was dental visit during the past 12 months (seeing a dentist for a check-up, exam, teeth cleaning, or other work). Exposure variables were frequency of SSB (i.e.,

regular soda and sports drink) and plain water intake during the past 7 days. Covariates were age, sex, race/ethnicity, and smoking cigarettes/cigars or using smokeless tobacco/electronic cigarettes. Chi-square tests were used to test unadjusted associations between dental visit and beverage intakes (significant at  $P < 0.05$ ). We used multivariable logistic regression model to estimate adjusted odds ratios (aOR) and 95% confidence interval (CI) for not seeing a dentist by SSB and plain water intake status after controlling for covariates.

**Results:** Overall, 23% of high school students reported not seeing a dentist for a check-up, exam, teeth cleaning, or other works during the past 12 months. Overall, 38% of students reported drinking SSB  $\geq 1$  time/day, and 18% drank SSB  $\geq 2$  times/day. About 25% of students reported drinking plain water  $< 1$  time/day. Based on chi-square tests, intakes of SSB and plain water were significantly associated with dental visit ( $p < 0.0001$ ). Based on multivariable logistic regression model, odds of not seeing a dentist were significantly greater among students who drank SSB  $\geq 2$  times/day (aOR=1.43, 95% CI=1.17, 1.75) compared to non-SSB consumers, and among students who drank plain water  $< 1$  time/day (aOR=1.64, 95% CI=1.38, 1.94) compared to those who drank plain water  $\geq 4$  times/day after controlling for covariates.

**Conclusions:** In the present study, higher SSB intake and lower plain water intake were associated with not seeing a dentist. These findings can inform adolescent-intervention efforts to decrease SSB intake and increase water intake to improve oral health and promote healthy lifestyles.

Project funding was provided by the Centers for Disease Control and Prevention.

### Self-Assessment of Ergonomics Among Dentists and Dental Hygienists Utilizing Photography

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**Problem:** Due to the postural demands and manipulative precision required of dental professionals, oral health clinicians are at higher risk for developing work-related musculoskeletal disorders (WMSDs). Interventions to improve ergonomics have been suggested to help reduce the prevalence of WMSDs. Dental clinicians' awareness of their postures and the clinical application of ergonomic recommendations remains unsatisfactory. However, training that involved self-assessment using photography was shown to be effective with dental and dental hygiene students.

**Purpose:** The purpose of this study was to determine whether training utilizing self-assessment and photography would improve ergonomic scores and the accuracy of ergonomic self-assessments among dentists and dental hygienists.

**Methods:** Upon approval from The Ohio State University Institutional Review Board (#2018H0157), this study used a randomized control design and utilized a sample of 30 dentists and 20 dental hygienists. Participants were randomly assigned into one of two groups (control or training). A validated modified-dental operator posture assessment instrument (M-DOPAI) with 12 components was utilized for self-assessments and rater evaluations. At week-1 and week-4, all participants independently completed ergonomic self-assessments and were photographed. At week-2 and week-3, participants in the training group were photographed and used those photographs to complete an ergonomic self-assessment with the principal investigator. At week-2 and week-3, participants in the control group independently completed ergonomic self-assessments. Four calibrated raters independently evaluated the week-1 and week-4 photographs. Mixed-design ANOVA was used to evaluate changes in ergonomic scores and the accuracy of ergonomic self-assessments from week-1 to week-4.

**Results:** The training involving self-assessment and photographs resulted in significant improvements in ergonomic scores for the dentists ( $F(1)=6.295$ ,  $p<.05$ ) and dental hygienists ( $F(1)=8.535$ ,  $p<.01$ ) and significant improvements in the accuracy of ergonomic self-assessments for the dental hygienists ( $F(1)=4.806$ ,  $p<.05$ ).

**Conclusion:** The continual use of self-assessment and photography may help increase awareness, lead to corrections in posture, and reduce the risk for WMSDs.

### **Interdisciplinary Collaboration Between Dental Hygienists and Cancer Treatment Facilities in Rural Illinois**

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**Problem:** Access to care in rural Illinois is limited due to many constraints including a majority of the population that fall below the Federal Poverty Level (FPL). This is a concern due to the many oral complications that can arise during radiation treatment. These complications can ultimately affect the proposed course of treatment. Moreover, if the cancer treatment facility does not have a dentist or dental hygienist

on staff, this can be a barrier to care. In the southernmost sixteen counties of Illinois, the population is 344,594 and covers 6,038 square miles. Currently, there is only one radiation oncologist providing treatment.

**Purpose:** The purpose of this project is to investigate how dental hygienists can be utilized in rural Illinois cancer care treatment facilities. The goal of this project is to determine if radiation oncologists currently collaborate with dental hygienists or if they feel the future partnership would be valuable to their patients. Current review of the literature does not show any connection between the two specialties in rural areas in Illinois.

**Proposal:** Theoretically, dental hygienists are involved prior to cancer treatment and are responsible for developing the most suitable oral environment for radiation treatment. After gathering data, it will be determined if radiation oncologists desire the need for collaboration between the two professions. The current disparity and high population of individuals positioned in the lower 50<sup>th</sup> percentile shows a vast need for an alliance in rural Illinois. Preventing and controlling the potential complications will be vital for a successful partnership. Once the potential partnership forms, dental hygiene students would be able to utilize externship opportunities at cancer treatment facilities. This partnership will allow them to create “individualized treatment plans”, proper self-care and education for the patient and their families. In addition, the dental hygienist can provide referral sources or information to dentists or any specialists the patient would need to contact before, during or after treatment.

**Evaluation Plan:** Surveys will be administered to radiation oncologists (via Survey Monkey) who are on staff of cancer treatment facilities in rural Illinois (south of Interstate 74). Qualitative and quantitative data will be gathered to determine radiation oncologists’ attitudes about how dental hygienists can be utilized in cancer treatment facilities. Questions will be included to address collaborative treatment before, during and after radiation therapy.

## The Additive Effects of Mobile Phone Use and Dental Hygiene Practice on Finger Strength: A pilot study

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**Problem:** Developing cumulative trauma disorders is an occupational risk factor for dental hygienists and can be attributed to repetitive motions. In the last 20 years, cell phone use has also been identified to cause strain due to repetitive motions with use. This study looked at additive effects of the repetitive motions of dental hygiene practice and cell phone use on the strength of muscles associated with instrumentation.

**Purpose:** The purpose of this pilot study was to determine muscular strength of muscles involved in scaling by dental hygienists and the additive effects of cell phone usage, as indicated by muscular force generation.

**Methods:** A convenience sample of 16 dental hygienists (experimental group) and 16 people that did not use tools repetitively for work (control group) participated in this experimental pilot study. Participants completed a modified Cell Phone Usage Questionnaire to determine cell phone use. Upon completion, participants' force production was measured using a hand-held dynamometer.

**Results:** There were statistically significant differences between the experimental and control group for the abductor pollicis longus ( $p=0.045$ ) with the control group generating greater muscle force. There were significant differences found when comparing the differences between low cell phone users in experimental group and control group for the flexor pollicis brevis ( $p=0.031$ ), abductor pollicis longus ( $p=0.031$ ), and flexor digitorum ( $p=0.006$ ). For all of these, the control group had higher muscle force generation. Finally, there was a significant effect of years in practice and cell phone use on muscular force generation for the flexor pollicis brevis ( $F=3.645$ ,  $df=3$ ,  $p=0.020$ ) and flexor digitorum ( $F=3.560$ ,  $df=3$ ,  $p=0.022$ ) with those who have practiced the longest producing the least amount of muscle force.

**Conclusion:** This study indicated no significant additive effects of cell phone use and dental hygiene practice on finger muscles used for both. However, results did indicate that dental hygiene practice had significant effects on muscular strength when compared to people who do not use tools repetitively for work. Future research should include type of

cell phones, exact duration of use, and ways to reduce risk for developing musculoskeletal disorders. Future research may also want to evaluate the additive effects on forearm and wrist muscles because these have been indicated for repetitive motions in dental hygiene practice and may also be used repetitively with cell phone use.

## Identifying Leadership Development Needs of Dental Hygienists Using an Online Delphi

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**Problem:** The roles of the dental hygienist as a part of an interdisciplinary team require a dental hygienist to have leadership skills to collaborate and carry the profession forward in a time when healthcare systems are transforming. A review of the literature strongly supports that there is a need to generate consensus on the leadership skills that dental hygienists should develop. Understanding the leadership needs of dental hygienists and preferences of how leadership skill should be developed, allows for the development of a leadership model/ framework for dental hygiene.

**Purpose:** The purpose of this online Delphi was to investigate the opinions of dental hygienists to understand leadership needs of dental hygienists and preference of how the leadership skills should be developed.

**Methods:** This qualitative study was conducted via an online Delphi using a crowdsourcing platform. There were 8-10 experts chosen from each of the seven areas of dental hygiene ( $n=54$ ). There were two rounds of Delphi questions in this study. Two questions were simultaneously presented in Round 1 for each of the seven break out groups: 1.) What are the most critical leadership skills needed by dental hygienists? and, 2.) How would dental hygienists prefer to develop leadership skills? Questions in Round 2 included ideas receiving more than 50% of the support from the separate seven crowds in Round 1. In Round 2, participants were all in one group, were not separated by occupational category, and users were presented with pairs of versions of ideas to assess ideas that were answered in Round 1. As votes were received, the versions receiving the most votes were ranked.

**Results:** Critical leadership skills identified by dental hygienists is the ability to work with other professionals at all levels including speaking, writing, listening, and also being able to compromise when necessary for the overall good. Dental hygienists preferred leadership development via a multi-prong approach including effective training modules, seminars,

books/videos and collaboration with mentors, coaches, and role models while catering to an individual's learning style. The identification of leadership skills and development preferences is a starting point to address leadership, however developing sustainable leadership solutions should be a point of focus to intentionally plan leadership succession, improve leadership, and manage the process over time.

**Conclusion:** Sustainable leadership positions the dental hygiene profession within the hub of healthcare providers which creates interdependence of the profession. Pathways to operationalize sustainable leadership within dental hygiene are prioritized and proposed within this study.

### **Sexual Harassment: A study of Virginia dental hygienists**

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**Problem:** The #MeToo movement has increased awareness of systemic sexism and sexual harassment in the workplace. Dental hygienists' job retention and career satisfaction along with quality of patient outcomes can all be effected by sexual harassment. In order for dental hygienists to effectively recognize and manage this type of illegal behavior they must first recognize that it is occurring.

**Purpose:** The purpose of this study was to determine if dental hygienists in Virginia (VA) experience sexual harassment while employed in the oral health care setting.

**Methods:** A cross-sectional research design was used to generate information regarding the extent to which VA dental hygienists perceived experiencing workplace sexual harassment. The revised Sexual Experiences Questionnaire (SEQ-W), was used to survey a convenience sample of 230 VA dental hygienists attending a Continuing Education (CE) event in Virginia. Total registration for the event was 270. The SEQ-W survey is comprised of 17 items measuring 3 constructs: sexual coercion, unwanted sexual attention and gender harassment. The online survey was made available for the three days of the CE course. Descriptive statistics (frequencies and percentages) were used to analyze the data.

**Results:** An overall response rate of 70% was obtained. Most respondents were employed in a solo dental practice (44%) followed by a group practice at 33%. Data reveal 21% of those surveyed reported at least one experience of sexual harassment as measured by the SEQ-W in the past 24 months. Of the

three constructs measured 25% of participants experienced gender harassment, 12% unwanted sexual attention and 4% sexual coercion. The most commonly reported items were being told offensive sexual jokes or stories (20%) and hearing someone make crude and offensive sexual remarks (16%). At the end of the survey, a definition of sexual harassment was provided and participants were asked "are you experiencing work-place sexual harassment" of which 10% indicated yes. These results suggest some participants were being sexually harassed at work but were unaware the behaviors experienced constituted sexual harassment.

**Conclusions:** Results from this study suggest 1 out of 5 Virginia dental hygienists responding to this survey experience workplace sexual harassment. Education to ensure identification of sexual harassment may be helpful in promoting awareness, prevention strategies and a healthier work environment leading to enhanced job satisfaction. However, more research is needed using a national sample of dental hygienists to determine the prevalence of workplace sexual harassment on a larger scale.