



American  
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# JOURNAL OF DENTAL HYGIENE

THE AMERICAN DENTAL HYGIENISTS' ASSOCIATION

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- Development and Testing of a Smartphone Application Prototype for Oral Health Promotion
- Dental Hygiene Students' Clinical Skill Acquisition: Activity theory and the use of videos
- Nursing Administrators' Views on Oral Health in Long-Term Care Facilities: An exploratory study
- Evidence-Based Practice Knowledge, Attitude, Access and Confidence: A comparison of dental hygiene and dental students
- Childhood Obesity: Dental hygienists' beliefs attitudes and barriers to patient education
- Treatment of a Culturally Diverse Refugee Population: Dental hygiene students' perceptions and experiences
- Effects of a Training Needle on Dental Hygiene Student Anxiety

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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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## What does research tell us about the future of dental hygiene?

Katy Battani, RDH, MS

As I began reflecting on this question, I thought to myself – research has told me repeatedly that more dental hygienists are needed to work in the public health arena in order to achieve oral health equity for future generations. However, my perspective comes from being immersed in the public health sector and I am sure that my colleagues in other specialty areas, such as academia, would say the same about the demand for qualified and passionate oral health care professionals in their respective fields. And they are correct!

Merriam-Webster dictionary defines research as “studious inquiry or examination, especially investigation or experimentation aimed at the discovery and interpretation of facts.”<sup>1</sup> Thorough research investigations allow for us to learn about the reality of a problem or situation in order to develop effective programs. Working within a state-level oral health program, I am continually reviewing data and conducting surveillance and research projects to identify and better understand oral health disparities, workforce issues, oral disease burden, and access and utilization trends at the state and local levels. Research data serves as the core springboard for jumping into innovative, improvement-focused solutions. However, we must first examine and appreciate the data before we can make that leap forward. Data should drive public health program development and resource allocation. Without the research data, we risk being misguided towards the inappropriate use of our resources.

Public health data also serves to steer and expand the future of the dental hygiene profession in a positive and progressive direction. As a contributor to “Advancing Dental Education in the 21<sup>st</sup> Century,” I was able to put on my researcher hat to review the factors impacting the future of the

profession. What are the challenges? What are the opportunities on the horizon? How will dental hygiene education advance to keep pace with an evolving workforce that will undoubtedly need to be prepared to expand into alternative settings with growing scopes of practice and responsibilities? Our health care system is in the midst of a transformation, largely driven by data that shines a big spotlight on rising costs and poor health outcomes. Though some oral health improvements have been made nationally, dental caries remains the most common chronic pediatric disease, almost half of all adults over age 30 have some form of periodontal disease,<sup>2</sup> and more than 50,000 new cases of oral cavity or oropharyngeal cancer will be diagnosed in 2018, with an increasing number of cases linked to human papillomavirus infections.<sup>3</sup> Additionally, oral health disparities persist for certain groups based on race, ethnicity, socioeconomic status, gender, age, and geographic location.

As our health care system continues to evolve, I feel confident there will be increasing opportunities for dental hygienists to contribute to the triple aim of improving patient experiences, improved population health, and reduced costs of care. Dental hygienists can contribute to achieving the triple aim through expanded scope of practice especially for vulnerable populations; integration into primary care and other alternative settings such as long-term care facilities, hospitals, community-based programs, and home residences; and through leadership roles at the local, state, and national levels.

Our educational programs need to adequately prepare graduates for a variety of professional roles and employment settings. Dental hygienists need to be prepared to collaborate inter-professionally with non-dental health care providers and community program staff and in some states, acquire advanced clinical skills. Baccalaureate, master’s and doctoral degree programs in dental hygiene will be essential to prime future professionals for leadership roles in public health, academia, research, industry, administration, business, and more.

In a nutshell, I foresee a promising and exciting future for our profession as long as we continue to evolve with the larger health care system and the changing demands of the public. We do not want to be left behind, siloed away from the larger health system in our traditional clinical practice roles and settings. Rather, dental hygiene must grow and advance



to become part of the comprehensive medical and community health care team, valued as experts based on our foundation in oral health promotion and disease prevention.

**Katy Battani, RDH, MS** is the project manager of the perinatal and infant oral health quality improvement project for the Maryland Department of Health, Office of Oral Health and a member of the Maryland Pregnancy Risk Assessment Monitoring System. Prior to working in public health, she was a faculty member at the University of Maryland, Baltimore School of Dentistry and served as the graduate program director for the Master of Science in Dental Hygiene program.

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## Development and Testing of a Smartphone Application Prototype for Oral Health Promotion

Sara L Nolen, RDH, MS; Lori J. Giblin-Scanlon, RDH, MS; Linda D. Boyd, RDH, RD, EdD; Lori Rainchuso, RDH, DHSc

### Abstract

**Purpose:** The purpose of this study was to develop and test a smartphone application (app) prototype, ToothSense, as an oral health promotion tool for the prevention of Early Childhood Caries (ECC) based on the Theory of Planned Behavior (TPB).

**Methods:** A quantitative and qualitative design process based on the TPB was used for the app development in the first phase of the study. A behavioral intervention technologic model was used to document the app features design, accounting for Doshi's intervention strategies for the TPB. Beta-testing of the app was hosted via an online software program. Testers were presented with a series of tasks and prompts followed by a 5-point Likert-scale questionnaire that quantitatively measured perceptions of the app's interactive design based on Jakob Nielsen's principles and behavioral strategies. A Net Promotor Score was calculated to determine the tester's likelihood to recommend the app prototype. Audio and video aspects of the app were qualitatively measured using a template approach.

**Results:** Beta testers agreed the app met the majority of the five usability statements. The Net Promotor Score indicated a likelihood to recommend the app prototype. Thematic analyses revealed the following themes: interface design, navigation, terminology, information, and oral health promotion.

**Conclusion:** Beta testing results from this study provided health promotion project design information for the prevention of ECC using the TPB and highlighted the importance and usability of smartphone app for oral health promotion.

**Keywords:** health behavior theories, oral health promotion, smart phone apps, mobile health apps, theory of planned behavior, early childhood caries

This manuscript supports the NDHRA priority area: **Client level: Oral health care** (health promotion: treatments, behaviors, products).

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### Introduction

Dental caries or tooth decay is the most common chronic infectious-disease affecting children today.<sup>1-3</sup> Tooth decay occurring in children aged six and younger is known as Early Childhood Caries (ECC)<sup>1</sup> and is considered one of the most significant public health problems throughout the world, in both developed and developing countries.<sup>1-3</sup> In the United States (U.S.), among children aged 2 to 5 years, 75% of the cases of ECC have been identified in 8% of the population,<sup>4</sup> indicating that dental caries is more common in lower socioeconomic households and racial ethnicities.<sup>5</sup> Dental caries is a preventable disease, yet despite all efforts, little improvement has been made in preventing ECC in the U.S.<sup>1</sup>

A systematic review of the literature by Castilho et al. identified that parents' previous caries experience, including the transmission of cariogenic bacteria, along with parents' oral self-care, and

sugar intake, could increase the risk of caries development in their children. Children's oral health was linked with their parents' knowledge, attitude, socioeconomic status, level of education and maternal age.<sup>6</sup> Furthermore, parental attitudes and beliefs were shown to be changed through increased oral health knowledge.<sup>7</sup> Parental support during the implementation process of behavior changes has been linked to increased success in the adoption of positive oral health behaviors.<sup>6,7</sup>

Dentistry has focused on individual health promotion primarily using health education, rather than incorporating behavioral and population approaches.<sup>8</sup> Early Childhood Caries has proven to be resistant to oral health promotion on the individual level.<sup>9</sup> Challenges to the problem are further precipitated by the difficulty in accessing young children. During the first two years of life, children average 10 or more visits to a primary health



care provider and may not ever visit a dentist or oral health care provider.<sup>10</sup> Developing an oral health promotion program to reach parents and caregivers prior to their child's first dental visit has the potential to be an effective intervention tool.

Behavior strategies have been identified as necessary elements to ensure implementation and adherence of any health promotion intervention tool.<sup>9</sup> The Theory of Planned Behavior (TPB) has been identified as a predictor of intent to engage in positive oral health behaviors.<sup>11</sup> The constructs of the TPB are: behavioral norms (attitudes), normative beliefs (subjective norms); and control beliefs (perceived behavioral control).<sup>12</sup>

Dumitrescu and colleagues designed a cross-sectional study to evaluate five social cognitive theories including the TPB to explain current oral health behaviors and predict individuals' intentions to engage in positive oral health behaviors. Results of the study indicated that TPB and the Health Action Process Approach (HAPA) were the best predictors of intention to engage in oral health behaviors. Research findings of Dumitrescu et al. indicate that oral health education should focus on perceived behavioral control by improving knowledge and attitudes and removing barriers to daily oral health care through addressing performance difficulty, confidence, perceived control, and locus of control.<sup>11</sup>

Smartphone applications (apps) have the capacity to provide computer-tailored, population based interventions throughout the day and night, as 90% of mobile phone users in the U.S. are reported to be in possession of their phone at all times.<sup>13</sup> Health promotion strategies have been proven to be successful when behavior change strategies have been incorporated into modern technology, including the Internet,<sup>14</sup> mobile phone text messaging,<sup>15,16</sup> and more recently smartphone apps.<sup>13,17-21</sup> In addition, apps incorporating behavior change strategies are typically associated with increased effectiveness of the intervention.<sup>21</sup>

Smartphones, mobile phones with the capacity of a hand-held computer, are widely used across all socioeconomic groups, making them an excellent resource for health promotion messaging.<sup>18,22</sup> An estimated 85% of adults aged 18-29 in the U.S. possess a smartphone and ownership has not been shown to be influenced by socioeconomic status (SES).<sup>23</sup> However, lower SES users have been shown to spend more money downloading apps and are more likely to use their smartphone as their only source of Internet access than higher SES users.<sup>24</sup> This user profile provides an opportunity to deliver remotely administered oral health promotion and the ability to access lower socioeconomic populations. Development of a smartphone oral health app requires a review of current literature to determine

the theoretical basis for the prototype and testing for acceptability within the target audience.<sup>25</sup> The purpose of this study was to develop and test a prototype of a smartphone app (ToothSense) as an oral health promotion tool for the prevention of ECC targeting parents and caregivers of children six years and younger. The study assessed the app's usability, quality, performance, likelihood to recommend, and users' perceptions of TPB intervention strategies.

## Methods

This study was granted exempt status from the Institutional Review Board of MCPHS (Massachusetts College of Pharmacy and Health Sciences) University. The app prototype development and testing process used both quantitative and qualitative measures in two phases of the study: app prototype design and development based on the Theory of Planned Behavior (TPB) followed by beta testing of the app prototype.

## Design and Development

An interdisciplinary team including a dental hygienist (primary researcher), graphic motion designer, and two app software developers collaborated to develop and beta test an oral health promotion prototype app, titled ToothSense. To ensure the development process was replicable and systematic, the Behavioral Intervention Technology (BIT) model was used. The BIT model was designed to process the delivery of BITs from a clinical to a technological framework,<sup>26</sup> and has been used previously to document app development.<sup>27</sup> The BIT model describes the clinical aims, intervention strategies, and their incorporation into the features of the app.<sup>27</sup> Furthermore, the BIT model accounts for the how, what, why and when questions of document design features in technological intervention strategies.<sup>26</sup>

## Intervention Aims and Strategies

The overall clinical aim was to increase positive oral health behaviors in children 6 years and younger by influencing their parents and/or caregivers to adopt positive oral health behaviors. Usage aims were designed to encourage daily interaction/use of the application.

Doshi's Intervention Strategies (DIS) by Behavior Change Model or Theory provides intervention strategies including knowledge, general information, perceived benefits/barriers/risks, self-efficacy/talk and perceived social norms accounting for all the constructs of behavior modification theories.<sup>28</sup> The app prototype features included goal setting, motivation, monitoring, and feedback to account for DIS. Education increased knowledge and the user's understanding of the overall goal and steps to reach that goal.<sup>26</sup> Motivation included strategies to increase the likelihood users would engage in certain desirable behaviors and be useful in addressing self-efficacy. Goal setting involved future planning

that included activity scheduling, while monitoring involves recording past or current states.<sup>26</sup> Both goal setting and monitoring accounted for the self-efficacy strategy. Feedback provided information on current or past oral health behaviors and was used to address self-efficacy and perceived social norms.

**Goal Setting**

The app prototype features for goal setting were found in the settings screen. Users were prompted to set toothbrushing reminders for morning and evening which resulted in push notification sent to the iOS device. A push notification is the delivery of information from a software application to a computing device without the request of the user.<sup>29</sup> The push notification read, "Time to brush!" and was sent to the user twice a day at the designated times. Additionally, push notifications helped to meet the initial usage aims.

**Monitoring and Feedback**

The app prototype accounted for monitoring and feedback in the following features: Sugar Bug Status, Brush Along, Smiles Club, and Mouth Journal. To monitor the strategies, reports were compiled through data collection and displayed to the user within the app. The data was displayed in two locations: Smiles Club and Mouth Journal. Smiles Club displayed a picture, age, brushing experience information (time

and date), and badges that corresponded to the time and affirmation of flossing. (Figure 1) Brushing experiences (time) were automatically recorded when users brushed to a video found on the Brush Along screen (Figure 2). Users were then able to "share" that experience with the Smiles Club by selecting "Share." Smiles Club information was displayed only to friends of the users; all information remained private unless the user accepted a friend request. Mouth Journal was a linear graph displaying a week of individual brushing experiences and the average time. Logs entries allowed the user to manually enter a brushing experience. The log option was located on the "Smiles Club" screen and allowed users to enter the length of brushing and time of day if the user chose not to use the "Brush Along" feature.

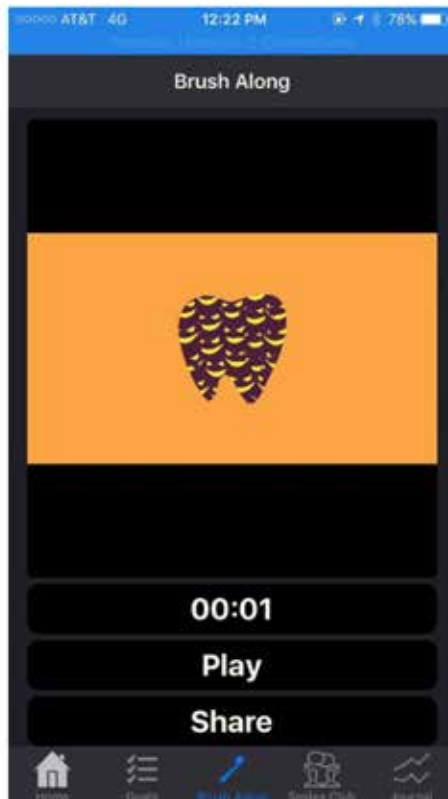
**Interactive Elements**

Interactive features incorporated into the prototype app included information delivery, notifications, logs, peer support, reviews, and visualization. All oral health information (OHI) was obtained from the American Dental Association (ADA) website.<sup>30</sup> Educational texts were used to deliver OHI for toddler oral health care, nutritional advice, importance of dental visits, infant oral health care, importance of family/parental involvement in maintaining habits, and social rewards and

**Figure 1.**  
Smiles Club Screen



**Figure 2.**  
Brush Along Screen



**Figure 3.** Home Screen:  
Oral Health Information





consequences of oral health. Two oral health videos were available for viewing and provided the following OHI messages: importance of primary teeth, and OHI for children two years and older. A link for texts and videos was accessible on an "Oral Health Information" page located on the home screen, the first screen to appear when application is active. Two icons appeared on this screen titled "Tooth Sense" and "Sugar Bug Status." (Figure 3). All educational and media texts could be accessed on a separate screen linked through the Tooth Sense icon.

### **Workflow**

The app prototype primarily used a user-defined workflow to administer its interventions. In addition, the prototype directed users to a specific workflow based upon their pre-determined oral health status in the Sugar Bug Status feature. Users were also able to specify the frequency of the push notification intervention in the Settings menu.

### **Application Prototype Testing**

In addition to design features, user satisfaction also plays a vital role in the overall success of health promotion. Satisfactory usability of a website or app is based on compliance with five interface design heuristics known as Jakob Nielsen's (JN) general principles for interaction design, in which users value an app that is efficient, intuitive, and allows for easy input of information.<sup>31</sup>

Upon completion of initial prototype development, the testing phase was conducted through a user testing service (UserTesting; Mountain View, CA), specializing in consumer feedback on quality and performance of mobile apps.<sup>32</sup> Participants were recruited by the user testing service to serve as beta testers. Inclusion criteria were: owner/user of an iOS operating system smartphone (iPhone; Apple Inc., Cupertino, CA); parent or primary caregiver of one or more children age six years or younger; and U.S. resident. Dental professionals were excluded from participating. The study required the beta testers have a personal smartphone capable of downloading the app prototype. Eight beta tests were deemed sufficient for evaluating the app prototype for usability and perception of the TPB intervention strategies. Determination of the number of beta tests was based on research findings demonstrating that usability testing with a minimum of 5 market testers will identify 85% of all usability problems.<sup>32,33</sup>

Beta testers were asked to complete a series of tasks to ensure all features of the app were utilized. Tasks were created based upon the app features and from suggestions provided by the user testing web site.<sup>32</sup> Most tasks were accompanied by a prompt to encourage feedback on the testers experience with the application features. A camera was placed on the shoulder of each beta tester while they conducted

the tasks to record the video and audio and they were encouraged to think aloud and talk through their actions and feelings. This method reduced the need to rely on self-reported measures, which can be biased.<sup>33</sup>

Upon completion of the tasks, the testers were asked to complete a survey consisting of usability statements based upon JN's five principles for interaction design,<sup>31</sup> and the presence of the TPB intervention strategies based on DIS.<sup>34</sup> Responses were recorded using a 5-point Likert-item (1=*strongly disagree*, 2=*disagree*, 3=*neither agree or disagree*, 4=*agree*, 5=*strongly agree*) and were tallied to obtain a mean score for each question on usability and perceptions of TPB. Mean scores of 4 and above indicated agreement with the statement, features and positive perception of interventions. Mean scores of 3 to 4 indicated some user indifference with the statement, app features, and perceptions of intervention strategies. Mean scores lower than 3 indicate disagreement with the statement, significant usability issues, and negative perceptions of the intervention strategy. A final question asked testers to rate the likelihood to recommend the app prototype (0=Not at all likely, 10=Very likely) using a Net Promoter Score calculated by the user testing service and compared to all sites tested by the service. A Net Promoter is a commonly used customer loyalty metric derived from survey responses to the question: "How likely are you to recommend this website/app to a friend or colleague?"<sup>32</sup> Beta testers rating an app as a 9 or 10 are considered "promoters", a rating of 7 or 8 "passives", and rate 0 to 6 "detractors."<sup>32</sup> The percentages of detractors are subtracted from the percentages of promoters to give a Net Promoter Score.<sup>32</sup>

Data from the audio and video recordings was analyzed to better understand the beta testers interactions and perceptions of the app. A template approach using codes was applied to organize the data.<sup>35</sup> Preliminary codes were developed based on the audio and video recordings and the theoretical framework of TPB.<sup>35</sup> Key points made by the participants were transcribed after listening and watching beta testers responses to prompts and complete tasks.<sup>34</sup> Analysis of texts were guided by the preliminary codes.<sup>35</sup> Similarities and differences of data emerged, and themes were identified, further clustered and defined.<sup>35</sup>

## **Results**

Eight beta testers, 6 females and 2 males, ranging in age from 22 to 36 years, participated in the study. The average age of the participant was 27.5 years. One tester had an annual income level below 40K while the remaining seven had income

**Table I.** Beta Testers Perceptions of TPB Intervention Strategies

TPB Intervention Strategy	Statement	Participant								
		P1	P2	P3	P4	P5	P6	P7	P8	Mean
General Knowledge	ToothSense provides user with general knowledge about children’s dental health.	5	5	5	5	5	5	5	5	5
Increased Knowledge	I feel that ToothSense has features and/or information that would improve MY knowledge on my child’s dental health.	5	4	5	5	5	5	5	5	4.875
Perceived Benefits	ToothSense adequately provided information about the benefits of positive dental behaviors for my child/ children.	5	5	5	5	5	5	5	5	5
Perceived Risks	ToothSense adequately provided information about the risks of not engaging in positive oral health behaviors.	5	5	5	5	5	5	4	5	4.875
Self-Efficacy	ToothSense gave me the confidence and skills I need to maintain a tooth brushing habit of two minutes two times a day.	5	5	5	4	5	4	5	5	4.75
Perceived Social Norms	The features SmilesClub in ToothSense will help to connect my child and me with those individuals (family and friends) who approve of brushing my child’s teeth two minutes two times per day.	3	2	1	5	5	2	2	3	2.875

levels between 40K and 100K. The average amount of time the beta testers used the prototype app was 00:15:12.

### **Prototype Application Usability**

All beta testers agreed the app met three of the five usability statements (Table I). The most common usability concern was regarding the interface design of the OHI and Sugar Bug Status screens, commonly described by the testers as crowded and difficult to read. Testers requested brighter colors and a simpler layout to improve the readability and decrease the number of icons. Several beta testers were unable to use all of the features and requested instructions and/or clarification. It should be noted however that the users rarely read the pop-up instructions incorporated into the app when using a feature for the first time.

### **Prototype Application and the Theory of Planned Behavior**

Beta testers agreed the TPB strategies were met in the app (Table II). All users felt strongly the app provided oral health knowledge and features/ information that addressed the risks and benefits of engaging in or not engaging in oral health behaviors. Most testers agreed the app would increase their oral health knowledge and felt the app gave them the confidence and skills needed to maintain positive tooth-brushing habits for their children. When asked about the ability of the application to provide features that would connect their children with other children who engage in positive oral health behaviors, only two users strongly agreed, while the remaining users were neutral or disagreed.

## Intention to Recommend

Beta testers were asked to rate the likelihood to recommend the app prototype (0=Not at all likely, 10=Very likely) and a positive Net Promoter Score of 20 was calculated by the user testing site and compared to all sites tested.<sup>32</sup> Three beta testers were “promoters”, 3 “passives”, and 2 “detractors”. The prototype received positive reviews in terms of concept, information provided, and likelihood to recommend the app, indicating the potential for an oral health promotion app.

## Qualitative Analysis of Audio and Video Recordings

Qualitative analysis of the audio and video recordings regarding the usability of the app prototype indicated that while most of the testers found the app to be helpful especially with regards to the timer and alarm function, some felt the features to be too advanced for their child’s age. Testers had negative comments in regards to the interface design particularly regarding the color, images and the location and size of the icons on the screen. Navigation through the Smiles Club and Mouth Journal presented difficulties for some testers and others indicated the need for more guidance in the app for error recovery and task completion. Terminology was another theme in the qualitative analysis with some testers having concerns over the use of “sugar bugs” to describe bacteria or not understanding the meanings of some of the buttons on the app. Testers responded positively to the oral health information available on the app prototype indicating that this was new information that helped them understand the risks related to not caring for their child’s teeth. The themes of interface design, navigation, feedback, terminology, information, health promotion and selected comments are shown in Table III.

## Discussion

The development and testing of embedding the TPB in a prototype contributes to the understanding of how to provide parental support during the implementation of oral health promotion to increase the adoption of positive oral health behaviors.<sup>6,7</sup> The beta testers feedback was positive with respect to accounting for the TPB as well as for recommending the app. The prototype serves as a model to address parental involvement in the prevention of ECC. The positive Net Promotor Score (likelihood to recommend) indicates the potential for a cascade effect in which users would recommend or discuss their experience with the app prototype and resulting in encouraging others to utilize the app. This research study provides a model for a potential app design thus it was important to address the prototype usability issues early in the development process with the goal of increasing user satisfaction and promotion of positive health behaviors.

Although dental apps for children are available from a variety of sources, there are no indications that the apps were developed in a research setting with a behavior modification theory, or specifically directed towards parents and caregivers. The ToothSense app prototype differs from other app products as it was developed to provide an intervention founded in a behavior modification theory for parents and caregivers of children, rather than as a child’s game.

There are several limitations to consider with this study. Limited financial resources influenced the development of the prototype and may have contributed to some of the usability issues. While this was a limitation it was beneficial to test a prototype early in the development stages to identify usability issues prior to release and ensure positive user interaction and ratings in the market place. Another limitation of this study was the short amount of time

**Table II.** Application Prototype Usability

Usability Statement	Participant								
	P1	P2	P3	P4	P5	P6	P7	P8	Mean
The features of ToothSense will keep me informed about my child’s oral health and progression towards positive oral health behaviors.	5	4	5	5	5	4	4	5	4.625
Control interactions such as exit, save, go back, or edit were user friendly.	5	4	5	5	5	4	5	5	4.75
The features of ToothSense are flexible and efficient.	5	3	4	5	5	3	4	4	4.125
ToothSense is pleasant to look at and not overcrowded with irrelevant information.	5	2	2	4	4	2	4	2	3.125
ToothSense adequately helps me recognize, diagnose, and recover from errors.	5	3	3	3	4	4	3	3	3.5

**Table III.** Beta Tester Comments Related to Usability of App Prototype Usability

Theme	Subtheme	Comments
Interface design	Aesthetics, size of elements/font, background color	<i>"I think the colors could be brighter, more playful, maybe even on a white background. It seems too dark." "The layout could use a new font, less use of capital letters." "PDF documents are hard to read." "A lot going on in the home page." "It looks crowded." "It looks very Halloween." "The sugar bugs are falling off. That's a really cute thing."</i>
Navigation	Smiles Club and Mouth Journal functions	<i>"Nothing shows up on Smiles Club." "It doesn't actually go, but the idea is cool. I am not sure how it works exactly." "Smiles Club needs instructions. I can't figure it out." "I don't understand what I am supposed to do with the Mouth Journal." "Everything was exactly where I thought it would be." "Everything is pretty self-explanatory." "It's easy to navigate."</i>
Feedback	Photo upload, Smiles Club Interaction	<i>"When I tried to take a picture it didn't let me or offer a solution." "My name disappears after uploading the picture." "Smiles Club doesn't work." "It would be nice to have a tutorial about Smiles Club."</i>
Terminology	Naming of buttons, choice of vocabulary	<i>"I think it should be 'submit' instead of 'signup'." "Sugar bug sounds a little weird. The feeling of bugs in the mouth is awful, and makes me want to avoid any information with him on it."</i>
Information	Oral health information, American Dental Association, dentist approved	<i>"There's a lot of information that I didn't know." "The video helped me understand the risks of not caring for my child's teeth positively." "Mention the American Dental Association or 'backed by dentist'."</i>
Health Promotion	Alarm, reminder, timer	<i>"I feel positive about having the timer and reminder." "I think especially as my child is older and brushing her own teeth, I think the ToothSense app with the timer showing her how long to brush her teeth and then the reminder daily is really beneficial. I use my phone for everything so that would be very beneficial." "It seems like a helpful app to get your children to start taking care of their teeth." "It seems like a great app and really great idea. I've never really seen an app like this so I think it's really smart to create something that everyone can use like this." "I like all these things that the app can offer." "I really like the alarm/reminder under goals tab. That's the thing that would make me use it all the time having the constant reminder." "I really like the brush along video. It gives your kid reminders. And it's something fun you could do with your kid."</i>

the beta testers used the prototype with an average time of 00:15:12. The iOS operating system may also have been a limitation in this study. Expanding to the Android platform would broaden the base of potential users.

## Conclusion

Using a mobile platform for oral health promotion provides the opportunity to engage parents, enable communication, and potentially help overcome oral health challenges for the management of oral diseases such as ECC. Beta testing results from this study provided health promotion project design information for the prevention of ECC using the TPB and highlighted the importance of health promotion smartphone app usability. Future research should include modifications to the app based on the prototype test results, pilot testing among parents and caregivers of children 6 years and younger and expansion of the mobile platforms.

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**Sara L. Nolen, RDH, MS** is a graduate of the Master of Science in Dental Hygiene Program ; **Lori J. Giblin-Scanlon, RDH, MS** is an associate professor and associate dean for clinical programs; **Linda D. Boyd, RDH, RD, EdD** is a professor and dean; all at the Forsyth School of Dental Hygiene, MCPHS University, Boston, MA. **Lori Rainchuso, RDH, DHSc** is an associate professor, Doctor of Health Sciences Program at MCPHS University, Boston, MA.

Corresponding author: Lori Giblin, RDH, MS;  
lori.giblin1@mcphs.edu

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## Dental Hygiene Students' Clinical Skill Acquisition: Activity theory and the use of videos

Sally N. Lockwood, MEd, RDH; Sharon M. Compton, PhD, RDH; Jacqueline L. Green, MSc and Kari Rasmussen, MA, PhD

### Abstract

**Purpose:** Entry-level students in dental hygiene programs have already demonstrated a level of academic success; however they often struggle with the acquisition of psychomotor skills. Recognizing that traditional course materials were not addressing the needs of entry level dental hygiene students, instructional videos were produced to demonstrate clinical skills. The purpose of this study was to investigate students' perception of instructional videos and their impact on the learning environment in regards to students' experiences of skills acquisition.

**Methods:** Online surveys were distributed to all students (n=84) in the fall semesters of 2015 (n=42) and 2016 (n=42). Responses from the surveys were analyzed qualitatively, utilizing an activity theory framework, to identify the impact of instructional videos on the learning environment. The activity theory framework involves the encapsulation of the learning environment that is mediated by tools and situated in a community where a learning activity is carried out to achieve an outcome.

**Results:** Response rates were 76% (n=32) and 69% (n=29), respectively. Student responses concluded that the videos were very or extremely helpful, with 84% (n=27) in 2015 and 79% (n=23) in 2016. Students made comments on the usefulness of the videos and gave suggestions for future improvements. In addition, the comments demonstrated that students found the videos helpful for review purposes and for overall stress reduction associated with the process of psychomotor skill acquisition.

**Conclusion:** Results from this study demonstrate the positive impact instructional videos have on the acquisition of psychomotor skills even within the dynamics of a small class size. Videos can also be utilized as an on-demand review tool that can be accessed before clinical evaluation processes, reducing student stress and providing a level of clarification to support student success.

**Keywords:** dental hygiene education, instructional videos, clinical education, psychomotor skills, activity theory

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### Introduction

Acceptance into a dental hygiene program is highly competitive; students entering these programs have already demonstrated their academic abilities in both the secondary and post-secondary educational environments. These historically successful students, often find first-year preclinical dental hygiene coursework challenging due to the focus on psychomotor skill development and the emphasis on active and self-directed learning. Pre-clinical dental hygiene coursework integrates theoretical knowledge and clinical skills to develop the abilities required for dental hygiene practice. Students demonstrate progression towards clinical competence as a result of observation, discussion, demonstration and clinical application. Pre-clinical coursework typically provides students with nine hours per week of laboratory

instruction and clinical experience over a single academic term. An average of six hours per week are completed in the laboratory during which time the clinical instructors demonstrate instrumentation skills and provide individual instruction. Students initially perform these skills in laboratory sessions on mannequins or typodonts followed by three hours per week in the dental hygiene clinic for supervised practice sessions performed on peers.

Historically, students relied on textbooks and course manuals for additional learning support of psychomotor skill development. Students have found these resources to be lacking due to their textual nature and the disconnect from the observational learning experience of instructor demonstrations. Recognition of this disconnect, and the constant evolution of technology has resulted in alternative

methods to support the education and competency development of both dental and dental hygiene students<sup>1,2</sup> and lead this instructional team to investigate possible interventions to mitigate these learning challenges.

Adoption of technology in teaching and learning environments is expected by today's students<sup>2</sup> and the use of instructional videos has become a common practice.<sup>3,4</sup> When used appropriately, videos are considered to be a powerful teaching medium, used for multiple learning scenarios, including clinical demonstrations and explanations.<sup>3,5</sup> Instructional videos also facilitate a self-paced instruction and more independent student learning environment. Often considered as a support for large classroom settings, videos have been shown to be a valued resource by post-secondary students to facilitate learning beyond the classroom.<sup>3</sup> A review of the literature shows that the instructional videos have been demonstrated to be effective in medical, nursing and dental education.<sup>6-12</sup> Similar to dental hygiene, many of the health science professions, such as medicine and nursing, involve the acquisition of psychomotor skills and the on demand availability of instructional videos has allowed for independent learning. Furthermore, videos have successfully been added to courses as supplementary learning experiences when classroom and laboratory contact hours have been reduced in the curriculum.<sup>6</sup> In a study by Tapping, first year medical students rated gross anatomy videos to be highly satisfying and their test performance was higher than the control group of students who did not have access to the videos, demonstrating that videos are a positive addition to course materials and can improve student learning outcomes.<sup>6</sup>

Instructional videos have been used in nursing and dentistry to supplement lecture demonstrations beyond the classroom in the teaching of clinical skills.<sup>7,9,10,12</sup> Student responses to instructional videos have been positive, commenting that videos allow them to review the demonstrated skill.<sup>7,9,10</sup> In addition, students requiring remediation to develop their clinical skills must gain this knowledge through self-directed learning and practice. Given the limited time allowed for clinical instruction in dental education, videos can play a beneficial role in remediation or in support of clinic instruction.

Considering the identified purpose and positive impact of instructional videos in educational environments, the dental hygiene faculty at this institution decided to supplement the learning resources in the preclinical course with self-made instructional videos to demonstrate specific clinical skills. The series of short videos were created over a span of several years could be viewed on demand multiple devices including mobile phones, tablets and computers. Informal feedback indicated that the videos were a positive addition to the student learning resources and that further video development was warranted.

It can be hypothesized that the addition of instructional videos promotes self-directed learning and can contribute to student stress reduction through the addition of resources and on demand support for psychomotor skill development. The purpose of this study was to investigate the impact of the addition of instructional videos by capturing the students' experience their acquisition of clinical skills when videos are made available as part of the course materials. This study also examined the affordance of the videos, or how the students actually incorporated instructional videos into their learning process.

## Methods

The Research Ethics Board of the University of Alberta approved this study. A qualitative approach was selected to understand the rationale for student preferences regarding the use of videos for the development of psychomotor skills. Qualitative studies provide alternative perspectives on approaches to teaching and learning and can complement quantitative research by shifting the focus on the numerical aspects of "what" to understanding the underlying "how and why."<sup>13</sup>

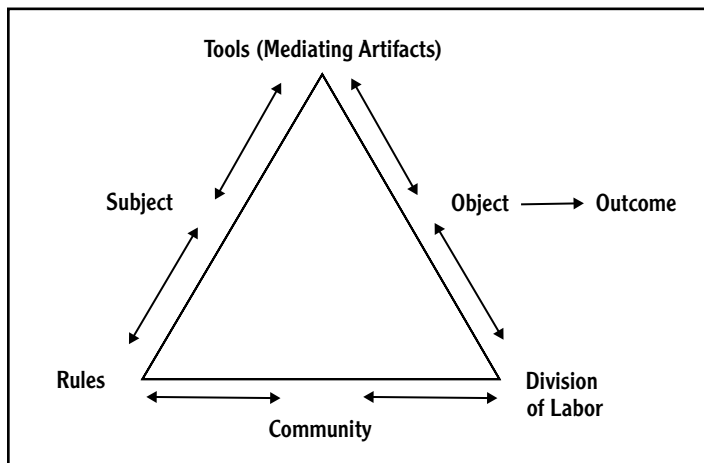
Students completing the preclinical dental hygiene course during the fall semesters of 2015 (n=42) and 2016 (n=42) were asked to complete a short online questionnaire regarding their use of the clinical instruction videos and to self-report on the effect these videos had on their learning experience. Students received an invitation to participate letter via email, describing the intent of the study. Responding to the anonymous online survey denoted consent for participation. Students wishing to opt out of the study could do so by not completing the survey.

The focus on the affordance (i.e., how the students actually incorporated the videos into their learning process) of the clinical demonstration videos is based on the work of Gibson<sup>14,15</sup> and allowed the researchers the ability to focus on the utilization of the videos as an instructional intervention. Additionally, the researchers were able to capture the perceived affordances of the videos as a measure of the students' overall experience of stress and confidence. To provide a theoretical lens in which to perform the data analysis and present the results, an activity theory framework was incorporated into the study. Engstrom's research dating to the 1990's identified the activity theory to be a valuable framework to examine technological interventions in the field of education.<sup>16</sup>

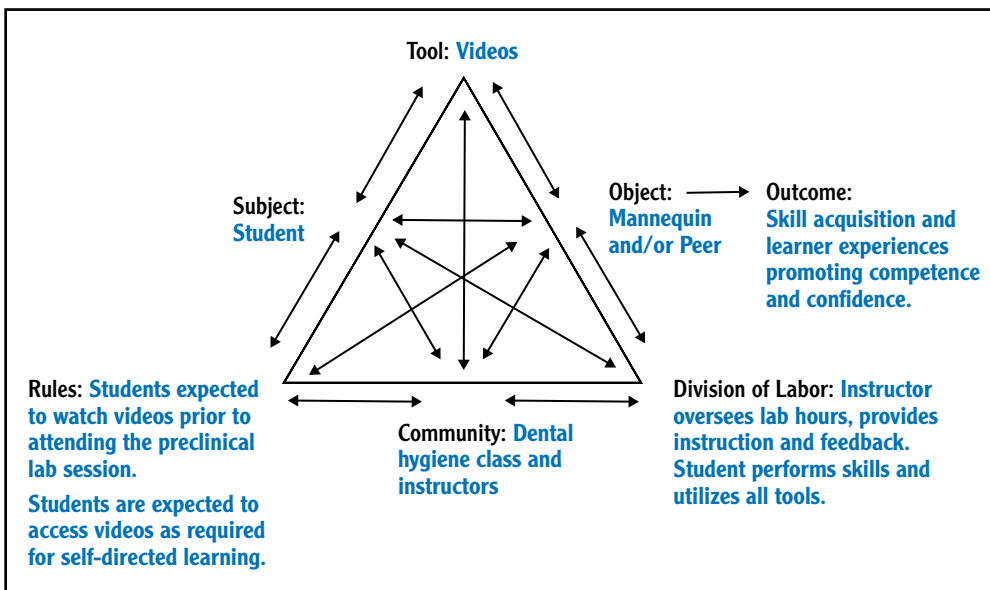
Activity theory, based on the work of Vygotsky et al.,<sup>17</sup> has become an integral part of academic research focusing around the exploration of innovative spaces and educational practices.<sup>17,18</sup> The introduction of videos into a learning environment, to be used as a resource with specific learning outcomes, is commensurate with activity theory.<sup>17-20</sup> Viewing

learning as a collective activity, that is tool-mediated and situated within an individual activity with a resulting outcome, aligns with the basic underlying assumptions of this theory.<sup>16-20</sup> This framework, based on the work of Vygotsky<sup>21</sup>, began as a technique to analyze activities based on the relationship between the subject, the object and the tools. Engstrom<sup>17,19</sup> expanded this framework to recognize the social component of any activity involving people by adding rules, community and the division of labor to the analysis of any activity (Figure 1). For the purposes of this research, the components of the study were aligned with the expanded activity theory framework (Table I). Figure 2 illustrates the application of the study to the activity theory framework.

**Figure 1.** Expanded Activity Theory Framework<sup>17,19</sup>



**Figure 2.** Application of the Activity Theory Framework



## Results

Each class had a total of forty-two students enrolled; with 76% (n= 32) of the surveys completed in 2015 and 69% (n=29) of the surveys completed in 2016. The majority of student responses showed that they felt the videos were very or extremely helpful (84% (n=27) in 2015 and 79% (n=23) in 2016); the remainder still felt that the videos were somewhat helpful and no one noted that they were not useful. Participant comments fell into two categories:

### Usefulness of videos

This category captured variation of experience on how the videos were utilized with their actual usefulness noted within the comments.

“They were very useful to watch beforehand to know what to expect in the sim lab while still learning basic instrumentation.”

“I found that they were useful when I was unsure of where to fulcrum for intra oral or extra oral or how to probe the quad 1 buccal and quad 2 lingual when preparing for the final instrumentation exam.”

“Watched them once in class, useful for notes, didn’t watch them on my own.”

### Usefulness of videos with improvement

Although still recognized as useful, students noted suggestions for changes or improvements they personally felt would increase the videos impact on their learning.

“I found them quite helpful but wished that it was more ... zoomed in to show the proper angulation for universals and sickles”

“I feel that if the videos are less zoomed in on to the instrument and the teeth, it might be more helpful. That way, students can get a sense of the whole picture”

When asked about accessing videos the majority of the students noted they accessed the videos once or twice a week; with 78% (n=23) of the respondents in 2015 and 83% (n=24) of the respondents in 2016. The remainder of the students who responded noted that they never accessed the videos; however, these students would still have viewed the videos once as they were shown as part of the preclinical lab sessions. For

**Table I.** Applications of the Activity Theory<sup>17,21</sup>

Activity Theory Component	Application
Subject	The starting point and primary subject of this activity is the student in the preclinical dental hygiene course.
Tools	<p>The mediating artifact under analysis within this research initiative is the addition of videos, created to demonstrate the clinical skills covered within this course.</p> <p>Additional mediating artifacts excluded from this analysis are the textbook, course manual, access to the instructor or peers, student study skills, and the simulation lab itself.</p>
Object	The clinical simulator (mannequin) or student peer in the lab session receiving dental hygiene work.
Division of Labor	<p>Clinical instructors oversee lab hours and provide demonstrations, instruction and feedback for small groups and one-on-one scenarios.</p> <p>Students perform skills and utilize all tools to enable the acquisition of identified skills.</p> <p>Students will continue to practice outside of class hours to ensure competencies are reached.</p>
Community	The community is the dental hygiene class and a team of clinical instructors.
Rules	<p>Students are expected to read their textbook, course manual and watch videos prior to the skill demonstration and practice session during the preclinical lab.</p> <p>Students are provided criteria for process evaluation and are expected to practice outside of class hours until competencies are met.</p> <p>Students are expected to utilize the textbook, course manual and videos as additional support outside of class hours.</p> <p>Clinical instructors will assess students to ensure they have acquired the necessary clinical skills.</p> <p>The research focus will be the use of the videos.</p>
Outcome	The outcome of this activity is the acquisition of identified skills and a learner experience that promotes competence and confidence.

those who commented on the reasons around their access, comments fell into one of four categories:

**Viewed as part of class**

These students often noted the viewing of videos as part of the lab session was when they accessed them.

“I mostly viewed them in class when they were shown...”

“Only when they were shown in class”

**Viewed for review purposes**

Videos were found helpful to check technique and as a review tool.

“Very helpful when you want to double check your technique.”

“I usually used them as a review tool after practicing in the lab.”

**Viewed for practice sessions**

Students did note they viewed the videos when practicing the skills.

“Or whenever I was practicing on my own.”

“Would depend on when I was practicing more.”

**Viewed for examination purposes**

Students noted that they accessed them before their evaluations.

“And before a PE [process evaluation] to review and feel confident about the upcoming examination”

“Usually before a process evaluation.”

An initial purpose was to provide access on demand; therefore, students were asked where they accessed the videos. The students primarily accessed the videos from their home desktop or laptop computer; with 90 % (n=27) of the respondents in 2015 and 71% (n=20) of the respondents in 2016. One difference identified between the two cohorts was the use of the videos within the preclinical lab. In 2015 10% (n=3) of students’ responses noted they used their phones to access the videos within the lab whereas 50% (n=14) of the students’ responses noted this usage in 2016. No comments were provided that explained this variation and further study would be required to assess this change in the utilization of the video.



The overall impact of the introduction of instructional videos on the learning process was a key question in this study. Students reported that they believed the videos clarified information and were useful for review purposes. In addition, students also indicated that the videos increased their confidence, reduced stress, and decreased the amount of time it took to learn the skills.

## Discussion

Introducing videos into dental hygiene programs is a now common practice. According to a national study on educational technology within American dental hygiene programs, 88% of students surveyed noted a high usage of videos in entry-level dental hygiene programs, stating videos were the most common use of technology within their programs.<sup>2</sup> Numerous studies have indicated that videos are seen as useful in terms of demonstration of clinical skills and for review purposes,<sup>7,9,10,12</sup> Data collected within this research study supports these findings with 84% (n=27) in 2015, and 79% (n=23) in 2016, of the participants noting that they found the videos very or extremely helpful and there were no students indicating that the videos were not useful. Furthermore, the usefulness of the videos was in alignment with the ability to clarify clinical skills (identified as equivalent as the demonstration experience), with 30 out of 31 students in 2015, and 26 out of 29 students in 2016, noting that the videos clarified information. Although not specifically asked, use of the videos for review was mentioned consistently in the additional comments section when participants were asked how often they accessed the videos. Student use of videos for review purposes has also been noted in studies by Jang and Kim<sup>7</sup> as well as Kelly et al.,<sup>10</sup> where participants commented positively that clinical skill videos were useful for repeated viewings in order to ensure understanding, as well as for remediation purposes.

This study aimed to investigate specifically how the availability of instructional videos impacted the students' learning process, and if this resulted in a change to the learning activity's outcome. The results showed that the students incorporated the instructional videos into their learning process as reported in previous studies. In addition to viewing the associated video(s) as part of each preclinical laboratory session, students utilized the videos for clarification, review of instrumentation process, and to prepare for evaluations. Additional findings, based on situating the analysis within the activity theory framework demonstrate the impact the videos had on student learning outcomes. Students self-reported that the use of the videos increased their confidence, reduced the stress of learning psychomotor skills, and reduced the amount of time it took to acquire these skills. The results from this study regarding increased confidence are contradictory to those of Jang and

Kim<sup>7</sup> who found student use of Objective Structured Clinical Examination (OSCE) videos did not correlate with the participant's anxiety towards taking the examination. Further exploration is necessary in order to determine the impact of instructional videos on confidence levels during skill acquisition.

The impact on the learning environment through the implementation of instructional videos in a preclinical dental hygiene course is substantive when one considers that these classes frequently consist of groups of seven students during demonstrations, with one-on-one assistance from the clinical instructors available during laboratory time. While Kelly et al. concluded videos were useful for clinical demonstration in large classes,<sup>10</sup> others have concluded that implementing videos improves clinical skills and knowledge,<sup>6-9</sup> further supporting this study's findings that the use of instructional videos is impactful for students, regardless of class size and instructor accessibility.

Analysis of the student narrative revealed that many of the students responding within the survey recommended additional videos as well as suggesting additional components to the existing videos. Suggestions included making changes to the perspective of the video such as moving from a second-order perspective (viewing the demonstration as a visitor watching the skill being performed) to a first-order perspective (viewing the demonstration from the perspective of the person performing the skill); or providing multiple angles of a shot to include patient operator positioning. Selected comments reflecting this narrative include:

"I wished that it showed different perspectives and more zooming in on the instrument on the tooth."

"Maybe show more of the full picture to start out with so we can understand [patient-operator] positioning better."

"... capturing more angles in the video, more thorough left-handed videos!"

These responses are reflective of each learner's perspective and learning needs and identifies the complexity of views and decisions that need to be investigated in the planning phase of such development projects. Balancing the numerous approaches that must be considered with the development of a multimedia resource is complex; however, even with these suggestions the videos were viewed as positive additions to the students' learning resources. Student opinion regarding the positive impact of videos on their learning experience further reinforces findings from studies that conclude the addition of videos into courses enhances student learning.<sup>7,9,10</sup>

Creation of videos that could show multiple positions, close-ups, variations of techniques, etc. is both time extensive and expensive. The videos

developed within this course involved multiple steps including: script development, demonstrating the technique with both right and left-handed clinicians, dubbing the video, and uploading them onto the course management system. Collaboration amongst the teaching faculty and technical support team along with designated responsibilities regarding the maintenance periodic review of the video content are necessary for a successful project. Issues relating to the use of technology must also be recognized to ensure access to the video resources over time. Careful planning and implementation is supported by Topping<sup>6</sup> who reported that the intense labor and costs associated with the making of gross anatomy videos was justified as student learning improved in spite of the reductions in clinical contact hours.

A limitation of this study was the small sample size due to the relatively small class size of 42 students. There was some compensation for the small class size by running the study over two years and incorporating two cohorts of students. However, the practicality of further extending the research was limited from the perspective of evolving technology and new forms of video as well as changing techniques in instrumentation. Videos that have been created and distributed over the course of one academic year, may change in subsequent years, making longitudinal evaluation challenging.

Future research could include studies focusing on the impact of a more generic "off-the-shelf" video as compared to videos recorded with the clinical faculty. Changing the filming to the first order perspective of the clinician and the incorporation of interactive elements within or around the videos could enhance the learning experience. Student made videos could also be part of the formative or summative evaluation process for assessing clinical skills.

## Conclusion

While the creation of videos demands collaboration, time and effort, their usefulness is accepted in academia and by students. Instructional videos have been shown to positively impact student confidence and reduce stress while learning a new psychomotor skill.

The affordance and impact of videos is substantive, even within the dynamics of a small class size, where students are learning in small groups and have a high level of access to clinical instructors. Videos can also be utilized as an on-demand review tool that can be accessed before clinical evaluation processes providing a level of clarification that enables student success.

**Sally N. Lockwood MEd, RDH** is an associate clinical professor in the Division of Dental Hygiene; **Sharon M. Compton, PhD, RDH** is professor and dental hygiene program director, and the director of the Educational Research and Scholarship Centre; **Jacqueline L. Green, MSc** is a research assistant; **Kari Rasmussen, MA, PhD** is an educational research methodologist, both at the Educational Research and Scholarship Centre; all are at the School of Dentistry, University of Alberta, Edmonton, AB, Canada

Corresponding author: Sally N. Lockwood, Med, RDH: sallyl@ualberta.ca

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# RESEARCH

## Nursing Administrators' Views on Oral Health in Long-Term Care Facilities: An exploratory study

Janelle Y. Urata, RDH, MS; Elizabeth T. Couch, RDH, MS;  
Margaret M. Walsh, RDH, MA, MS, EdD; Dorothy J. Rowe, RDH, MS, PhD

### Abstract

**Purpose:** To explore the knowledge, attitudes, and practices of supervising nurse administrators (SNAs) regarding the oral care provided to long-term care facility (LTCF) residents and the role of dental professionals in those facilities.

**Methods:** The investigators of this study partnered with the National Association of Nursing Administrators to send this cross-sectional study consisting of a 35-item electronic survey to its members whose email addresses were in their database. Online software tabulated responses and calculated frequencies (percentages) of responses for each survey item.

**Results:** Of the 2,359 potential participants, 171 (n=171) completed the survey for a 7% response rate. Only 25% of the respondents were familiar with the expertise of dental hygienists (DHs), however once informed, the majority were interested in having DHs perform oral health staff trainings, oral screenings, and dental referrals and initiate fluoride varnish programs. Most respondents correctly answered the oral health-related knowledge items, understood that oral health is important to general health, but reported that the LTCF residents' oral health was only "good" or "fair." Fewer than half, (48%) of the SNAs were "very satisfied" with the quality of oral care provided to the residents. While more than half reported that they had no dentist on staff or on-site dental equipment, 77% reported that they would consider on-site mobile oral care services. Oral health training for staff was provided primarily by registered nurses, however only 32% reported including identification of dental caries as part of the in-service training.

**Conclusion:** This exploratory study lays the foundation for more extensive research investigating various strategies to improve the oral health of LTCF residents, including increased collaboration between DHs and SNAs.

**Keywords:** access to care, dental hygienists, interprofessional collaboration, long-term care facilities, nursing administrators, oral care

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### Introduction

Older adults living in long-term care facilities (LTCF) often depend on others to assist them in activities of daily living and personal care needs, including oral care.<sup>1-3</sup> For the context of this manuscript, oral care is defined as daily oral hygiene, denture care, periodic oral assessments for symptoms of oral pain, dry mouth, oral disease, and dental referral for periodic oral examination.

Oral care among residents living in long-term care facilities (LTCF) is essential not only to reduce the risk of oral diseases, but also to decrease the potential for other systemic health problems and to promote quality of life.<sup>1, 4, 5</sup> Studies report that only 16% of those living in LTCFs receive any oral care, and those receiving care report an average tooth brushing time of 16 seconds.<sup>3, 4</sup> Certified nurse's assistants (CNA) are most often

responsible for assisting LTCF residents with activities of daily living, including bathing, oral care, dressing and feeding. Supervising nurse administrators (SNAs), consisting of directors of nursing, assistant directors of nursing and registered nurses, are responsible for supervising the CNAs.<sup>6-8</sup> While CNAs frequently acknowledge the importance of oral hygiene care for patients, in reality many CNAs report that minimal oral care, if any, is actually being done in practice.<sup>2, 9</sup> Studies suggest that SNAs have the authority to make critical policy and practice decisions in LTCFs and are in a key position to supervise and support the CNAs and the delivery of oral care through the provision of necessary equipment, training, advice, and the evaluations of the overall quality of oral care provided.<sup>7, 8, 10-13</sup>



Federally funded LTCFs require a comprehensive oral evaluation of a new resident within 14 days of admission, in addition to annually, and following any major change in health status, according to federal guidelines that include the Minimum Data Set (MDS).<sup>14,15</sup> The MDS is a standardized, primary screening and assessment tool of health status that forms the foundation of the comprehensive assessment for all residents in a Medicare and/or Medicaid-certified LTCFs. The MDS measures an individual's physical, psychological and psychosocial functioning in a wide range of categories, including oral/dental status.<sup>15</sup> However, the Agency for Healthcare Research and Quality indicates that the sections of the MDS pertaining to oral/dental status are minimal and may tend to overlook the health of oral tissues and including the presence of xerostomia.<sup>16</sup> Although the MDS assessment is used nationwide in every federally funded LTCF, the regulations do not provide consistent guidelines or training on how to conduct the oral assessments in the data set.<sup>16</sup>

A number of states have established special licensure categories to allow qualified dental hygienists (DHs) to treat homebound clients outside traditional dental practices, in alternative settings including private residences, residential care facilities and other institutions.<sup>17,18</sup> For example, in California, the legislature established the Registered Dental Hygienist in Alternative Practice (RDHAP) licensure category allowing specially trained and certified dental hygienists to provide specific oral health services without direct dental supervision in non-traditional community-based settings. RDHAPs are licensed to provide oral health care services including: dental prophylaxis, dental screening, fluoride varnish and preventive oral health education at the client's place of residence.<sup>17,19</sup>

While many other states allow for DHs to apply for direct access permits and licenses similar to the RDHAPs, little is known about the roles and overall presence of DHs in LTCFs. Moreover, little is known about SNAs' awareness and support of dental professionals in LTCFs, as well as their own knowledge base, attitudes, and involvement in the oral care of LTCF residents. It is also unknown as to what extent the SNA's responsibilities include the training, supervising, and evaluation of the oral care activities of the CNAs. The study was designed to explore the knowledge, attitudes, and practices of SNAs' regarding the oral care provided to their LTCF residents and the role of dental professionals in their facilities.

## Methods

This descriptive, cross-sectional exploratory study was approved by the Institutional Review Board at the University of California, San Francisco, and was carried out via an anonymous electronic survey. The survey was pilot tested for feasibility, validity and acceptability with a convenience sample of 8 SNAs and 6 RDHAPs, and was refined for clarity based on

sample participant feedback. Some SNA respondents expressed confusion with the dental language used in the pilot survey, and the survey items were changed accordingly to ensure content validity. Considered experts in the field, the SNA pilot testers were in agreement that the survey items were determinants of the knowledge, attitudes, and practices of SNAs. Study participants were recruited for the survey through the National Association of Directors of Nursing Administration (NADONA). The director of NADONA was contacted personally to explain the study and to ask for assistance with recruiting the NADONA members for the study. The director agreed to forward a link to the survey along with an informed consent-cover letter to the 2,398 members with an email address in the NADONA database. The cover letter explained the study purpose, risks and benefits and included the telephone numbers and email addresses of the researchers for potential participants to contact with any questions. Potential participants were informed they could opt out of the survey at any time. Informed consent was indicated when participants clicked the "next" button to begin the survey. Participants who completed the survey and submitted their email address were eligible for a drawing to receive one of four \$50 Amazon gift cards selected at random as appreciation for participating in the study. One month after sending the original survey, NADONA administrators posted reminders on the social media sites Facebook and LinkedIn as well as sending an emailed survey reminder in an attempt to capture non-respondents. A disclaimer on the reminder email stated that if the member had already completed the survey, to disregard the message.

## Measurements

The 35-item survey consisted of close-ended questions divided into four sections. The first section contained 12 demographic questions pertaining to the SNA (gender, age, ethnicity, job title, educational background, highest level of education completed) and their practice setting (regional location, number of beds, type of funding received at facility, sector of long-term care, and primary population of residents at their facility). The second section contained three knowledge statements regarding the oral care of residents. Items related to the SNAs' perceptions of the types of preventive care practices, which could be offered by DHs were in the third section. Following the initial question probing the SNAs' awareness of the DH services, the allowable duties, supervision, and settings of the California RDHAP were described, with a reference to the fact that other states' practice acts also allow specific trained and licensed DHs to practice in non-traditional community-based settings without direct supervision. This section also included SNAs' perceived importance of oral health. Oral care practices in the LTCF were assessed in the fourth section, which also included an estimated percentage of the LTCF population requiring assistance with oral



care. Several survey items from previous, related studies were incorporated into the survey of this study, including questions on facility characteristics, SNAs' perceptions of DHs and future interests in having DHs providing oral care.<sup>8, 20-22</sup> Survey items needing minor alterations based on the SNA feedback from the pilot testing included adapting oral terms to better fit SNAs' vocabulary, such as substituting mouth/oral care for oral care.

### Analysis of data

Respondents replied to the survey using Qualtrics, a research software program to tabulate the responses to each survey question and calculate the percentage of responses for each survey item. When reporting the levels of agreement, interest, or importance on the 5-point Likert scale, the bottom and top two categories of items were combined respectively to form two new categories. One survey item included a 6-point Likert scale ranging from "Good" to "Poor" and included an "Unknown."

### Results

A total of 2398 email messages were sent to SNA members of the NADONA; 39 bounced back as invalid and a total of 425 were opened. Responses were received from 171 members (n=171) representing all four regions of the United States (U.S.) for a response rate of 7%. The majority of the respondents were Caucasian females between the ages of 50-59 years, held the title of Director of Nursing, reported a bachelor's degree as their highest level of education and came from the southern region of the U.S. (Table I). Almost all respondents worked in a facility that had both private and federal funding and focused on skilled nursing. Over half worked in facilities where the primary population consisted of older adult residents aged 60 years and older (Table II). As reported by 132 of the respondents, the percentage of residents at their facility requiring supervision or assistance with daily oral hygiene care, ranged between 11% and 100%, with a mean of 69%,  $\pm$  a standard deviation of 18. In other words, the majority of SNAs reported that between 51% to 87% of their residents required assistance (data not shown).

### Perceptions and practices related to dental professionals

About a quarter of SNAs reported being aware of the preventive oral care services RDHAPs or DHs holding direct access permits and licenses can provide in LTCFs (Table III). Thirty-five of the 38, reporting awareness, responded to the question as to whether a DH was currently working in their facility: 66% replied yes; 29% no; and 6% unsure. Once informed of the services DHs could provide in LTCFs, most SNAs were interested in DHs presenting oral health training for staff, performing oral health screenings, making dental referrals, and establishing fluoride varnish programs at their LTCF (Table III).

**Table I.** SNA Demographics (n=171)

Administrator	% (n)
<b>Gender</b>	
Female	96 (141)
Male	6 (6)
<b>Age</b>	
21-29	1 (2)
30-39	6 (9)
40-49	26 (37)
50-59	43 (62)
60-69	23 (33)
70+	1 (2)
<b>Ethnicity</b>	
White/Caucasian	84 (124)
African American	8 (12)
Hispanic	2 (3)
Asian	2 (3)
Native American	1 (1)
Pacific Islander	2 (3)
Other	2 (3)
<b>Region of Employment*</b>	
Northeast	18 (24)
Midwest	27 (35)
South	42 (56)
Western	13 (17)
<b>Job Title</b>	
Director of Nursing	72 (105)
Assistant Director of Nursing	5 (5)
Registered Nurse who oversees nursing staff	8 (11)
Other	17 (24)
<b>Highest Level of Education</b>	
Associate's Degree	32 (43)
Bachelor's Degree	49 (67)
Master's Degree	18 (25)
Doctoral Degree	<1% (1)

\* Northeast: CT, ME, MA, NH, RI, VT, NJ, NY, and PA.  
 Midwest: IL, IN, MI, OH, WI, IA, KS, MN, MO, NE, ND, and SD.  
 South: DE, FL, GA, MD, NC, SC, VA, DC, AL, KY, MS, TN, AR, LA, OK, and TX.  
 Western: AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, and WY.

**Table II.** LTCF Characteristics (n=171)

Facility Characteristic	% (n)
<b>Funding Source</b>	
Private Pay	3 (5)
Federal	4 (6)
Mix of private and federal funding	93 (155)
<b>Number of beds in facility</b>	
0-50	7 (11)
51-100	33 (55)
101-150	38 (62)
151-200	14 (23)
Greater than 200	8 (14)
<b>Sector of long-term care</b>	
Continuing Care Retirement Communities	7 (10)
Assisted Living Facility	1 (1)
Skilled Nursing	90 (132)
Other	2 (3)
<b>Primary population of residents</b>	
Temporary residents of any age undergoing rehabilitation	3 (4)
Younger persons with disabilities or illnesses requiring long-term care	1 (2)
Geriatric residents 60 years and older	62 (90)
All of the above	34 (50)

### Knowledge

Almost all SNAs knew that daily tooth brushing is very important and that residents with dentures still need an annual dental examination. All respondents knew that residents can lose teeth, experience decay, or become physically ill from dental disease (Table IV). In addition, most agreed that hair brushing and getting dressed were very important daily activities (data not shown).

### Attitudes

The majority of respondents agreed that oral health is an important part of general health and that dental care is extremely important for residents at their facility. Only about a quarter felt that although dental care is important, it fell below the priority of general medical care. Slightly less than half of the respondents felt the oral health of their residents was "Good," and reported that they were very satisfied with the quality of oral treatment provided and the way the residents' oral care needs were met at their facility (Table V).

**Table III.** SNAs' Awareness of Services offered by Dental Hygienists in LTCF (n=171)

Adminstrator	% (n)
<b>Awareness of the practice of dental hygienists who can offer preventive services in LTC</b>	
Yes	25 (38)
No	75 (116)
<b>Present oral health training for staff (n=121)*</b>	
Extremely Interested/Somewhat Interested	77 (93)
Neither Interested or Uninterested	7 (9)
Not at all interested/Somewhat Interested	16 (19)
<b>Perform oral health screenings and referrals to dentists (n=120)*</b>	
Extremely Interested/Somewhat Interested	69 (83)
Neither Interested or Uninterested	13 (16)
Not at all interested/Somewhat Interested	18 (21)
<b>Perform oral prophylaxis or periodontal treatments, if legal in state (n=119)*</b>	
Extremely Interested/Somewhat Interested	66 (79)
Neither Interested or Uninterested	18 (21)
Not at all interested/Somewhat Interested	16 (19)
<b>Institute fluoride varnish program (n=119)*</b>	
Extremely Interested/Somewhat Interested	51 (61)
Neither Interested or Uninterested	26 (31)
Not at all interested/Somewhat Interested	23 (27)

\*Items answered only by respondents answering no to first item.

### Oral care practices

SNAs in this study reported that the oral/nutritional status and oral/dental status sections within the MDS were performed most often by "other staff" consisting of CNAs or designated MDS nurse/coordinators. Slightly over half reported having a written dental care plan for their residents' dental needs beyond daily tooth brushing, and that nurses in the LTCF provided oral care training for their staff (Table VI). The majority of respondents reported that this training covered the importance of oral care (90%), tooth brushing (85%), referral to a dentist (73%), identification of sores or infections in the

**Table IV.** Responses to Knowledge Statements Regarding Oral Care (n=171)

Administrator	% (n)
<b>Each resident should have their teeth brushed daily</b>	
True	99 (147)
<b>Residents with dentures need annual dental examinations</b>	
True	93 (137)
<b>Residents can lose teeth, experience decay or become physically ill from dental disease</b>	
True	100 (148)

mouth (72%) and techniques to address barriers to oral care (69%). However only about one third (32%) of the respondents reported providing training on how to identify dental cavities (data not shown).

The majority of SNAs reported having neither a dentist on staff nor having on-site dental equipment. Of those who reported not having on-site dental equipment, over three quarters (77%) said they would consider offering on-site mobile oral care services provided that a dental professional would bring in the equipment and deliver the care.

Over half of the SNAs reported that mouth care is combined with other activities of daily living (ADLs) and charted as being completed together. Although almost all reported that their facility conducted periodic performance evaluations, only about half of these respondents reported that the quality of oral care is considered as part of the performance evaluation (Table VI).

Almost all SNAs reported that residents at their facilities received some form of daily oral care. Thirty-four percent reported that residents received oral health assessments or exams twice a year; only 25% reported that residents received oral health assessments or exams monthly. Twenty-eight percent reported that residents at their facility received referrals for dental evaluation twice a year, while 42% reported that residents received referrals only when there is a dental emergency (data not shown).

## Discussion

This exploratory study investigated the knowledge, attitudes, and practices of a national sample of SNAs regarding the oral care provided to their LTCF residents and the role that dental professionals play in their facilities. Various resources and methods impacting the oral health of LTCF residents were examined. Several note-worthy findings have laid the foundation for more extensive additional studies surveying larger samples of SNAs.

SNA respondents in this study were largely unaware that DHs could offer oral disease prevention

**Table V.** SNAs' Attitudes Regarding Oral Care (n=171)

Administrator	% (n)
<b>Oral health is an important part of general health</b>	
Strongly Agree/Agree	93 (139)
Strongly Disagree/Disagree	7 (10)
<b>Response to oral health perception statement (choose one you agree with most)</b>	
Dental care is extremely important for residents at this facility	70 (103)
Dental care is important, but would fall below the priority of general medical care	27 (39)
If there is time, mouth care is a worthwhile service to provide	1 (1)
Overall, assuring oral health is a minor emphasis of the care provided to residents	3 (4)
<b>I believe the oral health of residents at this facility is:</b>	
Excellent	5 (8)
Good	47 (71)
Fair	39 (58)
Poor	7 (11)
Unknown	1 (2)
<b>I am very satisfied with the quality of oral treatment provided to residents at our facility.</b>	
Strongly Agree/Agree	48 (72)
Neither Agree nor Disagree	24 (40)
Strongly Disagree/Disagree	28 (41)
<b>I am very satisfied with the way oral care needs of residents are met at this facility.</b>	
Strongly Agree/Agree	45 (66)
Neither Agree nor Disagree	27 (40)
Strongly Disagree/Disagree	28 (42)

services in the LTCF setting. However, after reading an explanation of the many services that qualified direct access DHs, such as RDHAPs, could provide, more than half of the respondents were interested in utilizing DHs to provide a variety of important health-related functions, including oral health training of the facility staff, screenings for oral cancer and other oral conditions, the provision of oral prophylaxes and fluoride varnish applications, and to make dental referrals for their LTCF residents. Respondents' interest in DHs providing these services in LTCF mirrors the findings of other studies surveying

**Table VI:** Oral Care Practices as Reported by SNAs (n=171)

		% (n)			% (n)
<b>Who performs Minimum Data Set for Oral/Nutritional Status (Section J)</b>			<b>Residents go out of facility for dental care</b>		
Unit charge nurse		19 (33)	Yes		72 (108)
Other staff (i.e. CNA, MDS nurse/coordinator)		46 (78)	No		28 (42)
Dietician		33 (56)	<b>On-site dental equipment</b>		
Dentist		2 (3)	Yes		29 (43)
Dental hygienist		<1 (1)	No		71 (107)
<b>Who performs Minimum Data Set for Oral/Dental Status (Section K)</b>			<b>Facility offer on-site dental services</b>		
Unit charge nurse		24 (39)	Yes		64 (69)
Other staff (i.e. CNA, MDS nurse/coordinator)		58 (92)	No		34 (36)
Dietician		14 (23)	Unsure		2 (2)
Dentist		2 (3)	<b>Would you consider on-site mobile oral care services where a dental hygienist would bring in equipment to clean teeth and screen the mouth in the resident's room or somewhere else in the facility in the future, if available?*</b>		
Dental hygienist		2 (3)	Yes		77 (27)
<b>Written plan for dental needs beyond daily toothbrushing</b>			No		3 (1)
Yes		51 (76)	Unsure, more information is needed		20 (7)
No		49 (74)	<b>With regard to basic categories of activities of daily living, mouth care is:</b>		
<b>Who provides oral care training for staff</b>			Separately listed and check off when completed		39 (58)
Nurse		58 (81)	Combined with other activities of daily living and marked together		52 (76)
Doctor		<1 (1)	Not accounted for		9 (13)
Dentist or other oral health care professional		19 (26)	<b>Does facility conduct periodic performance evaluations for those providing assistance with activities of daily living?</b>		
Other administrative staff		5 (7)	Yes		93 (138)
No one		1 (2)	<b>Is the quality of oral care taken into consideration when conducting performance evaluations?</b>		
Other			Yes		58 (80)
Staff development		6 (9)	No		25 (34)
Educator		5 (7)	Unsure		17 (24)
Miscellaneous		5 (7)			
<b>Dentist-on-staff</b>					
Yes		41 (61)			
No		59 (89)			

\* Item was asked only if participant responded no to having on-site dental equipment

executive directors and managers of LTCFs.<sup>22,23</sup> A larger, more in-depth study of SNAs would further support collaboration of DHs and SNAs to serve this population and provide an impetus for DHs who may be interested in providing oral health-related services to LTCF residents. Providing necessary oral health care to underserved older adult populations addresses the objectives of Health People 2020 by increasing the proportion of older adults who are up-to-date on a core set of clinical and preventive services while also increasing the proportion of the health care workforce with geriatric certification.<sup>24</sup> Further research with SNAs may also clarify the conflicting data in regards to the high value placed on oral health versus the reality of the oral health of the LTCF resident. In this study, SNA respondents reported being knowledgeable about the relationship of oral health to general health, the need for daily tooth brushing and annual dental exams for all residents, including those with dentures. They also had positive attitudes supporting the importance of oral health for residents in LTCF. In spite of their awareness of these factors, they rated their residents' oral health as only "good" or "fair." While these findings are consistent with those of Pyle et al.,<sup>20</sup> the opposite was found in two other studies, reporting that directors of nursing exhibited low knowledge of oral health-related issues concerning oral lesions, daily oral care and denture care.<sup>25, 26</sup>

Fewer than half of the respondents in this study agreed that they were "very satisfied" with the quality of dental treatment and the methods by which residents' oral care needs were met in their LTCF; this was in congruence with the response that their residents' oral health was only "fair" to "good". These findings were similar to the results of three other studies,<sup>26-28</sup> but contrary to those of others.<sup>11</sup> Nunez et al. study of directors of nursing indicated that their residents received quality dental services.<sup>11</sup> While these diverging results could be a result of differences in facilities, respondents' positions, or phrasing of the questions, further research needs to be conducted to resolve the differences in satisfaction with the quality of oral care provided and the actual oral health of the LTCF resident. LTCF administrators may be interested in data exploring the reasons for the lack of correlation between SNAs' positive attitudes toward the importance of oral hygiene and their apparent lack of satisfaction with the way oral care needs of LTCF residents were being met.

Fewer than half of the SNA respondents in this study reported having a dentist-on-staff and that the majority of their residents leave the facility for dental care illustrating some of the challenges related to access to care and a finding that is similar to a number of other studies.<sup>11, 20, 21, 23, 31</sup> Smith and colleagues reported that only 19% of their participants had a dentist-on-staff.<sup>29</sup> In contrast, the majority of the executive directors, Pyle et al. surveyed, reported having a dentist-on-staff.<sup>17</sup> This significant difference

may be due to differing interpretations of the meaning of dentist-on-staff. Some respondents may interpret "on staff" to mean a dentist actually working within the facility with dental equipment, while others might have considered it to mean simply a dentist of record. One advantage to conducting exploratory studies, with a limited number of participants, is that ambiguities can be addressed and corrected before distributing the survey to a larger number of potential participants. A future survey should include a clear and concise definition of a dentist-on-staff and pose additional questions regarding the role of the dentist and other dental personnel. Because the majority of LTCFs apparently do not have a designated dentist-on-staff, future studies may address this issue by identifying barriers to transporting residents outside the facility and provide data affecting administrators' decisions on policies regarding residents' dental care and treatment.

Approximately three quarters of the respondents in this study reported that they would consider adding mobile oral care services to their facilities, a finding similar to Chung and colleagues.<sup>23</sup> In contrast, more than half of the respondents in a study by Johnson et al. stated uncertainty regarding implementing on-site mobile oral care services despite having sufficient space available to offer such services;<sup>21</sup> however cost may also have been a concern. It would be interesting to know whether DHs would consider encouraging LTCFs administrators to invest in mobile dental equipment, which both dentists and DHs could use, in order to offer on-site or in-bed oral care services. A large-scale study of DHs could survey the concept of dual use of space and equipment as well the DHs interest in providing preventive and therapeutic oral care at a LTCF.

The course content of staff oral care in-service training by nurses varies as well as the frequency of oral assessments which has been reported as ranging from monthly to annually.<sup>8, 21, 23, 26</sup> Only one third of the respondents in this study reported specific training on dental caries identification. Since caries detection was not included in most of the oral care trainings, nurses may be overlooking obvious carious lesions while performing oral assessments. Further research could explore the relationships between the frequency of oral assessments and course content of staff training with the LTCF residents' overall oral health.

A limitation of this study was the low response rate to the electronic survey. Recruiting sufficient respondents is inherent in internet surveys, particularly surveys of healthcare professionals, distributed using email addresses. Also, respondents in this study may have inherently had a greater interest in oral health at their LTCF with opinions differing from the non-responders, creating a response bias. Social bias may have also occurred in that respondents may have answered more



positively regarding the oral care services provided at their LTCF, knowing that certain practices must be followed in accordance with health and safety regulations. However, these limitations should not negate the results of these exploratory findings that may be instrumental in initiating larger scale studies that could potentially positively impact the oral health of LTCF residents.

## Conclusion

Improving the oral health of LTCF residents requires both oral health care providers and LTCF personnel to assume greater responsibilities. SNAs play a pivotal role in influencing, coordinating and reinforcing the oral care services provided in LTCFs.<sup>7, 8, 10-12, 31</sup> This study's exploration of the knowledge, attitudes, and practices of a national sample of SNAs yielded data that can be valuable to the design of future studies to assess the validity of these initial findings.

Additional studies could probe for the basis for the SNAs' lack of awareness of the full range of oral health education and services that DHs can provide, as well as what role DHs may play in resolving the issues. According to the results of this study, only one quarter of the respondents were initially familiar that DHs were competent to provide preventive oral care services in a LTCF. However, once the respondents were informed of the skills and expertise possessed by DHs, they were interested in having DHs present staff oral health in-service trainings, perform oral screenings, institute fluoride varnish programs and make dental referrals. More research is needed to explore collaboration of DHs with nursing staff members and other health professionals who care for LTCF residents, in conjunction with more extensive studies addressing oral care in LTCF and various means of improving the oral health of LTCF residents. Optimal oral health not only contributes to overall systemic health, but also promotes a better quality of life.

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**Janelle Y. Urata, RDH, MS** is a clinical research coordinator; **Elizabeth T. Couch, RDH, MS** is an assistant adjunct professor; **Margaret M. Walsh, RDH, MA, MS, EdD**, was a professor emerita; **Dorothy J. Rowe** is an associate professor emeritus; all in the Department of Preventive and Restorative Dental Sciences at the University of California, San Francisco, CA.

Corresponding author: Janelle Y. Urata, RDH, MS; janelleurata@gmail.com

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# RESEARCH

## Evidence-Based Practice Knowledge, Attitude, Access and Confidence: A comparison of dental hygiene and dental students

Victoria Santiago, RDH, BS; Melissa Cardenas, RDH, BS; Anne Laure Charles, RDH, BS; Estefany Hernandez, RDH, BS; Udochukwu Oyoyo, MPH; So Ran Kwon, DDS, MS, PhD, MS

### Abstract

**Purpose:** The purpose of this study was to evaluate whether current educational strategies at a dental institution in the United States made a difference in dental hygiene (DNHY) and dental students' (D3) learning outcomes in the four domains of evidence-based practice (EBP), knowledge, attitude, accessing evidence, and confidence (KACE), following a 12-week research design course.

**Methods:** All participants DNHY (n=19) and D3 (n=96) enrolled in the research design course at Loma Linda University completed a paper KACE survey distributed on the first day of class. Students completed the KACE survey once more at the end of the 12-week course. Pre- and post-survey results were compared both within and between the DNHY and D3 student groups to identify the learning outcomes in the four domains of EBP; knowledge, attitude, accessing evidence, and confidence in EBP. Descriptive statistics were conducted to profile all variables in the study; the level of significance was set at  $\alpha=0.05$ .

**Results:** All DNHY students (n=19) completed the pre and post KACE surveys; of the D3 (n=96) students enrolled in the course 82% (n=79) completed the post-survey. Comparison of the survey results showed that both DNHY and D3 students demonstrated statistically significant increases in their level of knowledge and attitude ( $p < 0.05$ ) towards EBP. In the attitude domain, DNHY students indicated more positive attitudes towards EBP ( $p < 0.001$ ) than their D3 student cohorts. Neither group demonstrated significant changes in confidence in applying EBP ( $p > 0.05$ ).

**Conclusion:** DNHY and D3 students increased their knowledge and developed more positive attitudes towards EBP following a 12-week research design course. Study results identify improvement areas for EBP knowledge acquisition including determining levels of evidence, analysis of study results, and evaluating the appropriateness of research study designs through the use of validated EBP survey instrument.

**Keywords:** evidence-based practice, evidence-based dentistry, KACE, dental hygiene students, dental students

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### Introduction

The vision of the American Dental Hygienists' Association is to support the integration of dental hygienists into the health care delivery system and improve the public's oral and overall health.<sup>1</sup> Evidence-based practice (EBP), plays an important role in realizing this goal and should be incorporated into the education process to prepare dental hygienists to meet the needs of the public. While the importance of the EBP concept has been emphasized for a wide range of health professions including medicine, nursing, and dentistry,<sup>2-8</sup> implementation and outcomes assessment in the dental hygiene curricula remains challenging.

Evidence-based dental practice as defined by the American Dental Association is an approach to oral healthcare requiring the systematic integration of relevant scientific evidence as it relates to the patient's oral and medical condition combined with the dentist's clinical expertise and the patient's treatment needs and preferences.<sup>9</sup> The primary goal is optimal patient care, and an increasing emphasis has been placed on establishing an evidence-based approach to clinical care and treatment.<sup>10</sup> However, it is important to identify factors that may influence a practitioners' ability to embrace EBP. Knowledge and experience of practitioner, educational environment and information

overflow, among other factors may be perceived as barriers to implementing EBP,<sup>11-13</sup> suggesting that developing positive perspectives towards EBP early in education process plays a key role in shaping attitudes towards EBP.

Dental hygiene students (DNHY) at Loma Linda University (Loma Linda, CA, USA) are taught to use an evidence-based approach to patient care throughout the two-year curriculum. Special emphasis on EBP is given during the 12-week research design and applied statistics course taught during the summer term. The research design course is notable in that both matriculating senior DNHY and third year dental students (D3) are taught the basic concepts and principles of conducting and evaluating research in dental and biomedical sciences together. The students also develop required skillsets to recognize clinical problems, search and review the literature, interpret results and draw appropriate conclusions based on the best evidence. The course is designed to enhance critical thinking skills and lay the foundation for the dental professionals' commitment to life-long learning in addition to meeting Commission on Dental Accreditation (CODA) standards.<sup>14</sup>

With the incorporation of EBP into the dental and dental hygiene curricula, a need was established for the development of an assessment tool to measure the outcomes effectiveness of EBP training. Hendricson et al., developed and validated a Knowledge, Attitude, Access and Confidence Evaluation (KACE) instrument to measure EBP education outcomes specifically for dentistry.<sup>15</sup> Previous assessment tools have been designed for medicine. The KACE survey consists of 35 items measuring four EBP domains: knowledge of EBP concepts (10 items); attitudes about EBP (10 items); accessing evidence (9 items); confidence in critical appraisal (6 items).<sup>9</sup> Overall, the KACE survey demonstrates sensitivity in regards to the type of training or experience, individual responsiveness, test-retest reliability, and internal consistency.<sup>15</sup>

There are a number of studies evaluating the four dimensions of EBP on dental students, dental faculty, and dental hygiene faculty.<sup>6,7,15,16</sup> however there is a gap in the research in regards to dental hygiene students and EBP education outcomes. The purpose of this study was to evaluate the changes in EBP knowledge, attitudes, evidence-accessing methods and confidence in a mixed class of dental hygiene and dental students as measured over a short period (12 week course) of time.

## Methods

The Loma Linda University Institutional Review Board (IRB #5160409) granted this study exempt status. All second-year DNHY (n=19) and D3 (n=96) enrolled in the Loma Linda University, School of Dentistry research design and applied statistics course during the 2016-17 academic year participated in the study. The Knowledge, Attitude,

Access and Confidence Evaluation (KACE) survey instrument developed by Hendricson et al.<sup>15</sup> was printed as a hard copy and distributed during the first class session. The survey consisted of 35 multiple choice questions addressing respondents' knowledge in determining levels of evidence, literature search strategies, analysis of study design and results, and the identification of PICO (problem, information, comparison, outcome) questions. All DNHY and D3 students completed the KACE survey on the first day of class; a second KACE survey was distributed as a post-test at the completion of the 12 week course.

The KACE assessment instrument was transferred to a survey distribution tool (Qualtrics, Provo, UT, USA). All of the knowledge responses were recorded by the research team into an excel data spread sheet as either incorrect (0) or correct (1) for appropriate data analysis. Questions assessing EBP attitudes, access and confidence utilized a 5-point Likert scale with the attitude questions scaled strongly agree=1 to strongly disagree=5; while the access of evidence scale ranged from: 1= very frequently to 5 = never. The confidence scale ranged from: 1=very confident to 5 = not at all confident.<sup>15</sup> While the original KACE instrument was used for this survey, the scale was in reverse order so as to align positive responses first. Data entry into excel spreadsheets was cross-checked for the correctness of entry.

Descriptive statistics were conducted to profile all variables in the study. Fisher's exact test was used to evaluate knowledge, and the non-parametric Wilcoxon Rank Sum (Mann-Whitney) procedure was used to assess whether the two student groups differed at the pre and post-survey on attitude, access and confidence. Friedman's test was used to evaluate changes within each group in the four domains. Standard residual analyses were carried out to assess the validity of assumptions including residual plots and Shapiro-Wilk tests of normality. Analysis of the statistical models above including parameter and confidence interval estimation was accomplished using a statistical software program (IBM®; SPSS®v24). The level of significance was set at  $\alpha=0.05$  for all tests.

## Results

All DNHY students (n=19) completed the pre- and post-KACE surveys; of the D3 students (n=96) enrolled in the research design course, 82% (n=79) completed both surveys. The survey responses are reported in the respective domains.

### Knowledge Domain

The mean percentage of correct responses to the knowledge of critical appraisal questions on the pre-test was 26% for DNHY as compared to 28% for D3 students; both DNHY and D3 had 38% mean for correct knowledge responses on the post-test. Within their respective groups, both DNHY and D3 students

demonstrated a statistically significant increase in knowledge (DNHY:  $p=0.002$  and D3:  $p<0.001$ ). However, the difference in the knowledge domain on the post-test between the two groups ( $p=1.0$ ) was not statistically significant. Correct responses by knowledge category are summarized in Table I.

### Attitude Domain

Respondents attitudes regarding EBP on the pre-survey were not statistically different ( $p = 0.966$ ) between the DNHY and D3 groups; both groups indicated negative attitudes towards EBP. DNHY and D3 students demonstrated statistically significant changes in attitude in a positive direction at the post-test ( $p < 0.001$ ), as reflected by a positive delta value (Fig 1). Post-test results demonstrated statistically significant differences between the two groups; with DNHY students indicating more positive attitudes towards EBP ( $p < 0.001$ ) than D3 students. Overall, students agreed or strongly agreed that EBP should be an integral part of the dental curriculum and that EBP will be valuable in their future to improve the quality of patient care. Attitude domain responses are summarized in Table II.

The pre- and post-survey descriptive summaries reported in Tables II-IV should be interpreted at the group level. Delta values were derived from individual scores rather than group-level summaries. Individual post-survey scores were subtracted from the pre-survey scores to derive the delta value and reflect the direction of change in score with respect to baseline (pre-survey). A zero value indicates no change in the respective domain while a negative value indicates a change in the negative direction. Thus, delta values do not correspond to a direct subtraction of post-survey scores from pre-survey scores. Changes in attitude, access, and confidence are illustrated as boxplots in Figure 1.

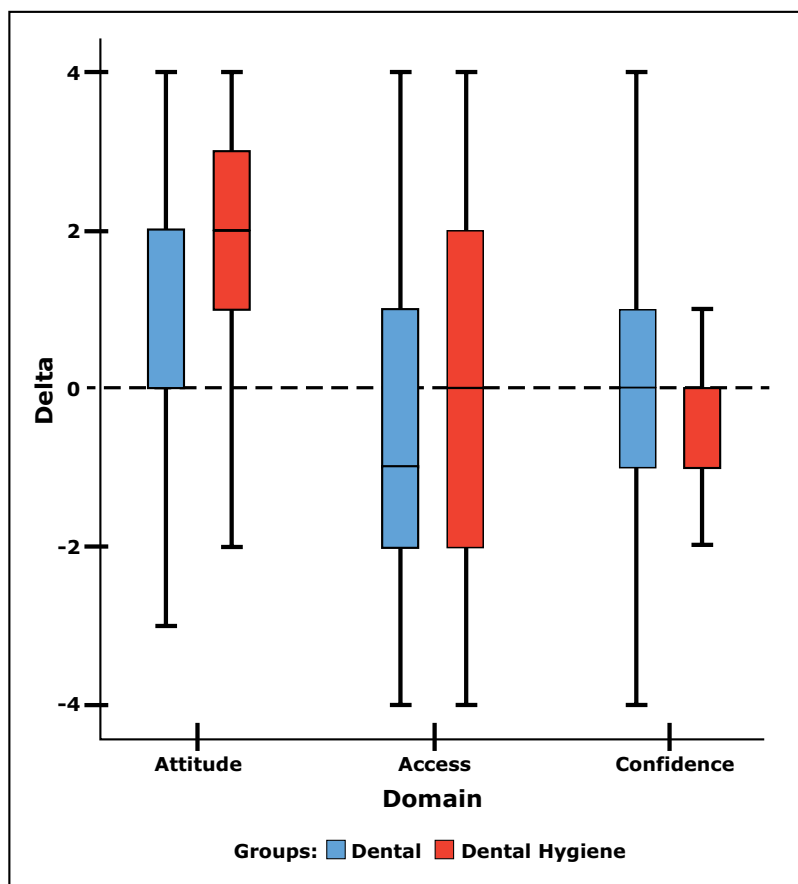
### Access Domain

DNHY and D3 students did not demonstrate a significant difference in strategies for accessing evidence on the pre-survey ( $p= 0.110$ ) however post-survey results showed a statistically significant difference ( $p = 0.004$ ) between the two groups of students. D3 students demonstrated a change in their ability to access information ( $p < 0.001$ ), while no changes were shown in the DNHY group

**Table I.** Correct Responses: Knowledge Questions

Type of Question	Pre-survey		Post-survey	
	DNHY	D3	DNHY	D3
Q1 Determining Ranking of Evidence	0	21.79	21.05	25.61
Q2 Determining Highest Level of Evidence	0	11.54	36.84	28.05
Q3 Literature Search Strategy	42.10	52.56	36.84	60.98
Q4 Analyzing Study Results	47.36	47.43	42.11	50.00
Q5 Identifying PICO Questions	26.31	10.25	36.84	43.21
Q6 Analyzing Study Results	31.57	3.84	31.58	23.17
Q7 Identifying Research Study Design	52.63	41.02	36.84	55.56
Q8 Determine Appropriate Study Design Needed	21.05	16.66	36.84	21.95
Q9 Sensitivity and Specificity	21.05	35.89	36.84	41.46
Q10 Prevalence and Incidence	21.05	35.89	65.15	28.40
Mean of Correct Responses (%)	26.31	27.69	38.09	37.84

**Figure 1.** Boxplots of Changes in Attitude, Access, and Confidence by Student Group





**Table II.** Summary of Responses: Attitudes about EBD in Dentistry

Attitude Question		DNHY			D3		
		Pre-survey	Post-survey	DELTA	Pre-survey	Post-survey	DELTA
I now believe that evidence-based practice will be more valuable in my future	Median	4	1	2	4	2	2
	IQ Range	2	1	3	0	1	2
I personally appreciate the advantages of practicing evidence-based patient care	Median	4	1	3	4	2	2
	IQ Range	2	1	2	1	1	2
EBP should be an integral part of the dental school curriculum	Median	4	1	2	4	2	2
	IQ Range	2	1	2	0	0	2
I support EBP principles more than I did one year ago	Median	3	2	1	4	2	2
	IQ Range	1	1	2	1	1	2
EBP is a routine part of my professional growth as a dentist/dental hygienist	Median	3	1	2	4	2	2
	IQ Range	1	1	2	1	0	1
The practice of evidence-based dentistry has changed the way I learn	Median	3	2	1	3	2	1
	IQ Range	0	1	1	1	1	2
It has been difficult for me to practice evidence-based dentistry in the past year	Median	3	3	0	3	3	0
	IQ Range	0	2	2	2	2	3
EBP is "cook-book" dental care that disregards clinical experience in providing the best treatment for patients	Median	3	3	0	2	3	-1
	IQ Range	1	1	2	1	2	2
It is feasible to use EBP routinely when providing care for patients in the dental school clinic	Median	4	2	2	4	2	1
	IQ Range	1	1	1	1	1	2
EBP improves the quality of dental patient care	Median	4	1	3	4	2	2
	IQ Range	1	1	2	0	0	1

\*1: Strongly agree; 2: Agree; 3: Uncertain; 4: Disagree; 5: Strongly Disagree

( $p = 0.609$ ) as illustrated in Figure 1. Participant responses regarding frequency of accessing evidence are shown in Table III. Both DNHY and D3 groups reported using colleagues and searching the Internet for dental evidence. Podcasts or databases of critically reviewed topics were rarely used by either group.

### Confidence Domain

Confidence levels in appraising various aspects of a published report were not statistically significant between DNHY and D3 groups on the pre-survey ( $p = 0.157$ ). Both groups reported having moderate confidence on the pre-test and did not differ from each other on the post-survey ( $p=0.824$ ). Neither group demonstrated a change in confidence that

was statistically different (DNHY:  $p=0.070$ ; D3:  $p=0.559$ ). Student responses regarding confidence in the various aspects of appraising the literature are summarized in Table IV.

### Discussion

Evidence-based practice is a decision making process that should be considered the standard of care in dentistry and positive perspectives towards EBP should be cultivated early in the education process. The purpose of this study was to evaluate whether current educational strategies at a dental school in the United States made a difference in the dental hygiene and dental students learning outcomes in the four domains of EBP; knowledge, attitude,

**Table III.** Summary of Responses: Frequency of Access for Dental Evidence

Access Method		DNHY			D3		
		PRE-survey	POST-survey	DELTA	PRE-survey	POST-survey	DELTA
Colleagues in dentistry or health care providers	Median	4	2	2	4	2	2
	IQ Range	2	2	4	2	2	2
Textbooks	Median	4	2	2	3	3	0
	IQ Range	2	2	2	2	1	1
Internet (excluding Cochrane reviews)	Median	4	2	2	4	2	1
	IQ Range	2	1	2	1	1	2
Original research published in peer-reviewed journals	Median	3	3	0	3	3	0
	IQ Range	2	1	2	1	2	2
Cochrane Database of Systematic Reviews	Median	1	4	-3	1	4	-2
	IQ Range	1	2	2	1	1	2
Journal of EB Dental Practice, EB Dentistry, Journal of EBM	Median	1	3	-2	2	3	-1
	IQ Range	2	1	3	2	2	2
Continuing education courses, workshops	Median	3	3	1	2	4	-2
	IQ Range	1	1	2	2	2	2
Podcasts and web conferences (webinars)	Median	1	4	-2	2	4	-2
	IQ Range	1	1	2	1	2	2
Databases of Critically Appraised Topics (CATs)	Median	1	4	-2	1	4	-3
	IQ Range	1	3	3	1	2	3

\*1: Very Frequently; 2: Often; 3: Occasionally; 4: Rarely; 5: Never

accessing evidence, and confidence. The study results demonstrated that there were no differences in the EBP domains between the DNHY and D3 groups at the beginning of the research design course; a finding that was noteworthy considering the different academic requirements of the two disciplines. These results were also in contrast to the studies of Stanley et al.<sup>6</sup> and Hendricson et al.;<sup>15</sup> both demonstrating positive associations between the degree level of education obtained and EBP knowledge, access to evidence and confidence. The collective responses of both student groups revealed that only a small number of respondents had a fundamental knowledge of pertinent EBP principles, findings similar to Straub-Morarend et al. multi-institutional, cross-sectional study of 138 students from seven schools.<sup>16</sup> In the area of EBP principles, participants in this study had the highest level of correct responses in being able to differentiate between the terms prevalence and

incidence and in literature search strategies while the lowest level of correct responses was in determining the level of evidence and the necessary study design.

This study evaluated the change in EBP knowledge that occurred over a 12 week course and the survey results indicate that both DNHY and D3 student groups demonstrated the same increase in levels of knowledge. These findings were modest in comparison to Hendricson et al.<sup>15</sup> study findings where participants demonstrated a doubling of knowledge after an EBD training course as measured by the KACE survey instrument. It is noteworthy that the learning objectives of the EBD training were specifically addressed to all components of the KACE knowledge domain,<sup>15</sup> whereas the research design course in the current study was an overview of the basic concepts and principles related to both evaluation and conducting research in dental education and biomedical sciences.

**Table IV.** Summary of Responses: Confidence on Appraising Literature

Appraisal Aspect		DNHY			D3		
		Pre-survey	Post-survey	DELTA	Pre-survey	Pre-survey	DELTA
Appropriateness of the study design	Median	2	3	0	2	3	0
	IQ Range	1	1	1	1	1	2
Bias in the study design or data analysis	Median	3	3	0	3	3	0
	IQ Range	1	1	2	1	1	2
Adequacy of the sample size	Median	3	3	0	3	2	0
	IQ Range	1	1	2	1	1	1
Generalizability of the findings	Median	3	3	0	3	3	0
	IQ Range	1	1	1	1	1	1
Appropriate use of statistical tests	Median	2	3	-1	2	3	-1
	IQ Range	2	4	2	1	3	2
Overall value of the research report	Median	3	3	0	3	3	0
	IQ Range	1	1	2	1	1	1

\*1: Very Confident; 2: Confident; 3: Moderately Confident; 4: Not Confident; 5: Not at all Confident

The attitudinal change towards EBP in dentistry in both student groups was significant. Both DNHY and D3 students started with a less positive perspective towards EBP and demonstrated transitioning to a more positive outlook. A positive perspective can impact behavior, as one is likely to achieve better in an area that provides enjoyment and views as useful.<sup>17</sup> This concept is also supported by studies in other disciplines demonstrating that an attitude index may be used as a positive predictor for better behavior.<sup>18</sup> Developing positive attitudes towards EBP are desirable learning outcomes since they may influence the future practitioner's implementation of EBP.

Participants in the study accessed a variety of sources in search for evidence and frequently referred to colleagues and other health care providers for evidence-based information. This is to be expected in an educational environment where classmates or faculty members are readily available for sharing opinions; however, these colleagues may not be accurate sources of evidence. Neither the DNHY nor the D3 groups demonstrated changes in confidence levels in the post-survey. Both groups remained only moderately confident in their ability to appraise various aspects of published research despite the increase in their knowledge and improved attitude. These findings are supported by other educational studies indicating no significant relationship between confidence and levels of knowledge or on the self-rated abilities of health care providers and teachers.<sup>19,20</sup>

Limitations of the study include the use of a convenience sample of students in a single institution;

therefore the results are not generalizable outside of this institution. Additionally, although the two student groups took the research design and statistics course together during the 12-week summer term, there were differences in the overall didactic exposure during that period that may have affected the results. The DNHY students also took a cariology class during the same term that included EBP concepts while the D3 took the cariology course in the previous year. Areas for further study include multi-institutional, cross-sectional surveys of dental hygiene students and faculty on their perceptions of EBP, learning outcomes of EBP in the curriculum and readiness to incorporate EBP in the future.

## Conclusion

This study evaluated the changes in knowledge, attitudes, evidence-accessing methods and confidence of EBP in dental hygiene and dental students over a short period of time at a U.S. dental institution. Within the limitations of this study, it can be concluded that dental hygiene and dental students increased their knowledge and developed more positive attitudes towards EBP following a 12 week research design and applied statistics course. Study results identified improvement areas for EBP knowledge acquisition including determining levels of evidence, analysis of study results, and evaluating the appropriateness of research study designs through the use of validated EBP survey instrument.

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**Victoria Santiago, RDH, BS; Melissa Cardenas, RDH, BS; Anne Laure Charles, RDH, BS; Estefany Hernandez, RDH, BS;** are graduates from the Department of Dental Hygiene; **Udochukwu Oyoyo, MPH** is an assistant professor, Dental Education Services; **So Ran Kwon, DDS, MS, PhD, MS** is a professor and director of the Student Research Program, Center for Dental Research; all at Loma Linda University School of Dentistry, Loma Linda, CA.

Corresponding author: So Ran Kwon, DDS, MS, PhD, MS; sorankwon@llu.edu

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## Childhood Obesity: Dental hygienists' beliefs attitudes and barriers to patient education

Doreen Dawn M. Cole, RDH, MS; Linda D. Boyd, RDH, RD, EdD; Jared Vineyard, PhD; Lori J. Giblin-Scanlon, RDH, MS

### Abstract

**Purpose:** Increasing childhood obesity rates present a significant threat to public health. The purpose of this study was to explore dental hygienists' (DH) beliefs, attitudes, knowledge, current practices, and barriers for assessing and educating patients about childhood obesity.

**Methods:** A random sample of DHs (n=13,357) was selected and emailed a link to the validated survey. Of the 1046 respondents who accessed the survey, 919 completed the survey for a completion rate of 89%.

**Results:** A majority of the respondents understood the risk of chronic disease and obesity (99%), role sugar-sweetened beverages (SSBs) play as added sugar content in the diet (76%), and the amount of SSBs consumed by youth (91%). Participants felt current research showed an association between obesity and periodontal disease (62%), but were unsure of the association between obesity and dental caries (51%). Most respondents never measure height and weight (91%) or plot BMI (94%). Fifty-one percent always provide nutritional counseling to reduce consumption of SSBs, but only sometimes provide nutritional counseling for healthy eating (61%). Respondents had a slightly positive attitude (mean score=4.15, SD=14.58) about assessing and educating for childhood obesity. Major barriers reported were time constraints (63%), and fear of offending the patient or parent (47%). Regression showed attitudes towards patient's nutrition, exercise, and weight predicted the dental hygienist behavior.

**Conclusion:** DHs have some understanding of the risks of obesity and general/oral health, but lack adequate training, knowledge, and confidence to provide obesity counseling in clinical practice settings. There is a need for further education to address the lack of knowledge about nutritional guidelines and practitioners' beliefs regarding addressing childhood obesity without offending the patient or parent.

**Keywords:** childhood obesity, nutritional counseling, public health, oral systemic disease

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### Introduction

The increasing prevalence of childhood obesity is a major public health concern in the United States (U.S.) as well as globally.<sup>1-5</sup> Obesity prevalence in children and adolescents in the U.S. aged 2 to 19 years of age was 17% and extreme obesity was 5.8% in 2014.<sup>2,4</sup> Causes for obesity are complex and multifactorial and include contributing factors such as genetics, environmental, behavioral, poor diet, and a sedentary lifestyle.<sup>1,3</sup> In children, feeding practices by caregivers are a modifiable risk factor for prevention of overweight and obesity in the early years of life.<sup>6</sup> A modifiable risk factor for obesity in particular, is the intake of sugar-sweetened beverages (SSBs), which increases the odds of being overweight and obese by 1.55 and is a determinant of body weight.<sup>7</sup> Added sugars also increase the risk for dental caries; a systematic review suggests the intake of added sugars must be below 5% to lower caries risk.<sup>8</sup>

The American Association of Pediatric Dentistry (AAPD), American Dental Association (ADA), and American Dental Hygienists' Association (ADHA) all have policies related to use of national guidelines to encourage healthy food choices and reduce added sugars, especially those found in SSBs such as soft drinks, sports drinks, and energy drinks.<sup>9-11</sup> Dental hygienists (DHs) provide nutritional counseling for caries prevention and control along with overall wellness as a key educational component of the preventative dental appointment.<sup>12</sup> Because children 3 to 12 years of age have more dental visits (51%-55%) than medical visits (34%), they build a trusted patient/clinician relationship, and place DHs in a favorable position to provide nutritional counseling and education on childhood obesity.<sup>12</sup>



## Obesity and Systemic Health

Childhood obesity has both physical and psychological effects, leading to chronic medical conditions, such as the accelerated onset of type-2 diabetes mellitus. Insulin resistance/hyperinsulinemia is believed to be an important link to metabolic abnormalities, obesity, risk for cardiovascular disease, and place the child at risk for adult obesity, ultimately impacting mortality and morbidity.<sup>1, 4, 13, 14</sup> In addition, childhood obesity can lead to social stigma having a direct impact on the child's and adolescent's social, behavioral, and emotional well-being.<sup>2</sup>

## Obesity and Oral Health

Since caries detection is a routine part of oral health assessment in the dental office, several studies have been carried out to evaluate the relationship between obesity and dental caries but the findings were inconsistent.<sup>15-19 20</sup> However, a systematic review and meta-analysis by Hayden et al. reported a statistically significant relationship ( $p=0.049$ ) between dental caries and childhood obesity.<sup>15</sup>

Birth weight, infant obesity, nutritional risk factors, and socio-economic factors demonstrate associations with the prevalence of early childhood caries (ECC) and obesity in a number of studies.<sup>16, 18, 19</sup> Since childhood obesity is a multifactorial issue, caloric intake and the types of foods consumed, such as SSBs, are an area for further investigation to fully determine the association between dental caries, nutrition, and obesity.

The evidence suggests an association between obesity and periodontitis in adult populations.<sup>21</sup> A recent systematic review and meta-analysis suggests an association between childhood obesity and signs of periodontal disease including bleeding on probing, probing depth, and plaque index.<sup>21</sup> Further research is needed in this area to clarify the relationship.<sup>22</sup>

## Medical Professionals

Health care professionals provide health services to young children and adolescents and can have an impact on addressing childhood obesity. Studies indicate that although Primary Care Providers (PCPs) face many barriers in providing intervention such as parental involvement, patient motivation, lack of time, and support services, they understand the importance of managing childhood obesity for short- and long-term disease prevention.<sup>23-27</sup> PCPs feel more comprehensive training and education would be needed to adequately address this sensitive issue.<sup>27</sup>

## Dental Professionals

Several studies to assess knowledge, attitudes, beliefs, and barriers of dental professionals to addressing obesity have been conducted.<sup>28-31</sup> Curran et al. and Lee et al. in separate studies surveyed general and pediatric dentists about their role in providing obesity education in adults and children.<sup>28, 30</sup>

Respondents felt they would only consult the patient on obesity when an established link between oral and systemic health had been verified.<sup>28, 30</sup> Major barriers were lack of training to properly educate and assist patients; and fear of offending the parent/patients; and having them leave the practice.<sup>28, 30</sup>

Kading et al surveyed North Carolina dental hygienists (DH) regarding factors affecting confidence in providing obesity education and counseling in adult populations.<sup>29</sup> Survey results showed that 95% of respondents felt DHs had a role in improving patient nutrition, while only 36% considered assisting patients in achieving their weight loss goals was part of the DH role and 82% were more apt to educate and counsel patients regarding oral health issues.<sup>29</sup> In regards to confidence in obesity education and counseling a primary focus of the study, 65% of respondents expressed a level of confidence in discussing obesity-related health risks.<sup>29</sup> Of note were 17% of the respondents reporting negative attitudes about overweight people, suggesting that obese individuals lack willpower.<sup>29</sup> While DHs reported learning nutrition counseling during their educational program, assessments for overweight or obesity were not part of the curriculum.<sup>29</sup>

Additional research in dental and DH students conducted by Magliocca et al found that 92% percent of students reported fewer than five hours of obesity education.<sup>31</sup> Even though 96% of the respondents considered assessing dietary habits an important component of preventive oral care, 31% reported discomfort in addressing nutrition with obese patients.<sup>31</sup> About one-third of students held negative stereotypes regarding obese patients including lack of willpower and laziness and 11% felt overweight/obese patients lacked will power.<sup>31</sup> These findings suggest the need to address obesity and approaches in supporting patients in behavior change to improve oral and general health.<sup>31</sup>

Childhood obesity is a public health concern both in the U.S. and around the world.<sup>3</sup> The purpose of this study was to assess DHs knowledge, beliefs, attitudes, and barriers in educating patients/parents about childhood obesity in the dental setting to update and expand on the research of Kading et al.

## Methods

A cross-sectional survey research design with a random sample of DHs was utilized for this study. Massachusetts College of Pharmacy and Health Sciences (MCPHS) University's Institutional Review Board granted the study an exempt status under 45 CRF 46.101(B) (2) protocol number IRB062716C.

## Survey design

The questionnaire was developed by combining survey instruments from the studies of Curran et al. and Ip et al.<sup>30, 32</sup> The Nutrition, Exercise and Weight Management, (NEW) Attitudes Scale was

developed and validated by Ip et al. to measure medical students' attitudes and beliefs regarding obese patients.<sup>32</sup> The NEW Attitudes scale had a test-retest reliability of 0.89 with moderate correlation to two previously validated measures of obesity bias.<sup>32</sup> Curran et al. developed a survey to explore the dentists' role in addressing obesity in adults and was modified to fit the topic of childhood obesity.<sup>30</sup> The NEW survey was used in its entirety along with the modified survey from Curran et al.; both surveys were used with permission from the authors.

The final survey instrument contained 7 sections: knowledge (9 items); attitudes and beliefs (34 items); practices (9 items); barriers (9 items); resources needed (1 item); practice information (2 items); and demographics (7 items). A 3-point Likert Scale was used to assess level of agreement to the questions.

Content validity was established with a panel of five nutrition and oral health experts.<sup>33</sup> A validation form was used to rate each survey question for the content validity index (CVI) on a 4-point scale.<sup>33</sup> The percentage of agreement about the relevance of each item was computed for the item CVI (I-CVI) and the scale CVI (S-CVI) was computed by the total of I-CVI's divided by the number of survey questions.<sup>33</sup> An acceptable I-CVI rating among the panel of experts must result in 0.78 or higher, and the S-CVI must result in 0.90 or higher in order to determine adequate content validity of the questionnaire.<sup>33</sup> The individual survey questions each received an adequate I-CVI score ranging from 0.8-1. The overall S-CVI score was .93, suggesting the survey was an adequate representation of this study's research questions. The survey was then pilot tested by a group of 10 DHs for feedback on clarity of questions with no revisions recommended. The final survey was entered into Survey Monkey®.

### Survey participants

Participants were recruited through the American Dental Hygienists' Association (ADHA) database of members. ADHA chose a random sample of 13,492 DHs with a 99% delivery rate resulting in a final sample size of 13,357. Of these, 1,046 individuals accessed the survey. Post stratification was used to weight the data by gender and race in order to match U.S. population percentages<sup>34</sup> and account for non-response bias.<sup>35</sup>

### Survey Procedures

An email invitation containing a link to the survey was sent by ADHA to the selected sample. Participants were given 2 weeks to complete the survey. A second email reminder was sent by ADHA at the end of the second week and participants were given 2 more weeks to complete the survey. Investigators did not have access to the email list.

### Data analysis

Weighted data were used for all analysis and were examined using statistical software (IBM, SPSS 24®). Demographics and participants' responses were calculated using summary statistics. Participant responses to "attitude" questions were appropriately weighted and summed, providing a summary "attitudes", anti-fat, self-efficacy, and patient knowledge score for each participant, as in the previously validated survey instrument.<sup>32</sup>

The  $\chi^2$  test of independence was employed to examine responses on knowledge, attitude, practice and barrier items by level of DH education and source of nutrition education. The Fisher's exact test was applied whenever there were inadequate cases within the cells. A Bonferroni correction was used on all tables larger than 2x2 to correct for omnibus familywise error.

Clinical research often reports *p*-values alone, however, this study also used an effect size to calculate the strength of the association. Effect sizes calculate the strength or magnitude of an effect and are key in interpreting clinical research. While a significant *p*-value can be found, the effect size may be small and thus not relevant to clinical practice.<sup>36</sup> In this study the phi coefficient ( $\Phi$ ) is reported to indicate the degree of association between variables in the  $\chi^2$  test. Values of .10 are considered small, .30 medium, and .50 large effect sizes.<sup>37</sup>

A Spearman's rank order correlation was used to assess the relationship between age and all response items. Univariate multiple linear regression analyses were conducted to assess the association between participants "attitudes" scores and responses to practices items and all statistical tests were performed at an alpha threshold of 0.05.

## Results

### Participation Rate

Following dissemination of the survey link to the sample population, one individual emailed to indicate they were no longer practicing and was removed from future sample calculations. Therefore, 1046 independent attempts were recorded with 919 completed surveys and the overall participation rate for this survey was 89.1%. The participation rate (PR) was reported as recommended by the American Association for Public Opinion Research.<sup>38</sup> PR is the number of people completing the survey divided by the number of people who started the survey, as the sources of nonresponse are unknown.<sup>38</sup>

### Demographics

The majority of the participants were white females (91%) with an average age of 28 years (SD=12.22) (Table I). Less than half held a certificate or Associate's degree in Dental Hygiene (AS) with 40% holding a Bachelor's degree (BS), and 15% a Master's degree

**Table I.** Demographic Characteristics of Study Population (n=919)

	<b>n (%)</b>
<b>Participant Age, mean yrs (SD)</b>	28.20 (12.22)
<b>Gender</b>	
Male	31 (3%)
Female	886 (97%)
<b>Race</b>	
White	814 (89%)
Asian	51 (6%)
Black or African American	30 (3%)
Other	25 (2%)
<b>Ethnicity</b>	
Hispanic	43 (5%)
Non-Hispanic	876 (95%)
<b>Education (any field)</b>	
Certificate	5 (1%)
Associate	228 (25%)
Bachelors	390 (42%)
Masters	267 (29%)
Doctorate/PhD	30 (3%)
<b>Education (dental hygiene)</b>	
Certificate	24 (3%)
Associate	388 (42%)
Bachelors	368 (40%)
Masters	140 (15%)
<b>Nutrition Education</b>	
Included in dental hygiene education	459 (51%)
Attended workshop or continuing education after graduation	118 (13%)
College level course after graduation	38 (4%)
Self-study on the topic	159 (18%)
Other	133 (14%)
<b>Primary Practice Setting</b>	
General Practice	613 (67%)
Pediatric Practice	30 (3%)
Other	276 (30%)
<b>Number of pediatric patients per week</b>	
<10 patients	651 (71%)
10-15 patients	137 (15%)
16-20 patients	32 (3%)
>20 patients	99 (11%)

Yrs = years, SD = standard deviation, % = ratio of responses to total respondents, and n = sample size.

(MS). Over half reported having some nutrition content in their entry-level DH educational program while 31% indicated receiving obesity education through continuing education; including self-study and workshops. Over 67% of the participants were employed in a general practice, with 71% seeing fewer than 10 pediatric patients per week.

### Early Versus Late Respondents

The non-response adjustment method was used to address the non-response bias in the study sample.<sup>38</sup> Comparing respondents to non-respondents presents challenges in survey research and several methods have been developed to estimate the potential differences between people who respond and non-responders. This includes treating "late" responders as non-responders and using those late responders to compare to early participants. For this study, individuals who responded before the reminder email was sent were considered early responders and all others were considered late. Independent sample t-tests were performed on continuous variables and a X<sup>2</sup> test of independence was used to examine the relationship across the all categorical variables. Early responders were not different than late responders on any of the variables ( $p > .05$ ).<sup>39</sup>

### Knowledge

Table II illustrates DHs' knowledge about obesity, and relationships with oral and systemic health. Most respondents understood the risk of obesity and other health issues (99%) and a majority understood the role of SSBs in contributing to the added sugar content in diets (76%), and the quantities of SSBs consumed by youth (91%). Although the respondents (28%) did not feel overweight children were more likely to become overweight adults, they felt parental obesity was a strong risk factor for childhood and adolescent obesity, with maternal obesity having the greatest effect (76%). Dental hygienists felt unsure regarding their knowledge about the association between obesity and dental caries (56%), although they felt current research demonstrates an association between obesity and periodontal disease with an increased BMI (62%).

### Attitudes and Beliefs

Participants' attitudes and beliefs about obese patients are illustrated in Table III. These questions explored the understanding of the risk factors of obesity and DHs' attitudes and beliefs towards educating and discussing weight related issues.<sup>30</sup> Results showed DHs had a slightly more positive

**Table II.** Knowledge Assessment (n=919)

Knowledge Question Responses	True n (%)	False n (%)	Not sure n (%)
Overweight children have increased risk of high blood pressure, pre-diabetes, Type 2 diabetes mellitus, sleep apnea, high cholesterol, joint problems, fatty liver, gallstones, oral health problems, and gastro-esophageal reflux.	910 (99%)	0 (0%)	9 (1%)
Overweight children are no more likely to become overweight adults than normal weight children.	261 (28%)	616 (67%)	41 (5%)
Parental obesity is the strongest risk factor for childhood and adolescent obesity, with maternal obesity having the greatest effect.	699 (76%)	41 (4%)	179 (20%)
On a typical day, 80% of youth will have a sugar-sweetened beverage (SSB).	832 (91%)	12 (1%)	75 (8%)
SSBs are responsible for the high added sugar content of diets.	702 (76%)	47 (5%)	171 (19%)
Eating 100 calories per day more than one's daily energy needs could lead to a 10-pound weight gain each year.	618 (67%)	48 (5%)	254 (28%)
In children, obesity appears to be associated with early tooth eruption, potentially putting them at risk for dental caries because of extended exposure time in the oral cavity.	224 (24%)	182 (20%)	513 (56%)
Current research has found an association between obesity and periodontal disease with an increase in odds of having periodontal disease with an increase in BMI.	568 (62%)	45 (5%)	306 (33%)
Literature has not agreed about the association between dental caries and obesity in children.	203 (22%)	248 (27%)	468 (51%)

% = ratio of responses to total respondents and n = sample size.

attitude (4.11) about obese patients, compared to Kading et al. and Magliocca et al. respondents, who had a negative attitude in that patients lacked will power (17%). One-third of respondents reported a negative stereotype of obese patients.

Significantly more respondents in the MS group (76%) agreed it would be rewarding provide nutritional counseling versus 60% of the BS group ( $X^2(4,907)=13.32, p=.01, \Phi=.12$ ). Master's level hygienists (45%) also indicated patients are likely to follow an agreed upon plan to increase their physical activity as compared to 34% of BS respondents. The AS group (41%) had the lowest number of individuals who were neutral on the same statement.

The NEW scale contains several items indicating the perceived self-efficacy of a hygienist for helping obese patients. Seventy-three percent of DHs with *obesity education as continuing education* (COE) agreed it would be rewarding to talk to someone about nutrition when compared to 61% of those with *obesity education in an entry-level DH program* (ELOE) ( $X^2(4,907) = 13.73, p=.01, \Phi=.12$ ). Additionally, 62% of the COE group agreed that they had a personal desire to counsel patients about nutrition with only 42% of ELOE respondents indicating the same desire

( $X^2(4, 907)=30.29, p<.001, \Phi=.18$ ). On a related item, 36% of the COE group agreed that they had a personal desire to counsel patients about physical activity with 20% of the same group disagreeing. Only 26% of those with ELOE reported a desire to provide physical activity counseling with 32% the ELOE group in disagreement ( $X^2(4, 907)=17.92, p=.001, \Phi=.14$ ). Significantly more of the COE group (28%) versus 18% of those with ELOEs, agreed in having a personal desire to counsel patients about weight management ( $X^2(4,907)=21.85, p<.001, \Phi=.16$ ). In contrast, 22% of those with COE indicated feeling awkward discussing weight when a patient is overweight/obese, versus only 15% of those with ELOE regarding the same response ( $X^2(4, 907)=10.08, p=.04, \Phi=.11$ ).

The NEW scale also contains several items indicating a person's anti-fat attitude. Among respondents, 56% of the ELOEs were in disagreement with the statement that people can eat a healthy diet if they choose to do so compared to 47% of those with COE ( $X^2(4, 907)=10.08, p=.04, \Phi=.11$ ). All other tests of independence between attitude items and obesity education source were not significant.



**Table III.** NEW Scale Item Response (n=919)

Attitude Question Responses	Disagree n (%)	Neutral n (%)	Agree n (%)
There is no excuse for a patient to be overweight/obese.	574 (63%)	259 (28%)	87 (9%)
It is usually sufficient to give a person brief, clear advice about weight management.	589 (64%)	225 (24%)	106 (12%)
People can eat a healthy diet if they choose to do so.	249 (27%)	197 (22%)	473 (51%)
Counseling about nutrition does not change behavior.	543 (59%)	235 (26%)	141 (15%)
I believe if I eat a healthy diet it would make me an effective role model.	41 (5%)	162 (17%)	716 (78%)
I find it rewarding to talk to someone about nutrition.	50 (5%)	268 (29%)	601 (66%)
I have a personal desire to counsel patients about nutrition.	138 (15%)	326 (35%)	4655 (50%)
Patients understand the connection between nutrition and cancer.	677 (74%)	159 (17%)	84 (9%)
The American food culture contributes to the overweight/obesity problem.	12 (1%)	20 (2%)	886 (97%)
Patients are likely to follow an agreed upon plan to increase their physical activity.	418 (46%)	353 (38%)	149 (16%)
Even if I counsel them, patients will continue their poor physical activity habits.	123 (13%)	528 (58%)	268 (29%)
I have a personal desire to counsel patients about physical activity.	260 (28%)	384 (42%)	275 (30%)
Overweight individuals tend to be lazy about physical activity.	372 (40%)	300 (33%)	248 (27%)
Patients understand the connection between physical activity and cancer.	618 (67%)	254 (28%)	46 (5%)
Patients think lack of physical activity can be a serious health risk.	252 (27%)	259 (28%)	408 (45%)
I think obese patients are motivated to change their lifestyles.	299 (32%)	492 (54%)	128 (14%)
I feel effective in helping overweight/obese patients manage their weight.	438 (47%)	389 (43%)	92 (10%)
I believe my patients will follow through with a weight management program.	315 (34%)	554 (60%)	51 (6%)
I feel confident treating overweight/obese patients.	249 (27%)	310 (34%)	359 (39%)
I think treating overweight/obese patients is not worth the time.	775 (84%)	120 (13%)	25 (3%)
Weight management counseling takes too much time.	405 (44%)	325 (35%)	188 (21%)
I do feel a bit disgusted when treating a patient who is obese.	731 (80%)	122 (13%)	66 (7%)
If a patient is overweight/obese, I feel awkward discussing his/her weight.	165 (18%)	214 (23%)	541 (59%)
The person and not the weight is the focus of weight management counseling.	51 (6%)	167 (18%)	702 (76%)
Patients know the health risks related to their weight.	276 (30%)	280 (31%)	363 (39%)
Patients take their weight seriously.	238 (26%)	450 (49%)	232 (25%)
Patients understand the connection between weight and cancer.	577 (63%)	294 (32%)	48 (5%)
I have a personal desire to counsel patients about weight management.	367 (40%)	355 (39%)	197 (21%)
Overweight/obese individuals lack will power.	471 (51%)	332 (36%)	117 (13%)
Patients think being overweight/obese is a serious health risk.	173 (19%)	350 (38%)	396 (43%)

% = ratio of responses to total respondent and n = sample size.



## Practices

The practices DHs currently incorporate into assessing and educating for obesity in the dental practice are illustrated in Table IV. Most participants reported *never* measuring height and weight and 95% have *never* plotted BMI in children. Over half *always* provide nutritional counseling to reduce consumption of SSB drinks, but only 65% reported that they *sometimes* provide nutritional counseling to encourage healthy eating.

Most respondents reported *never* collaborating with school officials or other health professionals to ensure healthy food choices are available in schools. In addition, 76% report *never* referring to a Primary Care Provider (PCP) or registered dietitian nutritionist (RDN).

Tests of independence demonstrated significant relationships between source of obesity education and three practice items. First, more of the COE participants (23%) indicated they *always* provide nutritional counseling to encourage healthy eating, while only 15% of the ELOEs endorsed the same frequency ( $X^2(4, 919)=17.10, p=.002, \Phi=.14$ ). Second, participants in the COE group reported they either never (70%), sometimes (22%), or always

(8%) advocate with school officials or leaders to ensure school food services, including vending services and school stores, provide nutritious food selections as compared to the ELOEs group (never=81%, sometimes=15%, and always=4%), ( $X^2(4, 919)=16.92, p=.002, \Phi=.14$ ). Finally, COEs are more likely to always (9%) or sometimes (24%) collaborate to increase awareness of the importance of maintaining healthy vending choices in schools, and to encourage the promotion of beverages of high nutritional value than those with ELOE (always=4%, sometimes=14%), ( $X^2(4, 919)=28.83, p<.001, \Phi=.17$ ).

**Table IV.** Practice Assessment of Study Population (n=919)

Practice Question Responses	Never n (%)	Sometimes n (%)	Always n (%)
Measure heights and weights	835 (91%)	61 (7%)	23 (2%)
Provide nutritional counseling to reduce frequency of between meal snacks.	163 (18%)	557 (60%)	199 (22%)
Provide nutritional counseling to reduce consumption of sugar-sweetened beverages including juice, sports drinks, soda, energy drink, etc.	40 (4%)	411 (45%)	469 (51%)
Plot body mass index on a height/weight chart.	877 (95%)	27 (3%)	15 (2%)
Provide nutritional counseling to encourage healthy eating.	156 (17%)	594 (65%)	169 (18%)
Advocates with school officials or leaders to ensure school food services, including vending services and school stores, provide nutritious food selections.	703 (76%)	167 (18%)	49 (6%)
Collaborates with school officials, other health professionals, and parent groups to increase awareness of the importance of maintaining healthy vending choices in schools, and to encourage the promotion of beverages of high nutritional value.	697 (76%)	171 (19%)	51 (5%)
Refer overweight or obese pediatric patients to a Primary Care Provider (PCP) and/or registered dietitian nutritionist (RDN)".	701 (76%)	185 (20%)	33 (4%)

% = ratio of responses to total respondents and n = sample size.

## Barriers

The major barriers to educating patients about childhood obesity were limited time, cited by 63% of the respondents. Minor barriers included insufficient knowledge about the guidelines for prevention and management of childhood obesity (52%), lack of confidence in addressing obesity issue (51%), lack of training to counsel on healthy eating for weight management (45%), lack of patient acceptance from a dental professional (51%), and lack of knowledge about making the appropriate referral (53%).

Dental Hygienists in the BS group (69%) said finding enough time in their schedule was a major barrier, compared to 63% of MS and 59% of AS level DHs ( $X^2(4, 919)=10.80, p=.03, \Phi=.11$ ). One-quarter of the Master's level DHs did not feel that lack of confidence in addressing the obesity issue with patients was a barrier as compared to 10% of the BS group and 17% of the AS group. ( $X^2(4, 919)=19.48, p=.001, \Phi=.15$ ). Lack of training about counseling for healthy eating patterns for weight management, showed the largest difference between the MS group (26%) who were more likely not to see training as a barrier in contrast to only 13% of the BS

group. ( $X^2(4, 919)=12.37, p=.02, \Phi=.12$ ). In regards to lack of knowledge about making appropriate referrals, 22% of the MS group versus 12% of the BS group saw this as a barrier. ( $X^2(4, 919)=10.26, p=.04, \Phi=.11$ ).

Fear of offending a parent or patient was seen by 62% of the ELOEs as being a major barrier versus 38% of the COEs ( $X^2(4, 919)=25.80, p<.001, \Phi=.17$ ). Thirty-percent of the COE group viewed lack of training about counseling for healthy eating patterns for weight management a barrier as compared to 41% of the ELOEs ( $X^2(4, 919)=18.69, p<.001, \Phi=.14$ ). The COE group was less likely (29%) to see patient resistance to healthy eating advice as a major barrier as compared to 42% of the ELOEs ( $X^2(4, 919)=25.44, p<.001, \Phi=.17$ ). Only 28% of COEs thought lack of knowledge in making appropriate referrals for care was a major barrier as compared to 34% of the ELOEs. ( $X^2(4, 919)=24.12, p<.001, \Phi=.16$ ). The perceived barriers to educating about childhood obesity are illustrated in Table V.

### Attitude Associations

Associations between attitude and practice was examined using multiple regression with the anti-fat, self-efficacy, and patient belief scales predicting each of the practice scales are displayed in Table VI. Practice scales were created by combining all items related to nutrition counseling (counseling), collaboration with other professionals (collaboration), and collecting/plotting anthropometric data and conducting a factor analysis.

Anti-fat, self-efficacy and patient beliefs were all significant positive predictors of the frequency that DHs provide obesity related counseling in practice.

Anti-fat attitudes and self-efficacy scales were significant predictors of the frequency of collaboration and referral by hygienists. The model of attitude subscales predicting anthropometric frequency was not significant ( $p=.08$ ) however the self-efficacy scale was a significant predictor within the model ( $p=.03$ ). Overall, self-efficacy was the most robust predictor of practice frequency.

### Discussion

Childhood obesity prevalence is a major public health concern.<sup>1,3</sup> Risk factors such as Type 2 diabetes mellitus and cardiovascular disease, once considered adult-onset diseases, have increased dramatically among youth.<sup>40,41</sup> Many respondents reported understanding the risk factors for systemic diseases and the majority understood the role SSBs play in the high sugar content in the child's diet. However, only about half reported consistently counseling patients on SSB consumption, and just over half (65%) reported sometimes counseling patients on healthy eating. Nutrition counseling on healthy eating to reduce caries risk and improve overall health is supported by the policies of the major professional dental organizations including the AAPD, ADA, and AHDA as an area that should be addressed as part of the preventative dental appointment.<sup>9-11</sup>

Since there is conflicting information regarding obesity and dental caries<sup>16,19</sup> respondents were unsure of the relationship. Goodson et al and Mojarad et al. evaluated the association between childhood obesity and dental caries and concluded that although dental caries increases with sugar consumption, obesity may not be a primary cause of caries<sup>16,20</sup>, which may be the source of uncertainty in the respondents.

**Table V.** Barriers Assessment of Study Population (n=919)

Barrier Question Responses	Not a Barrier n (%)	Minor Barrier n (%)	Major Barrier n (%)
Little or no reimbursement for this service.	280 (31%)	238 (36%)	311 (33%)
Not enough time in daily schedule.	62 (7%)	274 (30%)	583 (63%)
Fear of offending parent or patient.	81 (9%)	406 (44%)	432 (47%)
Insufficient knowledge about guidelines for prevention and management of childhood obesity.	129 (14%)	476 (52%)	313 (34%)
Lack of confidence in addressing obesity issue.	143(15%)	468 (50%)	308 (35%)
Lack of training about counseling for healthy eating patterns for weight management.	163 (17%)	419(46%)	337 (37%)
Lack of patient acceptance of healthy eating advice from a dental professional.	104 (11%)	461 (50%)	354 (39%)
Lack of knowledge about making appropriate referral for further evaluation and/or care.	141 (15%)	493 (54%)	285 (31%)

% = ratio of responses to total respondents and n = sample size.

**Table VI.** Univariate Linear Regression of “Attitudes” Scales Predicting Practice Frequency

Variable	Counseling	Collaboration	Anthropometric
Anti-fat attitude	.09**	.09**	.02
Self-efficacy	.30**	.26**	.08*
Beliefs about patient knowledge	.07*	.01	-.02
R <sup>2</sup>	.11**	.09**	.004

All coefficients are standardized.

\*  $p < 0.05$ , \*\*  $p < .01$ . R<sup>2</sup> is the adjusted R<sup>2</sup>.

Study participants, particularly those who had engaged with obesity education in a continuing education format (COE), found it rewarding to discuss nutrition with patients and noted a personal desire to do so, but felt awkward discussing weight with someone who is overweight/obese. Participants in this study stated they would be uncomfortable discussing weight related issues unless the patient had an identifiable systemic/oral link, which was similar to the findings in previous studies.<sup>20, 28, 29</sup> Interestingly, a study by Tavares and Chomitz on healthy weight interventions in the dental office, found 95% caregivers of children felt the dental office is an appropriate place to get information on healthy eating and exercise, and 95% of caregivers felt the DH was a good person to discuss height and weight goals with the child and parent.<sup>42</sup> These findings suggest an inconsistency between DHs perceptions regarding the response of caregivers/parents/patients to education about obesity intervention in the dental setting and their actual response.<sup>29, 42</sup>

Findings in this study are similar to Kading et al. in that a little over half (58%) of DHs lack the confidence to provide obesity education for prevention and management.<sup>29</sup> Further investigation into the relationship between childhood obesity and caries may provide DHs with more confidence to discuss obesity, support healthy eating and provide referrals to PHPs for further evaluation when indicated.

Results from this study regarding attitudes and beliefs about obese patients were similar of Ip et al. findings in medical students.<sup>32</sup> Medical students the Ip et al. study had a mildly positive attitude (24.4) and DHs in this study had slightly positive attitude (4.15).<sup>32</sup> The anti-fat and self-efficacy subscales of the attitudes scale in this study, predicted the frequency of practice. Respondents with a more positive attitude about obese patients were more likely to provide counseling on a lower intake of SSBs, encourage healthy eating along with referral to a primary care provider, advocate/collaborate with schools to change policy, and refer to a PCP or RDN. This finding suggests the importance of further education at the graduate level or continuing education on obesity to dispel stereotypes and social

stigmas. Further education on obesity intervention and management may enhance practice behaviors to address obesity in the dental setting and encourage inter-professional collaboration to benefit the patient’s oral and overall health.

The barriers reported in this study were similar to those reported in the literature.<sup>28-31</sup> Barriers included time constraints, fear of offending the parent/child, and a lack of knowledge on the guidelines for management of childhood obesity to be successful.

Only about half of participants in this study reported having received nutrition education which was unexpected given it is required as part of the Commission on Dental Accreditation Standards for Dental Hygiene Education Programs.<sup>43</sup> Lack of obesity education in entry-level DH program curricula, may deter DHs’ ability to gain the knowledge needed to be confident in assessing and educating for childhood obesity. Multiple studies report that DHs feel their education in assessing and educating for childhood obesity is limited, and that fear of offending the parent/child is a major barrier for implementation.<sup>28-31, 44</sup> Results from this study suggest higher levels of self-efficacy were a predictor of practice behaviors. Education in entry-level programs as well as continuing education opportunities may influence self-efficacy so DHs will be confident in providing education without fear of offending the parent or child.

A limitation to this study was the participation rate from the ADHA mailing list. Efforts were made during analysis to correct for bias by weighting the data and compare early respondents vs. late respondents. In addition, self-report surveys are susceptible to report bias such as responding in a socially desirable way to questions about attitudes, beliefs, and current practices.

## Conclusion

Dental hygienists understand the increased risk factors with obesity and systemic health. While confident in providing nutritional counseling for caries prevention and management, only a little more than half address healthy eating and the intake of sugar-

sweetened beverages. Brief nutrition interventions along with referral to a health care provider by the dental hygienist, can assist overweight and obese patients in making incremental changes in weight management without the risk of offending the patient or parent. Contrary to the commonly held belief by dental hygienists regarding the openness of patients and caregivers to obesity education, research indicates that the vast majority of caregivers of children are open to nutritional education in the dental office setting.<sup>42</sup>

Basic nutritional counseling for a healthy lifestyle and obesity education needs to be incorporated into entry-level DH education and made available to practicing DHs to increase their knowledge and confidence in their role as members of interprofessional healthcare teams to manage the obesity epidemic.

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**Doreen Dawn M. Cole, RDH, MS** is a territory sales manager with Hoya Corp, Dallas, TX; **Linda D. Boyd, RDH, RD, EdD** is dean and professor, and **Lori J. Giblin-Scanlan, RDH, MS**, is an associate professor and associate dean of clinical sciences; all are at the Forsyth School of Dental Hygiene, MCPHS University, Boston, MA.

**Jared Vineyard, PhD** is a postdoctoral fellow in the Idaho Center for Health Research at Idaho State University, Meridian, ID.

Corresponding Author: Linda D. Boyd, RDH, RD, EdD; linda.boyd@mcphs.edu

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# RESEARCH

## Treatment of a Culturally Diverse Refugee Population: Dental hygiene students' perceptions and experiences

Bianca M. Capozzi RDH, MSDH; Lori J. Giblin-Scanlon, RDH, MS;  
Lori Rainchuso RDH, MS, DHSc

### Abstract

**Purpose:** Dental hygiene professionals need to be prepared as part of their entry level education process, to treat the wide range of culturally diverse patients they may encounter in the United States. The purpose of this qualitative study was to explore the perceptions and experiences of a cohort of senior dental hygiene students in regards to their preparedness to treat a culturally diverse patient.

**Methods:** A purposeful sample of second year dental hygiene students (n=18) participated in semi-structured group interviews before and after the treatment of a culturally diverse patient. Data was gathered and analyzed using a thematic analysis. Demographics were enumerated using frequency percentiles, means, and summary statistics.

**Results:** Prior to the dental hygiene care appointment, the participants reported feeling confident and prepared to treat culturally diverse patients. Following the dental hygiene care appointment, participants reported feeling that more education and an increased number of clinical experiences were needed with culturally diverse patients.

**Conclusion:** Exposing dental hygiene students to diverse patients in a clinical setting as part of the curriculum was an effective method towards building cultural preparedness.

**Keywords:** curriculum, dental hygiene education, cultural competency, cultural diversity, health disparities

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### Introduction

The United States (U.S.) is rapidly becoming one of the most racially and ethnically diverse nations in the world.<sup>1</sup> According to the most recent 2010 U.S. census, minority groups will make up 35% of the American population by the year 2020 and become the majority of the population by the year 2050.<sup>2</sup> Both the Institute of Medicine (IOM) and the Health and Human Services Action plan found persistent health care disparities between racial and ethnic minorities.<sup>3,4</sup> The U.S. health care workforce has responded by incorporating cross-cultural education and training focusing on attitudes, knowledge, and skills in order to develop cultural competence in health care workers.<sup>3,4</sup> Culturally Competent (CC) health care providers are described by the Office of Minority Health (OMH) as respectful and responsive to individual health beliefs, culture and language preferences.<sup>5</sup> In addition, future health care providers should be aware of cultural humility, defined as the capacity to identify their predispositions, as a component of lifelong engagement in self-assessment to improve patient and provider relationships.<sup>6</sup>

A review of current literature for CC among health care providers identified a Systematic Review (SR) by Clifford et al. for culturally competent education (CCE) and training interventions in health and medical curricula.<sup>7</sup> Inclusion criteria were articles published from 2006 to 2016, from Australia, Canada, New Zealand or the United States, and the focus of the review was to identify which strategies were effective for improving the cultural competence of university based health professional students in training.<sup>7</sup> A total of sixteen studies met the inclusion criteria, 5 of the 16 studies were among medical students, four studies with nursing students, three targeted health sciences, and two each psychology and pharmacy students.<sup>7</sup> The SR described three main types of education and training intervention strategies including integration of cultural competency into the curriculum, cultural immersion, and cultural awareness training.<sup>7</sup> Results yielded a number of clear recommendations for improving future CC evaluations, however, the quality of evidence was insufficient to provide a strong basis for recommending the inclusion of one specific CCE and training strategy for university based health professionals.<sup>7</sup>

Similar research conducted by professional education associations to identify information for effective teaching strategies to foster CCE in dental schools is lacking. Outcomes from a survey conducted by the American Dental Education Association (ADEA) in the United States, and Canada found most dental schools include CCE in the first year of dental school, and only a small number continue to integrate CCE through all 4 years.<sup>8</sup> The literature little direction concerning curriculum change or methodologies necessary to graduate CC dentists.

Dental hygiene (DH) literature is also elusive regarding the most effective methods for CCE despite the January 1, 2013 addition of standard 2-15 to the Dental Hygiene (DH) education standards stating that, "dental hygiene graduates must be competent in interpersonal and communication skills to effectively interact with diverse population groups and other members of the health care team."<sup>9</sup> Dental hygiene education includes didactic courses providing the theory to prepare students for clinical practice, however students must also be able to apply this theory in practice.<sup>10</sup> Ocegueda et al conducted a nationwide survey in 2016 to identify how CCE was being incorporated into the DH curriculum.<sup>11</sup> The 19-item questionnaire addressed the curriculum methods, evaluation measures, program goals and employment of CCE was distributed to dental hygiene program directors (n=334) in the U.S.<sup>11</sup> Of the 27% who responded, 91% reported they included CCE in the curriculum, and 72% included CCE in DH courses with goals, objectives and outcomes pertaining to cultural competency; lectures or seminars (83.1%) and community outreach (76.4%) were the most common educational methods.<sup>11</sup> Fifty four percent of programs had definite learning objectives pertaining to CCE in community programs, but only 42% of the programs evaluated students based on CCE outcomes.<sup>11</sup>

To gain an understanding of cross-cultural adaptability among DH's and DH students, several studies<sup>13-15</sup> have been conducted using the Cross-Cultural Adaptability Inventory (CCAI™) instrument.<sup>12</sup> The CCAI,™ is a fifty-item standardized instrument that measures four subscales of cross-cultural adaptability: emotional resilience, flexibility/openness, perceptual acuity, and personal autonomy.<sup>12</sup> Tavoc et al conducted a study among practicing DH's and DH students (n=278) in Texas to determine if there was a difference between the two populations concerning cross-cultural adaptability.<sup>13</sup> Using the CCAI,™ Tavoc et al found no statistically significant difference among the groups, though, the authors concluded that DH education may be lacking in cross-cultural adaptability.<sup>13</sup> DeWald and Solomon used the CCAI™ to see if there were any changes in DH students' cultural effectiveness by administering the test instrument at the following points in the curriculum: at orientation; at the end of the first year; and at the end of the second year.<sup>14</sup> DeWald and Solomon found no

significant improvement in cross-cultural effectiveness in their research outcomes.<sup>14</sup> Their outcomes were similar in a previous study conducted by Magee et al. who studied randomly selected, culturally diverse DH programs (n=15) and non-culturally diverse programs (n=101) across the US.<sup>15</sup> The CCAI™ outcomes found DH students (n=188) from both culturally diverse and non-culturally diverse programs possessed the qualities of personal autonomy and self-identity, necessary for cultural adaptability. However, the overall CCAI™ scores were lower than the norm for both groups.<sup>15</sup> The investigator's conclusions suggested further education was needed to improve communication skills, confidence, and critical thinking skills for the treatment of a culturally diverse patient.<sup>15</sup>

Outcomes of numerous studies<sup>7,8,11,13-15</sup> highlight the issues associated with the lack of guidelines for integration and evaluation of outcomes for CCE for health professionals. Although CCE is being integrated into health professions education, there is a lack of agreement regarding the most effective methods. Determining how to successfully integrate CCE in dental hygiene education is essential to satisfy the intent of CODA and to address the reality of oral health disparities. The purpose of this study was to explore how senior dental hygiene students' perceptions and experiences of cultural preparedness were influenced by treating a culturally diverse patient.

## Methods

The study was granted approved status by the Massachusetts College of Pharmacy and Health Sciences (MCPHS) University Institutional Review Board (IRB081815D). A qualitative phenomenological study design was used and a purposive sample of senior dental hygiene students. The phenomenological design was chosen to in order to build broader themes and generate a theory inter-connecting the themes using an inductive process.<sup>16</sup> Semi-structured focus groups were chosen to obtain a holistic perspective on ways to integrate CCE into the dental hygiene curriculum.

## Participants

Senior dental hygiene students (DHS) in their second semester of clinical instruction in the MCPHS Bachelor of Science program were invited participate in the study. An invitation to participate letter explaining the purpose of the voluntary study was distributed to the DHS. Students received the letter during a didactic course addressing cultural diversity while providing opportunities for enrichment rotations in community settings as part of the CODA Standard 2-8d (Figure 1).<sup>9</sup> Inclusion criteria required that participants be available for both focus groups and provide treatment for a culturally diverse refugee patient. Exclusion criteria included being unable to attend the two focus groups or having had previous experiences treating a culturally diverse patient from a refugee population. After receiving and signing the informed consent,

**Figure 1.** CODA Educational Program Curriculum Standard 2-8d9

**Dental hygiene science content must include the following:**

- Oral health education and preventive counseling
- Health promotion
- Patient management
- Clinical dental hygiene
- Provision of services for and management of patients with special needs
- Community dental/oral health
- Medical and dental emergencies,
- Legal and ethical aspects of dental hygiene practice
- Infection and hazard control management
- Provision of oral health care services to patients with bloodborne infectious diseases

participants were asked to respond to the following demographic questions: sex, age, race, education.

The patients came from a local community outreach program working with refugees entering the U.S. (Table II). The organization provides English language classes, General Educational Development (GED) classes, skills and resources needed to find employment as well as medical and dental care. As many of the refugees have had no previous access to dental services or coverage for the cost of care, the dental hygiene program has partnered with the local community program to provide preventative dental hygiene services. Many of the community sites

**Table I.** Student Participant Demographics (n=17)

Gender	n (%)
Female	16 (94.1%)
Male	1 (5.9%)
<b>Mean age (SD)</b>	21.24 (2.08)
<b>Median age (IQR)</b>	20 (20-21)
<b>Race, n (%)</b>	
Caucasian	11 (64.7%)
Hispanic	2 (11.8%)
Armenian	1 (5.9%)
Asian	1 (5.9%)
Latino	1 (5.9%)
Portuguese	1 (5.9%)
<b>Education level</b>	
High school	17 (100.0%)

do not have interpreters available thus requiring students to develop various methods and skills for communicating with the refugee patient population.

**Table II.** Patient Cultural Groups (n=17)

Culture of refugee patient	n (%)
Cambodian	1 (5.9%)
Cuban	2 (11.8%)
Dominican Republic	1 (5.9%)
Ethiopian	1 (5.9%)
Ghana	1 (5.9%)
Haitian	8 (47.1%)
Somalian	3 (17.6%)

**Instrument**

Semi-structured interview questions were piloted among a focus group of DHSs prior to this study and served as the primary instrument for data collection (Table III). The focus group sessions occurred at two different times based on student clinical schedules and took place before and after the treatment of a refugee patient. There were two separate focus groups each consisting of (n=9) DHSs. The Principal Investigator (PI) conducted the focus groups with the assistance of a note taker to write down the responses of the students. The note taker was also able to capture any information that was difficult to transcribe on the recording device, for example, students talking over each other, or at the same time. Non-verbal data was not collected during the focus groups. The data reached saturation during the second focus group, when no new insights or perspectives from the participants were captured in the responses.<sup>16</sup> To ensure credibility and transferability, the PI used a digital audio recording device, in addition to an independent note taker to transcribe the response data during the focus groups. Demographic statistics were calculated including frequency percentiles, means, and summary statistics. All statistical analyses were performed with data analysis software (STATA®, StataCorp LLC; version 11.2). Qualitative data was analyzed through thoughtful engagement of the transcripts, followed by assigning labels to understand the student’s perceptions of the experience. Student’s meanings of these experiences were implicit and a thematic analysis of the data was performed to fully understand the lived perceptions. Emergent themes were abstracted, and representative quotes were extracted for each collective theme.<sup>16</sup> The PI used peer debriefing<sup>17</sup> by having a colleague not associated with the research, explore and review the design process, data collection and analysis to ensure the information gathered was valid and to enhance the credibility of the research.

**Table III.** Focus Group Questions

Focus Group	Q1	Q2	Q3	Q4
<b>Before Care</b>	What does the term cultural competence mean to you?	How do clinicians prepare themselves to treat someone with a different cultural background?	Explain how your dental hygiene education thus far has either prepared you or not prepared you enough to treat culturally diverse patients?	What do you consider to be possible obstacles or barriers in the treatment of a culturally diverse patient or someone of a different culture than you?
<b>After Care</b>	Explain your ability to address the patient's needs?	What were the barriers you encountered during treatment?	What in your dental hygiene education has helped prepare you to treat a culturally diverse patient or someone of a different culture than your own?	What are your suggestions for how your dental hygiene education could have helped you be more prepared in the treatment of a culturally diverse patient?  a. Would this education be better received in a clinical or didactic setting?

## Results

Upon completion of the recruitment process, 18 dental hygiene students (DHSs) met the inclusion criteria (n=18). Participant demographics included that the majority were Caucasian (64.7%) females (94.1%), with a mean age of 21years and high school was the highest level of education completed (100%). One student participant was eliminated from the data interpretation due their inability to treat a patient. The majority (47.1%) of the refugee patients identified themselves as being Haitian (Table II). The four emergent themes and representative quotes and are shown in Table IV.

### Pre-treatment Questions/Responses

#### **Awareness of Other Cultures**

Prior to providing care for the patient, the most common theme reported for the meaning of being culturally competent, was having an awareness of other cultures, "Being culturally aware, not just of your own culture but those around you. We could be of the same race but our religious beliefs can be different." "Just being sensitive."

#### **Open-Minded and Non-Judgmental**

A majority of the participants reported that a clinician should prepare themselves to treat a culturally

diverse patient by remembering to be open-minded and non-judgmental throughout the visit. Most students concurred that it was going to be a challenging experience and shared, "Don't get frustrated, it's not going to be easy" and "Keep an open mind" and, "[Remember to] ... not get overwhelmed."

#### **Didactic Coursework and Extramural Experiences**

Didactic coursework and extramural experiences were the most comment themes regarding preparation. All of the participants reported feeling as though their didactic courses and extramural experiences in dental hygiene had prepared them to treat a culturally diverse patient. "Review the lectures from DHY classes...[this can be a main resource to utilize in order to make the appointment go more smoothly]." "I think classes prepared us very well [for treating this type of patient]." "Classes and extramural rotations are making me feel more comfortable." All the students agreed with this participant, "I think we all feel prepared to tackle the battle."

#### **Language and Culture**

Language and culture were equally reported as possible obstacles or barriers in the treatment of a culturally diverse patient. One participant stated, "Language will be a barrier...how do we get them to understand?" Another shared, "Male and female



**Table IV.** Themes and Representative Quotations

Themes	"Responses"
<b>Pre-Treatment</b>	
Awareness of Other Cultures	"Being culturally aware not just of your own culture but those around you."
Open-Minded and Non-Judgmental	"Keep an open mind" and, "[Remember to] ... not get overwhelmed."
Didactic Coursework and Extramural Experiences	"I think we all feel prepared to tackle the battle."
Language and Culture	"Language will be a barrier...how do we get them to understand?"
<b>Post-Treatment</b>	
Patient Needs Not Addressed	"My patient was from Iraq and never saw a dentist. We attempted to do a full mouth series on him, but he couldn't do it."
Underestimated Potential Barriers and Knowledge	"We over-anticipated how prepared we were."
Education	"We would learn more clinically [working] with these types of patients, not in classroom."
Clinical Experience with Diverse Cultures	"We need all the culturally diverse patients we can get now in school to be that more prepared in the real world."

roles in other cultures may be different and might be hard to get through." Many students expressed the importance of appointment preparation and the use of pictures, models and props throughout the visit in order to meet the challenges communication in a different language. One participant reported, "If you don't know how to explain [something that comes up in the process of care] you can pull up the model [or diagrams] and use them." Another student stated while others concurred, "Use more visuals or models such as the typodont, throughout the appointment... [to be communicative throughout the visit]." (this was just to help with communication)

**Post-treatment Responses**

***Unmet Patient Needs***

The most common theme identified regarding successful treatment was the students' inability to address their patients' needs. One participant said, "The patient started crying, I felt so bad." Another student reported, "My patient was from Iraq and

never saw a dentist. We attempted to do a full mouth series on him, but he couldn't do it." One participant felt it was successful but, "At the second appointment, the patient waited 20 minutes until someone else who spoke her language could explain the treatment plan to her...[I felt bad cause she couldn't understand]."

***Underestimated Potential Barriers and Knowledge***

Following the initiation of treatment, the most common theme was that the potential barriers and knowledge associated with cultural diversity to have successful treatment had been underestimated by the students. Participants agreed with one student who shared, "There was a knowledge barrier on my part throughout the entire visit." All participants expressed feeling that they did not have enough knowledge and education on cultural diversity to carry out a successful visit. "We didn't have enough prior knowledge of what we were going to see or what to expect [with this specific type of patient]." Most of the participants reported they went into the experience over confident in regards to their ability to treat a culturally diverse patient. All participants concurred, "We over-anticipated how prepared we were." Most agreed, "I felt less prepared after the experience... [because I didn't know how much the process of care is affected with this type of patient]." Everyone reported the clinical experience was a better learning experience than learning about culture in a didactic setting. The opportunity to apply and use critical thinking skills was valued by all the student participants, "...seeing certain things in clinic [such as cultural oral habits] with the ... diverse refugee patient helped me more than just [learning] it in class."

***Education***

The most common theme identified in regards to being better prepared was the need for more education to increase their cultural knowledge and more exposure to culturally diverse patients. All of the participants agreed that they would like, "... specific

lectures and classes on diverse cultures... [to better prepare them of what they are going to see in clinic]." The students recommended that having more didactic courses specifically focused on cultural diversity might increase their knowledge, "We need specific lectures to give us insight and views on specific cultures." Respondents also reported that they would gain more in clinical settings than inside the classroom, "We would learn more clinically with these types of patients, not in classroom." It was evident the students felt the opportunity to treat more culturally diverse patients was vital to successful patient care outcomes.

### **Clinical Experience with Diverse Cultures**

All participants reported that this enrichment clinical experience was valuable, and that they felt that by becoming more educated in diverse cultures they would increase their confidence and become better prepared to care for culturally diverse patient populations. All the students agreed with the statement, "[We] have gotten a lot stronger after this [clinical] experience." They felt that the treatment of a culturally diverse patient was a great learning experience and added to their clinical development, "I would be so nervous in the real world if I hadn't had this experience [in a school setting first]." Providing preventive care to a culturally diverse patient helped all the participants recognize the importance of cultural awareness and the need to become competent in caring for a person from a culture that is different from one's own. Participants commented on the diversity of the U.S. and how vital it was to become comfortable in treating various cultures. All DHSs agreed that "We really need to know how to work with patients of different cultures," and "We need all the culturally diverse patients we can get now in school to be that more prepared in the real world." Participants also agreed that it is important to be challenged while still in school and recognized the value in making mistakes in the school setting in order to successfully prepare for the future. One participant stated and most others agreed, "I now feel more accepting, more open-minded and more culturally competent from this experience." All participants agreed this was a valuable learning experience to have as dental hygiene student.

### **Discussion**

The purpose of this qualitative study was to explore the before and after perceptions and lived experiences of senior dental hygiene students after providing care for a culturally diverse patient from a refugee population. Guided by semi-structured questions in focus groups, students shared their knowledge, thoughts, feelings, and beliefs about treating a patient from a diverse culture. The questions encouraged DHSs to think critically about the meaning of cultural competence, their educational background and experiences with a culturally diverse patient. Before providing dental hygiene care, DHSs felt confident

that their previous coursework along with various learning resources had prepared them to treat a culturally diverse patient. Following the dental hygiene care appointment, the students were not confident in their ability to provide care because they were more aware of the obstacles and challenges that interfered with meeting patient needs. They realized the depth of education that is needed, as well as the value of experiential learning. These findings correspond to previous research using the CCAI™ suggesting that more education is needed to improve communication skills, confidence, and critical thinking skills for the treatment of a culturally diverse patient.<sup>12-15</sup> Although students were previously exposed to a curriculum accounting for patients with special needs, and had participated in community dental/oral health programs, once they were faced with the challenges presented by a patient from a different culture, they felt unprepared. However, students also felt their knowledge and abilities had increased after a single patient experience. Additionally, they felt the clinical immersion was a great learning experience, and actually supported their development in becoming more educated about different cultures. In contrast to previous research,<sup>7,8,11,13-15</sup> this study used a phenomenological design to capture the voices and lived experiences of the participants. Limitations of this qualitative study included the small sample from a single educational program. Also, the students were novice clinicians, and no translators were provided. The data consisted of self-reported versions of students' own lived perceptions and experiences on cultural preparedness and may create bias limiting the study findings. There is also the possibility that the students did not understand the questions being asked or felt emotionally influenced by others throughout the course of the focus group questions and responses.

### **Conclusion**

Dental hygiene education should include opportunities for students to apply what is learned in the classroom in a clinical setting. Exposing dental hygiene students to culturally diverse patients in a clinical setting can serve as an effective method for increasing cultural awareness and ultimately address oral health disparities. While this qualitative study makes a novel contribution to the literature, further research among larger groups, in multiple settings should be conducted to better understand how to improve and implement cultural education for future oral health care providers.

**Bianca M. Capozzi, RDH, MSDH** is a member of the adjunct faculty at the Forsyth School of Dental Hygiene; **Lori J. Giblin-Scanlon, RDH, MS** is an associate professor and associate dean of clinical sciences at the Forsyth School of Dental Hygiene; **Lori Rainchuso, RDH, DHSc** is an associate professor in the Doctor of Health Sciences Program; all at MCPHS University, Boston, MA

Corresponding author: Lori J. Giblin-Scanlon, RDH, MS;  
lori.giblin1@mcphs.edu

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## Effects of a Training Needle on Dental Hygiene Student Anxiety

Diana Aboytes, RDH, MS; Christina Calleros, RDH, MS

### Abstract

**Purpose:** The purpose of this pilot study was to assess whether practicing with a cotton-tipped applicator as compared to a new training device had an effect on the anxiety levels of dental hygiene students prior to administering and receiving their first intraoral injection for local anesthesia.

**Methods:** This pilot study used a convenience sample of senior dental hygiene students from an entry-level Bachelor degree dental hygiene program. Participants completed a pre-test survey after watching a video demonstrating the inferior alveolar nerve block (IANB) injection technique to determine anxiety levels regarding administering and receiving an intraoral injection. Test and control groups were randomly assigned; and participants either received a dental syringe with an attached training needle device (test) or a cotton tip applicator (control). Both groups completed a post-test survey following a 15 minute practice session. Descriptive statistics were performed and Chi-square tests were used to determine significance.

**Results:** Pre-test results showed that 91% of the participants (n=23) reported having anxiety regarding administering or receiving an intraoral injection in one or multiple areas. Chi-square tests determined no statistical significance ( $p = 0.125$ ) between the test and control groups in the post-test surveys.

**Conclusion:** Dental hygiene students demonstrated decreased anxiety levels regarding administering and receiving an intraoral injection regardless of the assigned practice device in this pilot study. While use of a training needle was not shown to be superior at reducing anxiety in novice student operators when compared to a cotton tipped applicator, it may be a useful device for teaching local anesthesia administration techniques.

**Keywords:** clinical education, dental hygiene students, local anesthesia, training devices

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### Introduction

The ability to effectively administer local anesthesia is an essential clinical skill required for pain management in dentistry. Extensive knowledge of head and neck anatomy including muscles, nerves, arteries and veins is required for developing this skill. Dentists and dental hygienists complete head and neck anatomy education during prerequisite coursework in addition to dedicated courses in the dental education curriculum.<sup>1,2</sup>

Anxiety is defined as a painful or overwhelming sense of apprehension and uneasiness of mind usually over an impending or anticipated event.<sup>3</sup> It has been noted extensively in the literature that both administering and receiving local anesthetic injections are sources of anxiety for dental students<sup>4,5</sup>, and can be attributed to a multitude of factors. In the pre-clinical training sessions, the administration of local anesthesia is introduced using a student-to-student

model.<sup>1,4</sup> Students as well as educators have reported mixed feelings regarding the ethical use of student peers as training models in addition to promoting anxiety among students.<sup>5,6</sup>

A possible source for this anxiety may be the student's heightened awareness of potential complications.<sup>6</sup> While administration of local anesthesia has a history of being safe and effective, it is not completely risk free.<sup>1,6-8</sup> Inability to see internal structures and the close proximity of critical nerves and blood vessels add to the legitimacy of anxiety experienced by those administering and receiving intraoral injections.<sup>6</sup> Complications associated with intraoral injections range from minor, such as soreness at the site of needle penetration, trismus, and hematomas; to more serious risks such as permanent paresthesia, and ophthalmic developments such as esotropia and diplopia.<sup>7-10</sup>



Research has shown that anxiety can also negatively impact academic performance.<sup>11,12</sup> Administration of local anesthesia for pain control in patient care is a critical component of both dental and dental hygiene curricula. Anxiety reduction measures may have a positive impact on student performance and require further exploration.

A newly patented training needle device (Safe-D-Needle;™ Brentwood, TN) is currently available for use by dental and dental hygiene educators.<sup>13</sup> This modified dental needle replicates a standard dental anesthetic needle but has a smooth spherical ball at the tip. This ball encapsulates the tip and bevel of the needle, allowing for non-invasive safe practice. Among the claimed benefits of this device is decreased student anxiety during the learning process for the administration of a local anesthetic.<sup>13</sup>

The purpose of this pilot study was to assess whether practicing with a cotton-tipped applicator as compared to a new training device had an effect dental hygiene students' anxiety levels prior to administering and receiving their first intraoral injection for local anesthesia.

## Methods

Study and approval was granted by the University of New Mexico's Human Research Protection Office (HRPO). A randomized descriptive design utilizing a convenience sample was used for this pilot study. Upon completion of the didactic portion of a local anesthesia course, senior dental hygiene students (n=24) from the baccalaureate degree dental hygiene program at the University of New Mexico were recruited to participate. Exclusion criteria was failing to pass the didactic portion of the course. All students successfully passed the didactic portion and were eligible to enroll in the

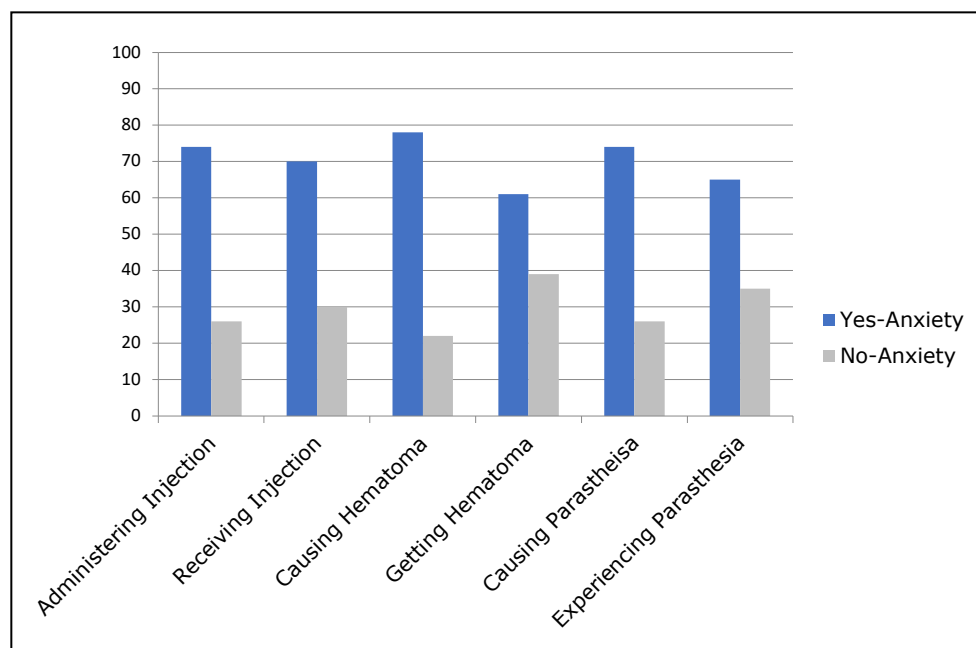
voluntary study. There was no penalty for non-participation however, incentive to participate was offered in the form of extra credit. Informed consent was obtained by all participants and they were assigned a study number for comparison of the pre- and post-test survey results. All participants began the study by watching a 9-minute instructional video on the inferior alveolar nerve block (IANB) injection.<sup>14</sup> The video demonstrated proper technique, including fulcrum establishment, correct site of penetration and proper angulation. Following the video, participants completed the anonymous pre-test survey consisting of six questions; responses were limited to yes or no. Survey questions were adopted and modified from three published research studies regarding student perceptions of local anesthesia.<sup>2,6,15</sup> Participants were asked questions regarding didactic course preparation and anxiety associated with administering or receiving intraoral local anesthesia injections. Anxiety in response to possible adverse outcomes was also explored.

Participants were randomly assigned to either the control group or the test group. The control group was given a cotton-tipped applicator to practice the technique for the administration of the IANB. A cotton tip applicator was chosen as students are encouraged to use an applicator to visualize and rehearse injections prior to using a dental anesthetic syringe and needle.<sup>7,16</sup> The test group was given a standard dental syringe with the training needle attached and asked to practice the same IANB technique (Figure 1). No further instruction was given after students were assigned to their respective groups. Both groups practiced with the assigned device for fifteen minutes. At the conclusion of the 15-minute practice session, participants completed a post-test survey assessing their anxiety levels associated with administering or receiving local anesthesia injections as well as regarding possible adverse outcomes. Survey results were exported to Microsoft Excel and descriptive statistics were analyzed for all questions.

**Figure 1.** Syringe with Training Needle and Cotton Tip Applicator

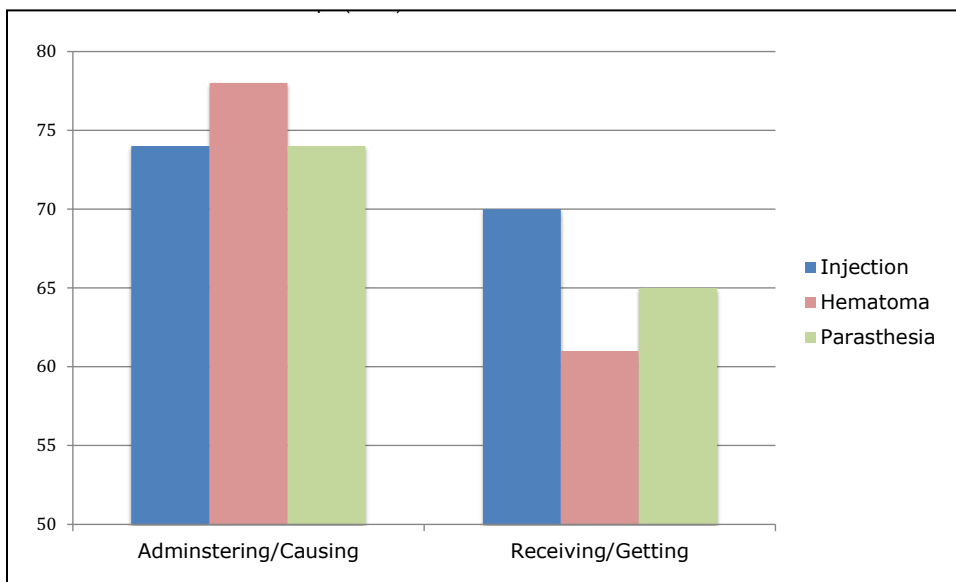


**Figure 2.** Pre-test Anxiety Responses in Combined Test and Control Groups (n-23)





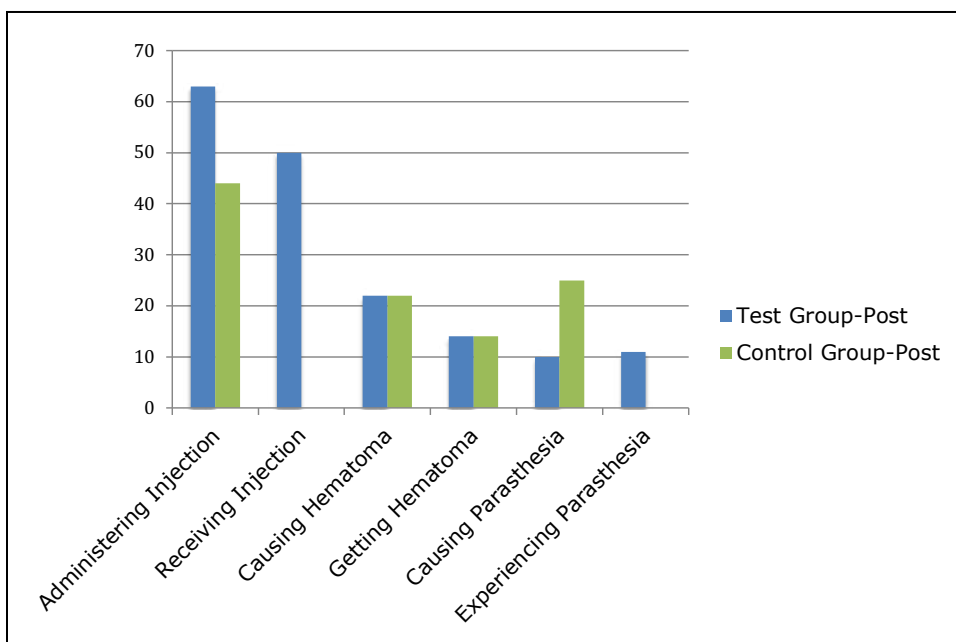
**Figure 3.** Pre-test Complication Concerns” Administration versus Receiving Combined Test and Control Groups (n=23)



didactic portion of the course. Subjects in both groups reported anxiety to both giving (74%) and receiving (70%) a local anesthesia injection. The majority of subjects also indicated they had anxiety about causing and receiving a hematoma and parasthesia. Combined control and test group responses to the pre-test are shown in Figure 2.

Pre-test responses from all participants indicated more anxiety regarding administering the injection versus being the recipient of the injection. Other identified areas of anxiety were causing a hematoma (78%) or causing parasthesia (78%). Trends in the differences in anxiety between causing a complication versus receiving one are illustrated in Figure 3.

**Figure 4.** Post-test Reductions in Anxiety



Pre-test and post-test questions were evaluated individually. When comparing pre- and post-test responses of participants indicating anxiety, the test group yielded a 63% decrease in anxiety toward administering anesthesia and a 50% decrease about receiving anesthesia from a classmate. Decreases in the test group were also reported in regards to both causing (22%) and receiving a hematoma (14%). Slight decreases were observed and in the test group in regards to causing or experiencing parasthesia.

Results of the control group yielded similar results. The control group produced a 44% decrease in anxiety about administering their first injection, but no decrease in anxiety was acknowledged regarding receiving an injection. Equal results between the groups were reported in regards to both causing and receiving a hematoma. No decreases were seen in anxiety in relationship to experiencing parasthesia; and a negligible decrease was reported regarding causing parasthesia. Anxiety levels in the post-test groups are shown in Figure 4.

Chi-square tests using a Yates correction were used to compare pre- and post-test results in addition comparing differences between the test and control groups.

## Results

Twenty-three subjects (n=23) participated in the study. Participant demographics were 22 female students and 1 male; ranging in age from 21 to 49 years with a median age of 27.3 years. Following randomization, the test group consisted of 12 participants and 11 in the control group.

Pre-test descriptive statistics revealed that all participants (n=23) prepared to begin the clinical aspect of the course following the

Chi-square tests were used to evaluate changes in anxiety among the test and control groups. No statistical significance was

found between the groups for any question except for “anxiety receiving your first local anesthesia injection.” ( $p = 0.036$ ). Because the small sample size could produce an approximation error, Yates Chi-squared correction for continuity was used resulting in  $p$ -value of 0.125, not statistically significant. The Chi square analysis with Yates correction for continuity is shown in Table I.

## Discussion

Anxiety can manifest itself physically resulting in a variety of signs and symptoms including dizziness, alterations in visual acuity and tremors or shaking of the extremities.<sup>17</sup> These particular physical effects can alter a student’s ability to safely administer an intraoral local anaesthetic.<sup>11,12</sup> For example, an unsteady hand or changes in visual acuity increase the possibility of inadvertent contact with other extraoral and intraoral structures contaminating the needle prior to penetration and/or resulting in soft tissue injury to non-target tissues.

Cognitive interference brought about by anxiety may result in missed steps or incorrect verbalization of the administration technique to instructors or clinical examiners.<sup>11</sup> The ability to verbalize the key steps in the administration process are critical to student performance and patient safety. For example, failure to properly aspirate may result in deposition of local anesthetic solution into the vascular system.

Decreased student anxiety levels can potentially benefit all individuals involved in the education and administration of local anesthesia. Lowering anxiety levels may help to counteract the physical manifestations of anxiousness by allowing for a steady hand, ensuring visual clarity and improving overall injection techniques; which can ultimately lead to improved academic performance. Improvements in overall performance outcomes may contribute to alleviating general concerns regarding the student-to-student teaching model.

In this pilot study, participants demonstrated decreased anxiety regarding administering intraoral local anesthesia injections which could ultimately contribute to improved academic performance. Producers of a training needle advocate that use of this device can decrease operator anxiety and provide unlimited practice opportunities, that contribute to enhanced competency and increased patient safety.<sup>13</sup> While there were no statistically significant differences in decreased anxiety between the test and control groups (training needle and cotton-tipped applicator); the use of some type of practice device can be beneficial in teaching the administration of local anesthesia.

Research with medical students has shown that how a student practices is just as valuable as the amount of time spent practicing.<sup>18</sup> Deliberate practice, a theory on skill acquisition and the attainment of expertise, is designed to maximize improvement and performance.<sup>18</sup> Essential aspects of deliberate practice states that focused, well defined tasks, coupled with repetitive practice, motivation, self-reflection, and feedback yields a level of expertise.<sup>18</sup> Students are taught to properly hold the dental syringe, establish a stable fulcrum, recognize the correct bevel orientation of the needle and identify the point of penetration. Performing these tasks with a training needle device attached directly to the dental syringe provides type of realistically focused, safe approach of deliberate practice. The attributes of the training device’s ball encapsulate needle, allows learners to practice techniques without the risk of inadvertently harming the patient and the novice clinician gains the opportunity to practice needle recapping techniques without the risk of injury.

A limitation of the study was the small sample size of 23 students. Therefore, the pilot study results cannot be generalized to all dental hygiene student populations learning to administer local anesthesia. Another limitation was that nearly all the subjects

**Table I.** Post-test Changes in Anxiety Levels Chi-squared analysis with Yates correction

Question	Chi Square	Degrees of freedom	$p$ value	Yates Chi-square	Yates $p$ value
Do you have anxiety about <i>administering</i> your first local anesthesia injection?	0.554	1	0.4566	.066	0.798
Do you have anxiety about <i>receiving</i> your first local anesthesia injection?	4.364	1	0.0367	2.347	.0125
Do you have anxiety about <i>causing</i> a hematoma?	0.000	1	1.000	0.032	0.571
Do you have anxiety about <i>getting</i> a hematoma?	0.000	1	1.000	0.583	0.445
Do you have anxiety about <i>causing</i> paresthesia?	0.562	1	0.454	0.013	0.909
Do you have anxiety about <i>getting</i> paresthesia?	0.714	1	0.398	0.045	0.832

were female. Research has shown differences in the attitudes of men versus women regarding the administering and receiving of local anesthesia, with female students reporting more anxiety than their male counterparts.<sup>19</sup> In addition, the survey questions were not validated prior to the study and participants could only self-report the mere presence or absence of anxiety and not describe the exact level of severity. At the time of this study, there were no reports in the literature for the use of the training needle. Future research should be performed on this device and the learning needs of dental hygiene for the administration of intraoral injections for local anesthesia.

## Conclusion

Dental hygiene students demonstrated decreased anxiety levels regarding administering and receiving an intraoral injection regardless of the assigned practice device in this pilot study. While use of a training needle was not shown to be superior at reducing anxiety in novice student operators when compared to a cotton tipped applicator, it may be a useful device for teaching local anesthesia administration techniques. Anxiety continues to remain a challenge for learning local anesthesia administration skills. Further research is needed to evaluate effective ways to decrease anxiety associated with this skill.

**Diana Aboytes, RDH, MS** is an assistant professor; **Christina Calleros, RDH, MS** is an assistant professor; both are in the Department of Dental Medicine, University of New Mexico, Albuquerque, NM.

Corresponding author: Diana Aboytes, RDH, MS; DAboytes@salud.unm.edu

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