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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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Inside this Issue

Guest Editorial

Research

Guest Editorial

Change is in the Wind: What research tells us about the future of dental hygiene

Hannah L. Maxey, PhD, MPH, RDH

Research points to a number of changes in healthcare delivery, education, and policy that are likely to shape the future of dental hygiene. Health system reform is changing the way "business" is being done in health care. Today's health reform programs are largely focused on improving patient care, reducing health care costs, and improving patient health.[1] This movement has initiated a cultural shift in health care delivery encouraging the adoption of comprehensive care that supports "total patient" health as opposed to the traditional model of treating diseases and organ systems.[1]

How might this impact dental hygiene? Oral health has historically been seen as the "role" of dental professionals and the dental care system, however over the last several decades it is increasingly being recognized part of "total patient" health and prioritized by non-dental health professionals leading to research into new practice models. [2-5]

New practice models integrating oral health as part of "total patient" care will have significant implications for the future of dental hygiene. Non-dental health care professionals are delivering oral health care services including oral health risk assessments and screenings, as well as providing preventive treatments such as fluoride varnish, as part of their scope of practice.[6-9] These practice models depend upon dental referral networks in order for patients to receive comprehensive oral health care services. As dental professionals with community health training, future dental hygienists will be well positioned to serve as liaisons between medical and dental offices; although, recent research points to an even broader future where dental hygiene professionals practice as part of integrated health care teams in diverse settings across the health system.

Interprofessional/multidisciplinary collaborative practice models are integrating dental hygienists into primary care and pediatric practices to extend more comprehensive oral health care for patients.[9-11] These practices are just the tipping point; the door is open for research into multidisciplinary practice models in diverse settings, including oncology and geriatrics. Health care delivery research points to a future where dental hygienists will have increasing opportunity to practice as co-therapists alongside a diverse array of medical colleagues.

Education is responding to health system transformation as well. The adoption of interprofessional health education is encouraging a "new" culture among health professional students, in which each profession plays an important role in supporting and promoting "total patient" health.[12-16] Today's dental hygiene students are being exposed to interprofessional education to prepare them for future opportunities. Recently an entire issue of the *Journal of Dental Education*, was dedicated to exploring the changing health care environment and outlining implications for the future of dental education through the "Advancing Dental Education in the 21st Century" project. A series of papers in the issue were specifically focused on dental hygiene.[17,18] In addition to the expansion of interprofessional education, a number of circular enhancements were recommended to prepare dental hygiene for the future including a recommendation to incorporate health policy into dental hygiene education programs.[17] The dental hygiene profession will need to identify champions, organize, and advocate for policies that advance oral health for their patients and communities in order to successfully navigate the changing landscape and realize new, expanded practice opportunities.

Coalition groups of dental hygiene professionals and oral health supporters must advocate for policies enabling dental hygienists to practice to the highest level of their education and skills to advance patient and population health in settings across the health system and the community. State practice acts are the policies defining and setting the parameters for the clinical practice of dental hygiene within the state and research demonstrates that policy influences health outcomes.[19-21] States with policies enabling dental hygienists to practice to the full extent of their scope of practice and those with the fewest restrictions, report greater oral health service utilization and better population oral health. Barriers in the form of restrictive state policies will need to be overcome for health care reform efforts and interprofessional/multidisciplinary practice to become the reality. States including Colorado, Wisconsin, Minnesota, and others have been successful in promoting interprofessional/multidisciplinary practice and can serve as case studies or examples to follow. Dental hygiene must identify champions from within their ranks, nationally and

within states, to carry the torch for policy changes that advance dental hygiene and oral health.

So, what does research tell us about the future of dental hygiene? Change is in the air! Dental hygiene is well positioned to be a relevant part of health system transformation. Our dental hygiene education programs are adapting to prepare our future colleagues for new roles and health care environments. We, as a profession, need to step out of our comfort zones (our favorite dental operatory!) and advocate for the policies that will enable the collective "us" to achieve this future.

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Research

Interest in Dental Hygiene Therapy: a study of dental hygienists in Maine

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Abstract

Purpose: The purpose of this study was to assess the awareness of registered dental hygienists (RDHs), licensed in the state of Maine, regarding the midlevel dental hygiene therapist (DHT) provider model and to gather data regarding the degree of interest in enrolling in a DHT program.

Methods: A quantitative cross-sectional study design with a non-probability purposive sampling of actively practicing RDHs in the state of Maine (n=1,284) was utilized for the web-based survey. Survey questions included awareness in the passage of DHT legislation, level of interest pursuing education and licensure in this midlevel provider model. Data was collected over a three-week period. Descriptive statistics and thematic analysis were used for data analysis.

Results: Response rate was 21% (n=268). Sixty-five percent of respondents expressed interest in enrolling in a DHT program and 40% of those respondents stated a willingness to enroll in a DHT program within the coming year. Although willing to travel 25-50 miles, a majority of respondents preferred programs incorporating online components combined with clinical training completed in nearby communities. Themes emerging from the open-ended question regarding DHT program feasibility and appeal included: convenience, flexibility, cost/affordability, and independent or collaborative practice.

Conclusion: Study outcomes indicated interest exists among Maine RDHs regarding the DHT provider role and enrollment in a DHT program. Although there are no DHT programs currently being offered in the New England states, results suggest further investigation is warranted regarding the development of a DHT program in the Northeastern United States.

Keywords: dental hygiene, dental therapist, dental hygiene therapy, access to care, underserved populations

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Introduction

Global access to dental care continues to be a challenge due to the lack of availability and disproportionate distribution of dentists.[1-5] An estimated 47 million residents in the United States (U.S.) are currently living in Dental Health Professional Shortage Areas (D-HPSAs).[1-5] Despite dental caries being a preventable disease, 18% of children aged 5-19 years, 27% of adults aged 20-44 years, and 19% over age 65 in the U.S. were found to have untreated dental caries between the years of 2011-12.[6] Disparities related to untreated dental caries increased in those aged 65 and over to 41% in Black or African Americans, and 48% in Mexican Americans.[6] Health disparities have also resulted in Hispanic adults lacking the most in accessing dental care, with 40% of those living below the poverty level having untreated dental caries.[6] Current dental workforce models are not meeting the needs of all Americans as demonstrated by these statistics.

PEW Charitable Trusts (PEWCT) reports from 2014, identified dentist shortages in the state of Maine, with an estimated 180,000 residents unable to access oral health care due to a lack of dentists in 15 out of 16 counties.[7] Most of the state, with the exception of the major metropolitan areas of Portland, Augusta, and Bangor, has been designated as Dental Health Professional Shortage Areas (D-HPSAs).[8] Concerns regarding an insufficient dental workforce in Maine dates back to 2010–11, when the state's dental licensing board reported 92 dentists had either withdrawn or not renewed their expired licenses.[7] While 96 new dental licenses were

issued during that period, the resulting gain of 4 dentists was insufficient to meet the needs of the state's residents.[7] In 2013, Maine was ranked among the top 12 states having greater than 15% of its residents living in underserved areas due to dental workforce shortages,[7] and was ranked 6th in the nation in regards to the percentage of low income children (62.4%) who did not receive dental care in 2011.[7]

Alternative dental workforce models to meet the oral health needs of their respective populations have been developed internationally to address dental workforce shortages, similar to those found in rural areas in the U.S.[1] New Zealand was one of the first countries to develop an alternative workforce model with the introduction of the dental nurse in 1921. The New Zealand dental nurse was created as a response to a dentist shortage and poor oral health; a public health issue that led to high rejection rates for military recruits during World War I.[1,2] The first school for dental nurses was two academic years in length and focused on preventive and restorative care delivered primarily in school-based settings for children up to age 12.[1,2]

Approximately 30 developed and developing countries including the United Kingdom, Australia, Canada, Nigeria, Italy, and Costa Rica began to use dental nurses by the 1970's.[9] Dental nurses were referred to as a dental therapists (DT) during the 1980's and since then, DTs have provided oral care in over 54 countries.[2,3] In some countries, the DT scope of practice requires that the care to be limited to children, however, others allow DTs with additional training to also care for adults.[3] New Zealand and Australia, DTs are dually trained as dental hygienists.[3] The scope of practice for DTs in most countries includes: preventive services, preparation and placement of amalgam and composite restorations, stainless steel crowns, pulpotomies, and scaling.[3] Some countries limit dental care to atraumatic restorative treatment (ART), a minimally invasive care approach that does not require drilling or anesthesia and simple extractions.[2, 10] Supervision for the dental therapist varies from practicing independently with a collaborative relationship with a dentist, to direct supervision by a dentist.[3]

The history of midlevel dental providers in the U.S. dates back to 1949, when the Forsyth Dental Infirmary in Boston, Massachusetts obtained permission from the state legislature to conduct a five year research project to train dental hygienists to prepare and fill simple cavities.[11] However, the law was repealed the following year due to objections from the dental profession.[11] Another attempt was made in 1972 at the Forsyth Center with a grant funded experimental program to teach dental hygienists to administer local anesthesia, and to prepare and place dental restorations.[12] The project was discontinued after two years due to legal action from the Massachusetts Attorney General and pressure from the state board of dental examiners.[3, 13]

Midlevel dental providers did not emerge again in the U.S. until 2003, when the urgent need to respond to the oral health needs of underserved native Alaskans was identified. Native American Alaskans were sent to New Zealand by their Tribal Health Consortium for training in culturally competent, emergent, and restorative care.[3] Care from the Alaska Dental Health Aid Therapists (DHATs) is limited to members of Alaskan tribal communities. The two-year training program was initially established at the University of Washington and is currently affiliated with Iḷisaġvik College, an Alaskan Tribal college and offers a certificate and an associate degree in Dental Health Therapy.[3,14]

Following initial education, DHATs complete a preceptorship under the direct supervision of a dentist.[15] Certified DHATs are able to practice under general supervision with the supervising dentist visiting the treatment sites to monitor the standard of preventive, basic restorative, and urgent care provided by DHATs.[15] Re-certification and 24 hours of continuing education are required of the DHAT biannually along with continual evaluation of competency.[15]

While the midlevel provider title varies, the scope of practice for Minnesota's advanced dental therapist (ADT), Maine's dental hygiene therapist (DHT) and Vermont's dental therapist (DT) allows for restorative care procedures similar to Alaska's DHAT.[3,4,16,17] However, differences exist in the level of education required, practice requirements and type of supervision, depending on the legislation enacted within each state.[3,4,16,17]

In 2009, Minnesota passed legislation to enable two types of dental therapists: a DT educated at the bachelor level and working under the direct supervision of a dentist, and an ADT initially educated as a dental hygienist and completion of dental therapy at the master's degree level.[3] The DT bachelor's degree program was discontinued in 2016; currently only the dual degree, masters level ADT program is available at the University of Minnesota School of Dentistry in Minneapolis, and at Metropolitan State University in St. Paul.[4] ADTs in Minnesota practice under general supervision, in accordance with a collaborative agreement with a dentist specifying the treatment settings, the populations being served, the scope of practice and allowable procedures, case selection criteria, assessment procedures and imaging protocols.[3] ADTs also work with low-income, uninsured, and underserved patients, or in dental health professional shortage areas.[3]

Maine has developed several alternative dental provider models, including the independent practice dental hygienist (IPDH), a specially qualified licensed dental hygienist.[18] IPDHs can deliver preventive dental hygiene treatment without a dentist's supervision, however, licensure is provided only to those who have completed 2,000 hours of clinical practice under the supervision of a dentist.[18] A written practice agreement with a dentist is also required for the IPDH to expose radiographs on patients.[18]

Licensed dental hygienists can also be given public health supervision (PHS) status authorizing practice in a public health setting.[18] Dental hygienists with PHS status, may provide preventive care to patients in public health clinics, provided there is a written supervision agreement from a dentist and approval for the planned treatment.[18] A third provider, the expanded function dental assistant (EFDA) performs duties under the direct supervision of a dentist including taking impressions, cementing crowns, coronal polishing, fitting orthodontic brackets, and placing pit and fissure sealants.[18] Although these providers are licensed to provide a range of services to patients in Maine, direct supervision by a dentist is required.[18]

Maine passed legislation (LD1230) DHT in 2014 establishing a midlevel oral health care provider, the Dental Hygiene Therapist (DHT).[16] DHT must hold a bachelor's degree in dental hygiene and complete an additional 4 semesters of training from a Commission on Dental Accreditation (CODA) accredited dental therapy program.[16] Unlike Minnesota's ADT, Maine's DHT must work under the direct supervision of a dentist and DHTs may not provide restorative care independently.[16]

Vermont passed legislation (S. 20) enabling dental therapists (DT) to practice in their state in 2016.[17] The Vermont DT, after completing 1000 hours of patient care under direct supervision, would be able to deliver care independently, while under a collaborative agreement with a dentist.[17] Vermont's DT is dental hygiene-based, DTs must hold a license to practice in the state and complete their DT training from a CODA accredited program.[17]

Legislation enabling dental health aide therapists (DHATs) to provide care to underserved residents and members of tribal lands and organization was passed by Washington state's House of Representatives and Senate in 2017.[19] DHAT providers are required to complete a two- year training program, as well as a 400-hour preceptorship with a supervising dentist, prior to becoming licensed providers.[20]

A number of states have legislation pending for midlevel dental providers including: Connecticut, Kansas, Massachusetts, Michigan, North Dakota, and Ohio.[21,22] In spite of the increasing number of states enacting legislation, little is known about the knowledge or interest of registered dental hygienists (RDHs) in enrolling in a dental therapy program, most specifically those licensed in the state of Maine. While legislators and oral health advocates were successful in creating the DHT license category, no academic programs for dental therapy exist in Maine or in New England. Maine state legislators and supporters of LD1230 requested assistance in producing evidence of RDHs interest to justify the launch of a dental therapy program in Maine, or regional program in New England. The purpose of this study was to assess the awareness of RDHs in the state of Maine, regarding the DHT provider model and to gather data regarding the degree of interest in enrolling in a DHT program.

Methods

A quantitative cross-sectional design, using a non-probability purposive sample of registered dental hygienists (RDHs) licensed in Maine was utilized for the study. Exempt status was granted for the study by the MCPHS University Institutional Review Board (IRB102815S).

The survey instrument consisted of nineteen items including the following categories: demographic (8 items), preferred program characteristics (5 items), interest in pursuing DHT (5 items), and additional comments (1 item). Item formats included: Likert-type scale, multiple choice, and open-ended questions. The survey questions asked Maine RDHs if they were aware of the passage of their state's legislation (LD1230) and assessed the level of interest in becoming a DHT. Survey questions also examined various aspects of a DHT program feasibility such as: online vs. face-to-face courses, part-time or full-time enrollment, and manageable travel distances for didactic classes or pre-clinical lab courses. A panel of five dental and dental hygiene experts reviewed the survey and pilot tested it for readability and clarity.

Inclusion criteria were RDHs in Maine holding active licenses. A list of Maine RDHs (n=1,284) with e-mail contact information was obtained from the Maine Dental Hygienists' Association. All RDHs on the e-mail list were invited to participate with a link to the survey provided in the e-mail invitation. Web-based survey software (Qualtrics®) was used to secure informed consent and to collect data over a three-week period in November 2015. After the initial email request to participate, a reminder email was sent 2 weeks later.

Descriptive statistics were used to report the respondents' demographic data, practice history, and responses to survey questions regarding preferred DHT program characteristics. A thematic analysis was performed on the data collected from the open-ended questions; common words and phrases were identified in the responses and codes created.[22] The codes were used to form a list of themes and direct quotes gathered to illustrate the dimensions of each theme.[22]

Results

The survey response rate was 21% (n=268). Ninety-eight percent of the Maine RDHs respondents were female, and the majority of the participants were Caucasian (88%). Respondent demographics and characteristics are shown in Table I. Eighty seven percent (n=232) were aware of the legislation creating the DHT midlevel provider in Maine.

Sixty-five percent of respondents expressed interest in enrolling in a DHT program with 40% indicating a willingness to enroll in a DHT program within the coming year (Table II). A majority of respondents preferred enrolling in a program on a part-time basis (51.8%), with 47.4% strongly agreeing that online delivery of lecture or didactic content was preferable to provide flexibility. Approximately 45% of the respondents were willing to travel up to 50 miles one way for preclinical courses, as well as the clinical practice portion of a dental therapy program. Respondents from each county in Maine expressed interest in practicing as a DHT in their county of residence. The most populous counties in Maine were the predominant locations chosen by respondents as counties where they would choose to practice, i.e., Cumberland (15.3%), Penobscot (8.2%), and York (6.3%).

Table I. Participant Demographics (n=268)

Variable	Frequency (%)
Age*	
20-24	7 (2.6%)
25-34	62 (23.1%)
35-44	56 (20.9%)
45-54	54 (20.1%)
55-64	53 (19.8%)
65-74	5 (1.9%)
* n= 31 (11.6%) of the participants did not report their age	
Gender	
Male	6 (2.2%)
Female	262 (97.8%)
Race/Ethnicity*	
African American	1 (.4%)
Caucasian	237 (88.4%)
Hispanic	3 (1.2%)
Native American	3 (1.2%)
Two or More Races	3 (1.2%)
* n= 21 (7.8%) of the participants did not report their race/ethnicity	
Year of Graduation from DH Program*	
1970-1979	36 (13.4%)
1980-1989	37 (13.8%)
1990-1999	53 (19.8%)
2000-2009	66 (24.6%)
2010-2016	35 (13.1%)
* n=41(15.3%) of the participants did not report their year of graduation	
Highest Education Level*	
Associate Degree	139 (51.9%)
Bachelor's Degree	85 (31.7%)
Master's Degree	14 (5.2%)
Other	10 (3.7%)
*n=20 (7.5%) of the participants did not report their highest education level	

Variable	Frequency (%)
Years of Dental Hygiene Practice*	
0-5	46 (17.1%)
6-10	41 (15.3%)
11-15	31 (11.6%)
16-20	29 (10.8%)
21-25	26 (9.7%)
26-30	22 (8.2%)
30+	47 (17.5%)
* n=26 (9.7%) of the participants did not report their highest education level	
States Where You Actively Practice as RDH	
Maine	249 (92.9%)
Massachusetts	3 (1.1%)
New Hampshire	4 (1.5%)
Vermont	0
2 New England States	8 (3.0%)
Other	4 (1.5%)
States Where You Are Currently Licensed as an RDH	
Maine	196 (73.2%)
Massachusetts	3 (1.1%)
New Hampshire	22 (8.2%)
Multiple New England States	43(16.0%)
Other	4 (1.5%)
Were You Aware of Passing of DHT Legislation?	
Maine	231 (86.19%)
Massachusetts	37 (13.81%)

Major themes identified from the open-ended questions regarding DHT program feasibility and appeal included: convenience, flexibility, cost/affordability, and independent or collaborative practice.

Convenience

Respondents reported convenience of the DHT program was a key factor in pursuing a DHT program. Sample quotes illustrating this theme include:

"The more convenient the better. I would need to work 2 days a week and I have children, so convenience is key."

"Being able to still work while in school."

"Minimal travel and time away from work and family."

"As much online as possible and clinicals all over the state."

"Having a variety of locations available for any internships. Only having to attend classes 1 or 2 days a week."

Flexibility

Flexibility was also a central component in making a DHT program feasible and appealing. Responses relating to this theme include:

"Flexible scheduling. Online classes. Weekend classes."

"Anything that is flexible, distance learning, close to home is much more appealing for me!"

"The more flexible the program the better. Lots of online courses would be a huge plus."

Table II. DHT Program Preferences (n=268)

Variable	Frequency (%)
Are You Interested in Enrolling in a DHT Program?	
Yes	175 (65.3%)
No	91 (34.0%)
Unsure	2 (.07%)
When Would You Be Interested in Starting a Program? *	
Summer 2016	45 (16.8%)
Fall 2016	62 (23.1%)
Spring 2017	5 (1.9%)
Summer 2017	4 (1.5%)
Fall 2017	19 (7.0%)
Spring 2018	2 (.07%)
Summer 2018	2 (.07%)
Other	22 (8.2%)
* n=107 (40.0%) of participants did not respond to the question	
Do You Prefer a Full or Part-Time Program*	
Full-time *(9+ credits/semester)*	25 (9.2%)
Part-time *(6-8 credits/semester)*	136 (51.8%)
* 40% (n=107) of participants did not respond to the question	
How Many Days Do You Anticipate Needing to Work While Enrolled? *	
0 days/week	10 (3.7%)
1-2	27 (10%)
3-4 days/week	114(42.5%)
5 days/week	7 (2.6%)
* 41% (n=110) of participants did not respond to the question	
Would online lecture courses be acceptable to provide flexibility? *	
Strongly Agree	127 (47.4%)
Agree	26 (9.7%)
Neither Agree or Disagree	6 (2.2%)
Disagree	1 (0.03%)
Strongly Disagree	1 (0.03 %)
* 40% (n=108) of participants did not respond to the question	

Variable	Frequency (%)
For preclinical courses, how far would you be willing to travel for a period of 1-2 semesters approximately 2 times weekends per month? *	
<25 miles	40 (15%)
25-50 miles	80 (29.8%)
50-75 miles	30 (11.1%)
75+ miles	11 (4.1%)
* 40% (n=107) of participants did not respond to the question	
In the clinical phase of the program, how far would you be willing to travel one way for clinical practice experience? Check the furthest distance you would be willing to travel a minimum of 2 days/week in this final year of the program.*	
<25 miles	32 (12%)
25-50 miles	99 (37%)
50-75 miles	22 (8.1%)
75+ miles	7 (2.6%)
* 40% (n=108) of participants did not respond to the question	
If working as a licensed DHT, where would you choose to practice in Maine? (County)*	
Androscoggin	7 (2.6%)
Arrostook	8 (3.0%)
Cumberland	41 (15.3%)
Franklin	2 (0.07%)
Hancock	5 (1.9%)
Kennebec	10 (3.7%)
Knox	4 (1.5%)
Lincoln	2 (0.07%)
Oxford	9 (3.3%)
Penobscot	22 (8.2%)
Piscataquis	7 (2.6%)
Sagadohoc	4 (1.5%)
Somerset	4 (1.5%)
Waldo	3 (1.1%)
Washington	5 (1.9%)
York	17 (6.3%)
* 44% (n=118) of participants did not respond to the question	

Cost and Affordability

A significant feasibility issue raised was cost and affordability, in addition to the need for the state to provide loan forgiveness for DHTs working with vulnerable and underserved populations. Examples of these comments include:

> *"Cost is a huge factor."*
>
> *"A loan forgiveness program, scholar-ship, or a student aid program."*
>
> *"For the benefit of the state of Maine I feel there would need to be some sort of reimbursement for a skillful practitioner...It appears to me that the state is forgiving loans to many recently graduated dental students and not getting longevity from them. Dental therapists trained in the state of Maine and current residents in the state of Maine are more likely to stay long term and finally get the benefit of consistency for patients."*

Level of Practice Supervision

Several respondents were IPDH (Independent Practice Dental Hygienist) providers and recommended the DHT should be able to work independently from a dentist. In Maine, the IPDH can perform many procedures within their scope of practice, but without general supervision by a dentist.[19] Sample quotes related to this theme include:

> *"I'm an independent hygienist and currently operate my own practice. I would need to be able to practice as a DHT back in my own practice."*
>
> *"DHT needs to be independent of the dentist to be successful. The intent of a DHT was to help the underserved."*

Discussion

Survey results indicated significant interest exists among Maine dental hygienists in pursuing a dental therapy education program. DHT Program curriculum design should take into consideration the stated needs of the potential participants: flexibility, convenience, and affordability. Advances in delivery of synchronous and asynchronous content with distance education increase the feasibility for delivering didactic content through an online format. Programs in advanced practice nursing often use online learning in addition to clinical practice sites to meet students' learning needs. Dental therapy programs can adopt this model to provide access to potential students living in rural areas, and those needing the flexibility to work while continuing their education.

Although respondents were willing to travel for some aspects of the program, limiting required travel was consistently reported to be of high importance to RDHs in Maine. Those interested in enrolling in a DHT program also indicated preference for having clinical sites nearby, with this finding consistent of the need to keep these future providers in the communities where they will practice. Given dental therapy legislation has passed in Maine and Vermont, and nearly passed in Massachusetts in 2016, a regional dental therapy program consistent with the CODA Standards for Dental Therapy Programs may be a good way to meet the needs of potential midlevel dental providers in the New England states.

Cost was another finding reported to be a factor in pursuing a DHT education program. This is consistent with previous findings of financial concerns being a barrier to entry and completion of graduate dental hygiene education.[25,26] Respondents suggested Maine provide loan forgiveness opportunities for DHTs practicing in Dental HPSAs and/or with underserved populations. Minnesota has loan forgiveness program specifically designated for ADTs working in rural areas for a minimum of 3 years.[27] Maine currently has opportunities for loan repayment for primary care physicians, dentists, and veterinarians, and this program could be extended to the DHT.[28]

The dental therapy model adopted by the Maine legislature requires the DHT to practice under direct supervision from a dentist thus limiting the provision of care in D-HPSAs.[16] The identified shortage of dentists and dental practices in D-HPSAs provides a rationale for allowing for DHTs to provide dental care independently to D-HPSAs residents.[4] Evidence for dental therapists to practice independently has already been demonstrated. Minnesota's DT model, developed to practice under the supervision of a dentist, was recently discontinued while ADT training and licensure continues with outcomes assessments demonstrating the ADTs' versatility in providing quality care and expanding services to underserved populations.[14]

Limitations of this study include the cross-sectional research design, non-probability sampling technique, and low response rate, preventing generalization of the results to states outside of Maine. Another limitation was the lack of questions regarding respondents' knowledge of the DHT's scope of practice, which may have influenced the level of interest in entering a DHT program. Since 13% of the participants were unaware that DHT legislation had been enacted in Maine, they may also have not be aware that there are no DHTs practicing in Maine, and that the timeline for DHTs to begin practicing in Maine is unknown.

Conclusion

Although most of respondents expressed interest in practicing as DHTs populous areas where there are higher numbers of practicing dentists, workforce shortages continue to be reported in many areas within these more populated counties. The documented quality of care delivered by dental therapy providers in other states, along with dental therapists' ability to access underserved populations, suggests DHTs in Maine could successfully meet the needs of the state's D-HPSA residents. Results of this study indicate interest exists among Maine RDHs regarding the DHT provider role and subsequent enrollment in a DHT program. Future studies should expand inquiries regarding the dental therapist's scope of practice and provide participants with more background information regarding the unique aspects of the state's model for a better understanding of their level of interest in entering a dental therapy program. Although there are no DHT programs currently being offered in the New England states, results suggest further investigation is warranted regarding the development of a DHT program located in the Northeastern United States.

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Research

Food Security and Unmet Dental Care Needs in Adults in the United States

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Abstract

Purpose: Low food security is potentially related to poor dental health and unmet dental care needs. Food security has become a significant public health concern in the United States (U.S.) since the Great Recession beginning in 2007. The purpose of this study is to determine the association between low food security and unmet dental care need in adults in the U.S.

Methods: A cross-sectional design with data from the National Health and Nutrition Examination Survey (NHANES) 2011-2012 was used for the study to measure unmet dental care need. The study population included 4,845 adults, ages 20 years and above. Chi square tests and logistic regressions were conducted for the statistical analysis.

Results: Overall, 47% of participants had unmet dental care need and 16% were found to have low food security. A higher percentage of adults with low food security had unmet dental care need (70.0% vs. 41.0%; $p < .000$) as compared to adults with full food security. In adjusted analysis, adults with low food security were more likely to have unmet dental care need as compared to participants with full food security (Adjusted Odds Ratio, 1.58 [95% CI: 1.18, 2.12; $p < .01$]).

Conclusions: A significant association between low food security and unmet dental care need was identified among adults in the United States. Dental professionals routinely provide community educational programs and regularly query patients about food intake due to its impact on oral and overall health. It is important for dental professionals to be able to discuss community food resource options or refer patients to social service providers to assist individuals with low food security.

Keywords: NHANES, National Health and Nutrition Examination Survey, food insecurity, dental care, unmet dental need

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Introduction

The United States (U.S.) and Canada experienced sharp increases in the numbers of people reporting inadequate food beginning in the 1980's likely related to changes in the work-force, the nature of work and the compensation workers received.[1] The number of food banks also increased during that time period to meet the food needs of the population.[1] The term "food insecurity," defined as "limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways,"[2] was first introduced in 1990 and remains a significant social and public health concern today.[3] Although food insecurity has been an issue for generations of people, there has been an increase in food insecurity in the U.S. beginning with the Great Recession of 2007 - 2009.[4] The concept of a food desert (an area of 500 people, or a census tract where 1/3 of the residents must travel more than one mile to a supermarket/large grocery store; or a rural area where the residents must travel more than ten miles to a supermarket/large grocery store) was introduced during this period and continues to be used to describe many geographic areas in the U.S.[8] Difficulty in food access often involves individual's settling for the foods that are available closer to one's home. Such options are often highly refined, calorie-laden, low-nutrient, less expensive foods with a long shelf-life. Lack of proper nutrition impacts health in many ways and there is the potential for food insecurity to be related not only to poor general health, but also to poor oral health.

One of the proposed mechanisms for the relationship between food insecurity and poor dental health is that a high carbohydrate load, particularly of highly refined carbohydrates, provides an oral environment conducive to the development of biofilms containing cariogenic bacteria.[9-10] It has been reported in the literature that children living in households with food insecurity were more likely to have untreated dental caries;[11-12] however, it is unknown if such an association exists *in adults*. In order to study the impact of food insecurity on unmet dental need in the adult population, the Andersen Behavioral Model of Health Services Usage was utilized.[13] This instrument provides a conceptual framework for studying vulnerable populations and health disparities. Under the Andersen model, increased service use or need for such use is determined by a number of factors broadly categorized as: immutable predisposing factors, enabling factors, and personal health practices. In this study, healthcare service need for *unmet* dental care was considered to be influenced by predisposing factors (e.g. sex; age; race or ethnicity), *not* having enabling factors (e.g. education; social support through marriage or partnership; adequate income; and *the interest of the study, food security*), and *not* having healthful personal health practices and/or conditions (e.g. smoking; alcohol use; previous dental visit over a year ago). The purpose of this study was to determine the association between low food security and unmet dental care needs in adults in the U.S.

Methods

This study received institutional ethics acknowledgement and approval as non-human subject research (secondary data analysis of collected, publicly available data).

Study design

An observational, retrospective, cross-sectional design with data obtained from the National Health and Nutrition Examination Survey (NHANES), 2011 and 2012, was used for the study.[14]

NHANES researchers from the Centers for Disease Control and Prevention (CDC) used stratified, multistage probability sampling designs for the surveys to select participants who were non-institutionalized civilians and lived in the U.S. (including Washington, DC).[14] The researchers oversampled smaller subgroups to increase estimate accuracy. Participants responded to interview questions involving demographic information and questions regarding health and nutrition. Data for the oral examination were collected in a mobile examination center by calibrated licensed dentists who received extensive and periodic training and re-calibration. Details of the NHANES study methodology for 2011 and 2012 are available on the NHANES website.[14]

The study population sample was comprised of adults, age 20 years and above, who had no missing data in the areas of household food security, unmet dental care need, sex, race/ethnicity, and age from the NHANES 2011-12 and consisted of 4,845 participants.

Measures studied

Unmet dental care need was the dependent variable. Individuals were considered to have an unmet dental care need if the NHANES dental examiner recommended that the participant be seen by a dentist. Conversely, individuals were considered to have no unmet dental care need if the examiner recommended that the participant continue with regular, routine care.

Food security was the key independent enabling variable. CDC researchers created a household food security variable in the NHANES 2011 and 2012 data sets based upon the U.S. Food Security Survey Module questions of Bickel, et al.[15] The 2011-12 survey contained 18 questions related to difficulties in food access, availability and quality for households with children; and 10 questions for households without children.[15] Affirmative responses to the food security module questions were tallied and categorized as shown in Table I. Households indicating no affirmative responses, were defined as having "full" food security. Households indicating 1-2 positive responses, were defined as having a "marginal" food security. Households without children under the age of 18 years, indicating 3-5 positive responses, or households with children under the age of 18 with 3-7 positive responses, were defined as having "low" food security. Households in which there were no children under the age of 18 years indicating 6-10 positive responses, or households with children and indicating 8-18 positive responses, were defined as having "very low" food security. If a household had children, but the respondent refused or did not answer the questions concerning the children, the household was classified using the criteria for households without children in the NHANES research. In the data analysis for this study, the categories "low" and "very low" food security were combined (due to small sample sizes) into the category of low food security.

A logistic regression model for the presence of unmet dental need was built incorporating other enabling variables (i.e., factors known to impact access to services), predisposing variables, and personal health practices and/or conditions. Additional enabling variables used in the study were: educational level (less than high school; high school

graduate; some college/technical school; college/technical school graduate or above), marital status (married; widowed/divorced/separated/never married); medical insurance (yes; no); family federal poverty ratio (0 to less than 1.25; 1.25 to less than 2.00; 2.00 to less than 4.00; 4.00 and above). The family federal poverty ratios listed here have been used in previous research,[16] however, the federal government does not have definitions related to low income, middle income, upper income, etc.

The predisposing variables used in this study included: sex (male; female), race/ethnicity (non-Hispanic White; non-Hispanic Black; Mexican-American or other), and age (20 to under 35; 35 to under 50; 50 to under 65; 65 and above). Personal health practices and/or conditions used in the study were smoking status (current smokers; former smokers; never smokers), body mass index (less than 25; 25 to less than 30; 30 and above), alcohol use (none; moderate [1-2 drinks per day]; heavy [more than 2 drinks per day]), and dental visits (within 6 months; within 1 to 2 years; more than 2 years).

Statistical analyses

Chi square tests were used to examine the unadjusted association between dental care need, food security and the other independent variables. Logistic regression was used to examine the association between food security and dental care need with two different models: an unadjusted model and a model adjusted for predisposing factors, enabling factors, and personal health practices. All analyses included sampling weights to account for the complex NHANES survey design and were conducted using the Statistical Analysis System Software (SAS® version 9.3, SAS Institute, Inc.; Cary, NC, USA).

Results

Descriptive sample characteristics are presented in Table II. Unmet dental need was identified in 47% of the adults in the sample and low food security was found in 16% of the sample population. The majority of the sample was non-Hispanic White (66.8%), married (61.6%) and insured (79.9%).

Sample results for unmet dental need are presented in Table III. The association of unmet dental care need for participants with low food security vs. those with full food security (70% vs. 41%) was significant ($p<.0001$). There were also significant associations between unmet dental care need and the predisposing factors, enabling factors, and personal health practices/conditions. Unmet dental care need was reported by a higher percentage of non-Hispanic Black as compared to non-Hispanic White (66.3% vs. 40.2%), and adults living below the 1.25 times the family federal poverty level compared to adults living at or above 4.00 times the family federal poverty level (64.1% vs. 31.3%).

In the adjusted analysis, adults with low food security were more likely to report unmet dental care need as compared to adults with full food security (Adjusted Odds Ratio (AOR) = 1.58, 95% CI = 1.18, 2.12; $P<.01$). Adjusted Odds Ratios and 95% confidence intervals for the other independent variables are presented in Table IV. Interaction analyses of food security with age, race/ethnicity, and federal poverty level supported the significant positive adjusted analysis association.

Table I. Household Food Security Surveys: Difficulty in Food Access, Availability, and Quality

Number of difficulty responses	Food Security Level: 4 categories	Food Security Level: 3 categories
0	full food security	full food security
1-2	marginal	marginal
3-5 (no child/children in household)	low	low
3-7 (with child/children in household)	low	low
3-5 (with child/children in household but no valid responses concerning the child/children)	low	low
6-10 (no child/children in household)	very low	low
8-18 (with child/children in household)	very low	low
6-10 (with child/children in household but no valid responses concerning the child/children	very low	low

Based on 18 questions for households with a child or children under the age of 18 years, and 10 questions for households without a child or children or in which no valid responses concerning the child or children were provided. Questionnaire available from the Department of Agriculture[15] www.ers.usda.gov/briefing/foodsecurity.

Table II. Study Sample Characteristics National Health and Nutrition Examination Survey, 2011-2012

	Unweighted Number	Weighted%
All	4,845	100
Unmet Dental Care needs		
Yes	2,678	47.1
No	2,167	52.9
Household Food Security		
Full	3,293	74.5
Marginal	572	9.7
Low	980	15.8
Predisposing Factors		
Sex		
Female	2,427	51.4
Male	2,418	48.6
Race/Ethnicity		
Non-Hispanic White	1,798	66.8
Non-Hispanic Black	1,277	11.3
Mexican American	463	7.5
Other Hispanic	488	6.5
Non-Hispanic Asian	674	5.1
Other races	145	2.7
Age in years		
20-34	1,312	27.8
35-49	1,228	27.7
50-64	1,255	27.1
65 and above	1,050	17.3
Education Level		
Less than high school	1,122	16.3
High school graduate	1,022	20.5
Some college	1,452	31.9
College degree and above	1,247	31.3

	Unweighted Number	Weighted%
Enabling Factors		
Family Federal Poverty Level		
0 to less than 1.25	1,507	21.7
1.25 to less than 2.00	772	14.7
2.00 to less 4.00	1,057	25.0
4.00 and above	1,128	32.9
Married	2,726	61.6
Widowed/separated/ divorced/never married	2,116	38.4
Insurance		
Insured	3,686	79.9
Uninsured	1,154	20.1
Last Dental Visit		
6 months to less than 1 year	2,599	60.3
1 year to less than 2 years	641	12.3
2 years and above	1,597	27.3
Personal Health Practices		
Body Mass Index		
Less than 25	1,525	30.6
25 to less than 30	1,564	33.8
30 and above	1,699	34.7
Smoking Status		
Current Smoker	973	19.9
Past Smoker	1,098	24.1
Never Smoke	2,769	56.0
Alcohol Drinking		
Non-drinker	1,159	18.3
Moderate	1,616	40.1
Heavy	1,094	25.0

Note: Based on 4,845 adults age 20 years and above with no missing information on dental care need and food security. Missing values for income, body mass index, and alcohol use are not reported in the table.

Discussion

The purpose of this study was to examine the association between food security and unmet dental care need in adults. Adults with low food security were more likely to have unmet dental care need as compared with adults with full food security. These findings are consistent with a Canadian study in which Muirhead et al. found that adults who reported food insecurity had poorer oral health and were more likely to be wearing dentures than adults who had food security.[1] Results of this study are also consistent with other studies among

Table III. Dental Care Need National Health and Nutrition Examination Survey, 2011-2012

	Unmet Dental Care Need		No Unmet Dental Care Need		
	Number	Wt%	Number	Wt%	*p*-value
Household Food Security					**<.0001**
Full	1,626	41.0	1,667	59.0	
Marginal	369	56.6	203	43.4	
Low	683	70.0	297	30.0	
Predisposing Factors					
Sex					**<.0001**
Female	1,188	40.2	1,239	59.8	
Male	1,490	54.4	928	45.6	
Race/Ethnicity					**<.0001**
Non-Hispanic White	809	40.2	989	59.8	
Non-Hispanic Black	850	66.3	427	33.7	
Mexican American	319	67.9	144	32.1	
Other Hispanic	275	55.9	213	44.1	
Non-Hispanic Asian	350	51.1	324	48.9	
Other races	75	49.2	70	50.8	
Age in years					**0.002**
20-34	601	38.8	711	61.2	
35-49	725	50.8	503	49.2	
50-64	817	53.3	438	46.7	
65 and above	535	44.8	515	55.2	
Education Level					**<.0001**
Less than high school	780	68.8	342	31.2	
High school	657	57.5	365	42.5	
Some college	787	47.9	665	52.1	
College degree and above	453	28.2	794	71.8	
Enabling Factors					
Family Federal Poverty Level					**<.0001**
0 to less than 1.25	1,011	64.1	496	35.9	
1.25 to less than 2.00	474	56.8	298	43.2	
2.00 to less than 4.00	547	44.8	510	55.2	
4.00 and above	408	31.3	720	68.7	
Marital Status					**0.008**
Married	1,485	44.5	1,241	55.5	
Widowed/ separated/ divorced/never	1,191	51.2	925	48.8	
Insurance					**<.0001**
Insured	1,865	42.1	1,821	57.9	
Uninsured	810	66.8	344	33.2	
Last Dental Visit					**<.0001**
6 months to less than 1 year	1,178	36.3	1,421	63.7	
1year to less than 2 years	399	58.3	242	41.7	
2 years and above	1,096	65.7	501	34.3	
Personal Health Practices					
Body Mass Index					**<.0001**
Less than 25	746	40.2	779	59.8	
25 to less than 30	867	46.3	697	53.7	
30 and above	1,036	54.1	663	45.9	
Smoking Status					**<.0001**
Current Smoker	694	67.3	279	32.7	
Past Smoker	579	45.7	519	54.3	
Never Smoke	1,400	40.5	1,369	59.5	
Alcohol Drinking					**<.0001**
Non-drinker	633	47.6	526	52.4	
Moderate	733	37.3	883	62.7	
Heavy	695	55.8	399	44.2	

Note: Based on 4,845 adults, age 20 years and above, who had no missing data on food security and dental care need.

Wt.: weighted

Missing values for income, body mass index, and alcohol use were not reported in the table.

Table IV. Unmet Dental Care Needs:
Logistic Regression National Health and Nutrition Examination Survey, 2011-2012

	AOR	95% CI	Significance
Household Food Security			
Full			
Marginal		[0.80,1.39]	
Low		[1.18,2.12]	**
Predisposing Factors			
Gender			
Female	0.57	[0.46,0.72]	***
Male	reference		
Race/Ethnicity			
Non-Hispanic White	reference		
Non-Hispanic Black		[1.84,3.00]	***
Mexican American		[1.18,2.95]	**
Other Hispanic		[0.94,2.20]	
Non-Hispanic Asian		[1.68,3.11]	***
Other races		[0.68,1.33]	
Age in years			
20-34	reference		
35-49		[1.68,2.72]	***
50-64		[2.14,3.99]	***
65 and above		[1.42,3.52]	***
Education Level			
Less than high school		[1.30,3.00]	**
High school graduate		[1.28,2.49]	***
Some college		[1.19,1.93]	***
College graduate and above	reference		
Enabling Factors			
Family Federal Poverty Level			
0 to less than 1.25	1.67	[1.19,2.34]	**
1.25 to less than 2.00	1.55	[1.08,2.22]	*
2.00 to less than 4.00	1.17	[0.84,1.64]	
4.00 and above	reference		
Marital Status			
Married	reference		
Widowed/separated/ divorced/never	1.08	[0.82,1.43]	
Insurance			
Insured	0.63	[0.52,0.77]	***
Uninsured	reference		
Last Dental Visit			
6 months to less than 1 year	reference		
1 to less than 2 years	1.92	[1.44,2.55]	***
2 years and above	1.91	[1.38,2.66]	***
Personal Health Practices			
Body Mass Index			
Less than 2	reference		
25 to less than 30	1.23	[1.06,1.42]	**
30 and above	1.48	[1.19,1.85]	***
Smoking Status			
Current Smoker	1.99	[1.50,2.65]	***
Past Smoker	1.09	[0.85,1.41]	
Never Smoke	reference		
Alcohol Drinking			
Non-drinker	0.90	[0.76,1.08]	
Moderate	1.12	[0.90,1.40]	
Heavy	reference		

Note: Based on 4,845 adults, age 20 years and above, with no missing data on food security and dental care need.

AOR: adjusted odds ratio

Asterisks represent significant group differences by Unmet Dental Care Need Based on Logistic Regression.

***P <0.001; **.001 < P <0.01; *0.01 < P <.05

children with low or very low food security,[11, 15] and a study with school lunch programs in Brazil.[17]

Addressing low food security

Low food security is a consideration in the larger social context of food justice which includes issues such as local food movements, toxin-free foods, public investment/community development to regain supermarkets/large grocery stores, and labor laws, among other issues.[15] Efforts are being made to address individual and community needs for safe, healthful, and adequate food sources and have been supported by the U.S. Department of Agriculture (USDA).[15] Food deserts have been the primary foci of these efforts. When communities lose or do not have access to supermarkets or large grocery stories, non-traditional food retailers (i.e. gas-marts, pharmacies, dollar stores, small grocery stores) may fill the void; but often those retailers do not stock fresh fruits and vegetables.[18] Such markets with limited food choices often stock heavily processed, sugary foods and beverages.[19]

The USDA supports a variety of healthful feeding programs: the National School Lunch Program fed more than 20 million free lunches per school day to children in 2017;[20] and the Women Infants and Children (WIC) program had 7.3 million participants in 2017.[21] Additional programs from the USDA include the Supplemental Nutrition Assistance Programs (SNAP), School Breakfast Program, Fresh Fruit and Vegetable Program; Summer Food Service Program, Commodity Supplemental Food Program, Food Distribution Program on Indian Reservations, the Emergency Food Assistance Program, Special Milk Program, Farmers' Market Nutrition Program, and the Senior Farmers' Market Nutrition Program.[22] However, many people with low food security do not have access to the programs, are ineligible, or do not know about them. This lack of utility of the available food supplementation programs is a concern for general health; and, as indicated by our study results, is also a concern for unmet dental needs.

Low food security and health needs

This study indicates a link between unmet dental needs and low food security with adults having low food security being 58% more likely to have an unmet dental need (AOR= 1.58, 95%CI=1.18, 2.12; $p<.01$). Relationships between low food security and other health needs including unmet dental care need, require better understanding. Low food security is experienced differently for household of adults with children.[3] Children are found to experience less food insecurity than their mothers in the same household;[3] the child's needs are placed before the needs of the parent. Low-nutrient, high-calorie, and highly processed foods are often low-cost and readily available; and food prices strongly influence food purchases.[23] Individuals with food insecurity often have diets which are pro-inflammatory, and cariogenic. However, Chi et al. found that although lower socioeconomic status was associated with food insecurity, the food insecurity was not associated with fast-food consumption. This had previously been postulated as a potential mechanism of linking food insecurity to caries considering that fast-foods are sources of added sugars, such as sugar-sweetened beverages.[24] The relationship between caries and diet is complex, and there are contradictory theories regarding what constitutes a healthful diet.[25] Some researchers have theorized that excessive carbohydrate intake, in the absence of preventive interventions, leads to dental disease followed by systemic disease.[25] Conversely, others view lipids as a leading factor for systemic disease and promote high carbohydrate diets which can be misinterpreted as a recommendation for a diet consisting of highly refined carbohydrates.[25]

Social and cultural norms associated with foods influence food choices, preferences, beliefs, and behaviors[23] adding to the complexity of food insecurity and influence on general as well as oral health. Food insecurity has been associated with increased rates of depression, diabetes, distress, and low medication adherence among adults with diabetes and an increased risk of opportunistic infections.[26, 27] Low food security has also been linked to increased incidence of hospitalizations among adults with HIV/AIDS.[28] Food insecurity has been associated with nutrition-related conditions such as higher rates of parental overweight/obesity, fewer healthful mealtime foods, barriers to fruit and vegetable access, and increased binge eating.[29]

Unmet dental care need is an additional burden as well as a challenge for individuals with food insecurity. While there are a number of USDA programs addressing issues related to food insecurity, there is a need to examine the additional deficiencies contributing to the amount of unmet dental need for adults in the U.S.

Limitations of this study include the epidemiological cross-sectional research design which did not include temporality and therefore does not include causation. For the purposes of this study, the association between food insecurity and unmet dental need is presented as a relationship. While a number of factors were controlled in the adjusted analyses, there may have been confounders that were not available in the data set. The sample population may have had unmet dental need due to the distribution and availability of dental providers. Dietary patterns were not included in the sample population which would be helpful in identifying the mechanisms between the

association of food insecurity and unmet dental care need. However, the study's strength comes from the nationally representative, highly regarded NHANES research. Dental examinations were completed by calibrated licensed dentists and the questionnaires were administered by extensively trained and calibrated researchers. While a larger sample size would have strengthened this study, multiple cycles of the NHANES did not include the same variables.

Conclusion

Food insecurity and health disparities present serious challenges to policy makers in the U.S.[5] This study demonstrates a relationship between unmet dental care need and food insecurity. Dental professionals routinely query patients about their food intake due to its impact on oral and overall health, in addition to participating in community educational programs. Oral health care professionals should be aware of the various community food resource options available to individuals with low food security, make referrals to social service providers, and facilitate dental care for people with low food security through supportive policies to improve access to care.

Disclosure

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Research

Variations in Periodontal Diagnosis Among Clinicians: dental hygienists' experiences and perceived barriers

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Abstract

Purpose: Research indicates clinicians face barriers when attempting to utilize evidence-based protocols for periodontal disease and periodontal disease diagnosis often varies between dental providers. The purpose of this study was to identify and better understand dental hygienists' perceived barriers and experiences during the process of diagnosing periodontal disease in clinical practice.

Methods: This study used a qualitative design and a purposive sample of dental hygienists (n=20). Utilizing a virtual video-conferencing platform, participants logged into focus group sessions to discuss their experiences with diagnosing periodontal disease in clinical practice. Focus group sessions were recorded and transcribed. Thematic analysis involved the use of inductive coding to draw themes from the data.

Results: Dental hygienists reported being responsible for periodontal disease diagnosis, and that they utilized similar classification systems, and agreed with colleagues' periodontal disease diagnoses. However, participants reported the lack of a standardized periodontal classification system was confusing when communicating outside of their dental practice and described both intrinsic and extrinsic barriers to diagnosing disease. A common theme expressed by participants was that patients' lack of acceptance of their periodontal disease status and inability to fund treatment interfered with providing an evidence-based diagnosis and treatment plan. Newly licensed dental hygienists felt somewhat prepared to diagnose periodontal disease upon completion of their education but reported increased confidence in their skills and knowledge with years of practice and continuing education.

Conclusion: Study data indicates dental hygienists feel the lack of a standardized periodontal classification system causes confusion and inconsistencies when communicating with other oral health care providers outside of their clinical practice setting, and dental hygienists face barriers when diagnosing periodontal disease. These findings may be instrumental in assisting educators in preparing students for clinical practice.

Keywords: periodontal disease, periodontal diagnosis, dental hygienist, barriers

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Introduction

Data from the National Health and Nutrition Examination Survey (NHANES) indicates that more than 47% of adults over the age of 30 have either mild (8.7%), moderate (30.0%), or severe (8.5%) periodontal disease (PD) with increasing severity as the population ages.[1] Chronic periodontal disease is a major cause of tooth loss.[2] Research suggests PD can have serious effects on systemic health and links have been suggested between PD and both chronic and autoimmune diseases including cardiovascular diseases, diabetes, pre-term births, respiratory diseases, and other systemic conditions due to related inflammatory mediators.[3,4]

Evidence-based recommendations released by the American Dental Association (ADA) state periodontal disease should be treated at its earliest stages with scaling and root planing and in some cases supplemented with subgingival-antimicrobial dosed doxycycline.[2] By treating PD in its early stages, clinicians can reduce inflammation; however, without an accurate diagnosis, a treatment plan cannot be

established.[5] Williams et al. states good clinical reasoning and decision making, play a key role in the treatment of PD, and inadequate diagnostic skills can interfere with the early detection of disease.[5] Research indicates disagreement and variations in the diagnosis and treatment of periodontal disease among clinicians, students, and dental faculty.[5-9] Some studies suggest the variation in periodontal disease diagnosis may be due to a lack of standardized diagnostic terminology, practice, and changing diagnostics.[10-12]

Clinical guidelines for periodontal diagnoses and classification of periodontal disease from the American Academy of Periodontology (AAP) include the recording and interpretation of probing depths and clinical attachment levels; radiographic surveys; the presence or absence of inflammation, bleeding and other clinical signs and symptoms; in addition to the medical, dental, and social history.[13,14] While Birrenbach et al. found that even though physicians feel clinical guidelines are helpful to guide practice and improve patient outcomes, barriers may still prevent health care providers from utilizing them.[15] A lack of awareness and familiarity with clinical guidelines along with insufficient time to utilize guidelines are among the most commonly cited barriers.[15] Another study reported disagreement and lack of self-efficacy among healthcare practitioners in regards to utilizing and understanding recommended measures of assessment and their outcomes.[16] Spallek et al. conducted a cross-sectional study of dentist attendees at an evidence-based practice (EBP) continuing education course and identified common barriers to implementing EBP included difficulty in changing current practice models, resistance and criticism from colleagues, and distrust in the evidence or research.[17]

Diagnosis and treatment of PD is based on the ability to utilize the evidence-based ADA and AAP clinical guidelines and the utilization of clinical decision-making skills.[2,13,14] Shortcomings in PD diagnostic capabilities and clinical decision making skills may prevent early and accurate disease diagnosis, leading to delayed treatment and increased risk of oral and systemic complications.[5] Diagnostic inconsistencies can lead to under or non-treatment of disease and overall inaccurate reporting of PD incidence and prevalence.[12,18] Without proper assessment of PD and adherence to AAP standards for a timely diagnosis,[13,14] patients may not receive evidence-based care,[2] placing them at increased risk for a multitude of oral health related chronic conditions including heart disease, diabetes, and stroke.[3,4,5]

Research indicates a variation in PD diagnosis among dental providers,[5-9] and dentists report a range of barriers in the utilization of evidence-based guidelines;[17] however, there is a gap in the literature on the clinical practice experiences and barriers of dental hygienists regarding PD diagnosis. The purpose of this study was to identify and better understand dental hygienists' perceived barriers and experiences during the process of diagnosing periodontal disease in clinical practice.

Methods

This study was granted exempt status by the MCPHS Institutional Review Board.

A qualitative phenomenological design was used with a purposive sample of dental hygienists to allow individuals to describe experiences in their own words or voice.[19] Semi-structured, open-ended questions were developed based on the purpose of the study to gather participants' experiences and perceived barriers for diagnosing PD. Content validity of the interview questions was not indicated for this study. Qualitative focus groups utilizing semi-structured interview guides are useful for identifying group norms and allow for sharing of a variety of viewpoints within a population.[19]

Focus Group Setting

A virtual focus group setting (Zoom Video Conferencing©) was chosen for its convenience and accessibility.[20] Research has shown that virtual or video-conferencing is an effective tool for gathering data for qualitative research when face-to-face interviewing techniques are not possible.[21] Video-conferencing provides a high degree of social presence (provides the sense the other participants are with one another in the 'room') which is important when conducting interviews.[21] Furthermore, social presence also allows participants to visualize non-verbal cues that may be overlooked in written or audio surveys.[21]

Sample Selection

Purposive sampling and snowball sampling were used for sample selection. Purposive sampling is used when participants are chosen based on preselected criteria related to the topic under study.[19] Snowballing involves those who meet the preselected criteria reaching out to others who also meet the criteria. An initial minimum sample size of 15 was identified, with a final sample size determined by reaching data saturation.[22] Saturation refers to the point at which new data provides no new themes or codes on the subject under study.[22] Purposive sampling and a small sample size are common with qualitative research design, and past studies indicate a small likelihood of newly emerging themes (or saturation) after 12 interviews with a purposive sample of participants.[23, 24]

Inclusion criteria included the following: being a registered dental hygienist holding an Associate's degree or Bachelor's degree, current and valid licensure, and having practiced

clinical dental hygiene in a public health or private practice setting in the U.S. for a minimum of one day a week for at least one year. Dental hygienists holding graduate degrees, and those who were not currently practicing at least one day of clinical dental hygiene or had been practicing less than a year, were excluded from the study. The exclusion rationale included: individuals not practicing are less likely to remain current with evidence-based guidelines and may not be utilizing them, new graduates may not have enough experience to provide substantive response, and individuals holding a graduate degree may have had additional in-depth study of periodontal classification.

Survey Instrument

Interview questions were developed based on the existing literature; focus group questions were pilot tested by 5 dental hygienists with similar characteristics to the proposed sample with the exception that they had recently started a graduate program. The Zoom platform was used for the 1-hour pilot test. Proposed questions were asked and the investigator found two of the questions were unclear; these were subsequently revised. The revised questions served as the primary instrument for the focus group questions.

Recruitment

Invitations to participate were sent via email to researcher's colleagues and also to members of a dental hygiene forum on a social networking website; messages and flyers were delivered electronically each week throughout the duration of the 6-week study. A gift card drawing was offered as an incentive to participate. Interested participants were able to access the informed consent and demographic survey to determine study eligibility. The eligible participants received an email with an embedded link allowing access to the assigned Zoom focus group session.

Participants were able to log in with either their real or fictitious name and were also able to either opt in or out of the video feature. Focus group size was determined by participant availability; there were four focus groups with 3 to 7 participants per group, which was smaller than the typical focus group size of 8 to 10 participants.[19] The smaller size was not considered a disadvantage as qualitative research aims to extract the participants' experiences in rich detail which is not feasible with larger populations.[23] Participants were informed they would be asked 6 open-ended questions (Table I) regarding the research topic during a 45 to 60-minute focus group session. The participants also received an email containing the various periodontal classification systems to use as a reference during the focus group sessions (Table II).

Table I. Focus Group Questions

Who in your clinical practice setting is responsible for diagnosing periodontal disease?
After reviewing the classification guidelines emailed to you, what classification system do you and your colleagues currently use for diagnosing periodontal disease?
Please explain how you feel about the lack of a standard periodontal classification system?
Is there often agreement or disagreement among clinicians in your clinical practice setting when diagnosing periodontal disease? Please explain your answer.
What barriers do you or your colleagues face when diagnosing periodontal disease in your clinical practice setting?
Do you feel your clinical education prepared you to diagnose periodontal disease?
Please explain your answer.

Focus group sessions were audio recorded and moderated by the principal investigator (PI) who also took field notes.

Audio recordings were transcribed verbatim by the PI and were also reviewed by a focus group participant to ensure accuracy. An inductive coding process, consisting of close reading of the transcript for a general sense of the information followed by summarizing the data into common word phrases to identify meaningful units of text related to each question, was used to draw themes from the data.[25] The research questions served as the context for organizing the themes identified, and direct quotes from the participants illustrated the dimensions of each theme.[25]

Accuracy and credibility were established through peer debriefing and member checking by which impartial colleagues and participants reviewed the major findings and provided their feedback.[26] Recordings and notes of this study were shared with an impartial colleague to help minimize bias and identify discrepancies in the interpretation of the data. Contradictory findings are included in the discussion.[26] Reliability was assessed by reviewing the transcripts and data for errors and assuring the stability of the code definitions.[26]

Results

Thirty dental hygienists completed the informed consent and demographic survey and 20 qualified for the study (n=20), yielding a 67% response rate for participation in the focus group sessions (Table III). Out of the 20 participants, 10 opted out of video and one used an alias.

Table II. Periodontal Case Types

1986 ADA/AAP Periodontal Case Types	1986 AAP Classification System
Healthy	Juvenile Periodontitis
Type I Gingivitis	Prepubertal periodontitis
Type II Mild Periodontal Disease	Localized Juvenile periodontitis
Type III Moderate Periodontal Disease	Generalized Juvenile periodontitis
Type IV Advanced Periodontal Disease	Adult Periodontitis
	Refractory Periodontitis
1989 AAP Classification System	**1999 AAP Classification System**
Early-Onset Periodontitis	Gingival Diseases
Prepubertal periodontitis	Plaque-induced
Juvenile periodontitis	Non plaque-induced
Adult Periodontitis	Chronic Periodontitis (slight, moderate, severe)
Necrotizing Periodontitis	Localized
Refractory Periodontitis	Generalized
Periodontitis Associated with Systemic Disease	Aggressive Periodontitis (slight, moderate, severe)
	Localized
	Generalized
	Periodontitis as a Manifestation of Systemic Diseases
	Necrotizing Periodontal Diseases
	Abscesses of the Periodontium
	Periodontitis Associated with Endodontic Lesions
	Developmental or Acquired Deformities and Conditions

Table III. Participants Demographics

Variable	(n=20) Frequency (%)
Location of Dental Practice	
Northeast	12 (60%)
Southeast	2 (10%)
Midwest	3 (15%)
Southwest	3 (15%)
Highest Degree Attained	
Associate's Degree	13 (65%)
Bachelor's Degree	7 (35%)
Years in Practice	
1-5	6 (30%)
6-10	3 (15%)
11-20	4 (20%)
21-30	4 (20%)
31-40	3 (15%)
Days/Week Working	
1-3	8 (40%)
4-7	12 (60%)
Dental Practice Specialty	
General	18 (90%)
Periodontal	1 (5%)
Group	1 (5%)

Evaluation of the focus group sessions revealed the participants shared many of the same clinical experiences surrounding the periodontal diagnostic process and its relationship to the patient care process. Data saturation levels were reached by the third focus group session; no new themes were identified in the fourth session. Participants shared experiences in all 6 areas discussed during the virtual focus group sessions resulting in the following common themes: diagnosis responsibilities, usage of classification systems, opinions on the lack of a standardized periodontal classification system, agreement between clinicians, barriers to diagnosis, and educational preparation. Six themes were identified in the analysis of the data.

Responsibility for Diagnosing Periodontal Disease

Regarding responsibility for diagnosing PD, just over half of the participants responded it was the dental hygienist who was responsible for patients' disease diagnosis. Participants made the following statements regarding diagnosis responsibility: "In our office, it's the hygienist that decides and diagnoses the periodontal disease," and "I would say the hygienist is the one who does all of the chartings and gives the doctor a strong recommendation, but it is ultimately up to the doctor to decide what treatment is done." Less commonly, participants reported it was the dentists' responsibility, or the diagnosis responsibility depended on who saw the patient first. Conversely, two participants indicated their patients were not necessarily given a periodontal diagnosis but rather a treatment plan. For example, one participant stated, "…I don't think we actually classify anybody. We treatment plan based on individual needs, but we never document a classification..."

Usage of Periodontal Classification Systems

When asked about using a specific periodontal classification system, just over half of the participants stated they used the 1986 ADA/AAP Case Types. An equal number of participants reported using the 1999 AAP periodontal classification system or not using a classification system at all. One participant stated, "We don't specifically put

down any type of classification..." Another participant reported using a combination of the 1986 ADA/AAP Case Types and the 1986 AAP periodontal classification system.

Lack of a Standardized Classification System

Diagnostic inconsistencies and confusion were mentioned frequently among the participants when asked about the use of a standardized classification. Nearly half of the participants reported the lack of a standardized classification system made for inconsistencies between clinicians, about a third of participants said it caused confusion for them personally, and several stated it caused confusion when referring to a periodontist. One participant stated, "There's a lot of discrepancies just with the hygienists at the same office," while another stated, "It could be very confusing… if I were not in the same practice every day." Regarding communication outside of the office, one participant stated, "I work in one practice and we all use the same terminology… but it could get confusing when communicating outside the office." Another stated, "We refer to a bunch of different periodontists and each one of them has a different system." Conversely, several participants stated they did not feel the lack of a standardized classification system caused inconsistencies between clinicians or practices, and two participants stated that they did not find it caused any confusion at all. "I'm lucky to work in just one office. So, we all in that office have a standard. It's not an issue within our own practice."

Agreement between Clinicians

In the area of diagnostic agreement, more than half of the hygienists stated they experienced agreement with their colleagues when diagnosing disease. One participant shared, "I don't ever seem to find that there's a conflict or a disagreement." However, a little over a third of the participants expressed that they often experienced disagreement with their colleagues when diagnosing periodontal disease. Of experiencing disagreement, almost half stated the disagreement was between the hygienists and the doctor while the remainder stated that the disagreement was between the hygienists. One participant commented, "There's agreement between the hygienists but depending on which doctor is in the office that day, there can be disagreement." Another participant from the same practice stated, "Not everybody is doing the same thing. We are not all on the same page." A third participant shared, "Everybody has their own idea on it and it does cause some conflict when you start a patient and, for whatever reason, they get scheduled with somebody else…"

Barriers to Diagnosing Periodontal Disease

Almost one half of the participants reported the financial constraints of patients and lack of insurance coverage affected the diagnostic process when discussing barriers experienced while diagnosing PD. Participants explained that despite their ability to deliver a PD diagnosis they knew the patient would not proceed with treatment because they could not afford it. Furthermore, some participants felt the PD diagnosis lost credibility if insurance denied payment for the treatment. Patients felt the disease was not serious if the insurance would not cover the procedure. One participant stated, "I think there is definitely a lack of education around it and the fact that it's a disease that doesn't hurt." Another shared, "A lot of patients are very turned off by anything that their insurance doesn't cover…They feel like if there's something that isn't 100% covered, it must not be important." Four participants said their biggest barrier to diagnosing periodontal disease was due to the patient being in denial of their disease and not accepting the diagnosis. Other comments regarding barriers to PD diagnosis included: disagreement between hygienist and dentist on diagnosis and treatment recommendations, patients not trusting the hygienist, hygienists letting their personal feelings get in the way of their ability to give a patient a diagnosis, lack of time during the appointment to complete the assessments necessary to diagnose, and lack of legal authority to diagnose.

Educational Preparation

The final theme was in regards to dental hygiene education and whether hygienists felt prepared to diagnose periodontal disease upon graduation. Half of the participants reported that while they felt somewhat prepared by their dental hygiene education, they became more knowledgeable and confident with practice and continuing education. One participant stated, "I think that the school was very good at introducing periodontal disease. They focused a lot on it. But, I think the biggest part of my education came from experience" Almost a third of participants stated they felt prepared to diagnose upon graduation; a few dental hygienists stated they were not prepared at all; some felt they were prepared when they graduated, but time in practice has actually caused them to lose their knowledge because they are not diagnosing as they were in dental hygiene school. One participant stated, "I feel like I got all the tools and understanding [from hygiene school], but I feel like I don't implement it enough in an actual daily clinical practice...I am not classifying like I did during school."

Discussion

Based on the results of this study, the following themes emerged from the clinical practice experiences shared by the partici-pants: diagnosis responsibilities, use of classification systems, opinions regarding the lack of a standardized periodontal classification system, agreement between clinicians, barriers to diagnosis, and educational preparation. The findings were consistent with previous research in regards to variations in periodontal diagnosis[5-12] and barriers to following evidence-based protocols.[15-17]

More than half of the participants in this study reported being responsible for the diagnosis of PD in their clinical practice setting. It is noteworthy that none of the participants resided in a state where diagnosis of PD is part of the scope of practice.[27] Participants also reported feeling confused by the lack of a standardized periodontal classification system, often adopting classification systems being used by colleagues employed in other dental practices. Participants reported less frequently that they noticed differences among the clinicians within their own clinical practice setting. These findings are consistent with previous research suggesting evolving periodontal nomenclature and a lack of a standardization make it challenging for providers to accurately diagnose disease.[10-12] Even though these classification disparities were noted by participants, more than half of the dental hygienists in this study reported feeling most familiar with one of the more dated periodontal classification systems and 20% reported not using any classification system at all.

Contrary to the results of previous research looking at variation in periodontal diagnosis among dentists, dental hygienists, and dental faculty, nearly three-quarters of participants in this study reported they were often in agreement with the clinicians in their clinical practice setting when diagnosing periodontal disease.[5-9] However, when participants reported a lack of diagnostic agreement, occurrences of disagreement were equal between dental hygienists and between dental hygienists and dentists.

When discussing barriers to diagnosing PD, 40% of the participants stated financial limitations and lack of insurance coverage affected patients' ability to follow through with the diagnosis- based treatment recommendations. Participants also reported that patients often lost sight of the seriousness of the disease diagnosis when insurance declined coverage for periodontal treatment. Patients' dental knowledge was also thought to affect their level of acceptance of their PD status. Even though the majority of the participants reported diagnosing PD in clinical practice, responses to the question regarding diagnostic barriers may have been interpreted differently than the PI intended. Many of the responses to this question were pertaining to barriers to disease treatment rather than to the diagnostic process. However, this could also indicate that dental hygienists may be allowing for factors such as insurance coverage to dictate the PD diagnosis rather than focusing on the disease process itself.

Other barriers mentioned included insufficient time to gather the data needed for a diagnosis, feeling the patient did not trust the dental hygienist's diagnosis and experiencing disagreement between the dentist and dental hygienist. Another area identified was the inability to set aside personal beliefs and preconceptions when assessing a patient's needs, such as: assuming the patient could not afford treatment, assuming a patient would not accept treatment plan because of advanced age, or assuming the patient would not follow through with treatment due to lack of insurance coverage. Previous research in medicine indicated that health care providers experienced both internal and external barriers, including lack of familiarity, resources, confidence, or not seeing value in guideline principles, impacting their ability to follow evidence-based care guidelines.[15, 16, 28-30] Likewise, if a dental hygienist has difficulty utilizing evidence-based practices due to internal or external barriers, it could be difficult for them to assign a PD diagnosis.[13]

Data from the American Dental Hygienists' Association (ADHA), indicates there are only three states, (Colorado, Connecticut, and Oregon) which allow for a dental hygienist (without an advanced license) to make a dental hygiene diagnosis.[27, 31] Despite diagnosis not being part of the scope of practice in a majority of states, only one participant indicated this was a barrier to assigning a PD diagnosis. This finding is not surprising given the dental hygiene diagnosis requires critical analysis and interpretation of periodontal assessments in order to reach evidence-based conclusions regarding the patient's dental hygiene treatment needs and the dental hygiene care plan.[31]

Regarding the role of dental hygiene education, participants commonly reported feeling somewhat prepared to diagnose PD, but length of time in practice and along with continuing education strengthened their skills and confidence. Some participants stated that they felt completely prepared and confident following graduation from a dental hygiene program while others felt that while they were well prepared that they had lost some knowledge regarding PD classification due to lack of use in their clinical settings. Reports of less than adequate preparation are consistent with previous research conducted with dental students.[32] While the students reported feeling they did not have enough faculty

available to assist them, being assigned too many non-clinical tasks, and experiencing high stress levels due to clinical requirements, the key finding to the topic of variation in periodontal diagnosis among clinicians was the inconsistent clinical feedback students received from their instructors.[32]

Limitations of this study include the lack of representation for bachelor degree dental hygienists in the study sample, purposive sampling technique, and the participants' ability to articulate their clinical practice experiences in regards to barriers to diagnosing periodontal disease. Varying schedules and availability to join focus group sessions presented challenges so that the participants in each group had either the same degree level or an even representation of associate and bachelor degree participants. There was the potential of misinterpreting the participants' responses due to the personal values and experiences of the PI. However, to increase the credibility of the analysis, the PI utilized the process of member checking to validate the findings as recommended by Creswell. [26]

Areas for future research include examining the perceived patient barriers to periodontal disease diagnosis reported by the participants in this study. More extensive research needs to be conducted on the evolving PD diagnostic terminology and its impact on the clinician's ability to accurately diagnose periodontal diseases particularly in light of the proposed 2017-18 change in PD classification guidelines.[14]

Conclusion

The purpose of this study was to explore dental hygienists' experiences and perceived barriers during the process of diagnosing PD. Study data indicates that dental hygienists feel the lack of a standardized periodontal classification system causes confusion and inconsistencies when communicating with other oral health care providers outside of their individual clinical practice settings. Dental hygienists also face barriers related to perceived patient difficulties in proceeding with treatment when diagnosing PD as well as discrepancies in the PD diagnosis with other dental hygienists and dentists. Identifying the challenges and barriers to making an accurate PD diagnosis may be instrumental in assisting dental hygiene educators in preparing students for clinical practice and ultimately improve the quality of patient care.

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Research

Polypharmacy and Off-label Drug Use in Dentistry: knowledge, attitudes and practices of California dental hygienists

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Abstract

Purpose: This study examined the knowledge, attitudes, and practices of dental hygienists, licensed in the state of California, regarding polypharmacy and off-label drug use for purposes in dentistry.

Methods: A cross-sectional design was used to assess the knowledge, attitudes, and practices (KAP) related to off-label drug use and polypharmacy via an online survey tool. The study sample included licensed dental hygienists, who were members of the Long Beach and Tri-County Dental Hygienists' Associations located in Southern California (n=360). Descriptive statistics were used to assess the participant characteristics. ANOVA was used to assess differences in knowledge, attitudes and practices when compared to three key variables: highest academic/professional degree, experience and license type.

Results: One hundred seven electronic surveys (n=107) were returned for a 34% response rate. Over half of respondents (53%) held an associates' degree for their license, most (72%) worked in a general dentistry setting and 46% had practiced 15 years or less. Regarding knowledge of polypharmacy and off-label drug use, the results demonstrated very low knowledge, with 25% of the respondents unable to answer any of the knowledge questions correctly. No significant differences in practices related to off-label drugs or polypharmacy were found based on type of licensure, highest degree achieved, or years of experience. However, participants holding a baccalaureate degree or higher were significantly more confident ($p = .011$) in discussing polypharmacy with patients and colleagues.

Conclusion: Participants showed a general low-level of knowledge related to polypharmacy and off-label drug use in dentistry regardless of their level of education, years of experience, or type of dental hygiene licensure; indicating a need for increased pharmacology content in both entry-level dental hygiene programs and continuing education courses.

Key Words: off-label drug use, polypharmacy, patient assessment, dental hygiene education

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Introduction

Medical advances of all types have made it possible for individuals to live longer and healthier lives. Similarly, as the population ages, more people are taking increasing numbers of medications, polypharmacy, frequently for the treatment of multiple chronic health conditions.[1] Polypharmacy is a concern for healthcare providers due to patients' elevated risk of adverse drug reactions, drug interactions, and medication errors.[2] Data from the National Health and Nutrition Examination Survey (NHANES) showed an 8% increase in prescription drug use in the United States (U.S.) from 1999-2000 to 2011-2012.[3] Additional NHANES data demonstrate that polypharmacy rates increased from 8.2% to 15% over the same period of time.[3] Polypharmacy, in combination with off-label drug use, may affect multiple facets of patient care, in medicine and dentistry alike.

While controversy exists on the use of drugs for off-label therapies related to prescribing practices, increased adverse events, and lack of supporting evidence for off-label prescribing, the U.S. Food and Drug Administration (FDA) stated it "recognizes that these off-label uses or treatment regimens may be important therapeutic options and may even constitute a medically recognized standard of care."[4] Although the FDA acknowledges the potential benefits of off-label drug therapies, the safety, efficacy and approval of drugs being used off-label are not required or monitored by the FDA. A lack of regulatory

evidence supporting the benefits and potential risks of drugs used for off-label purposes may contribute to rising adverse events or potentially ineffective treatments and remains a concern among healthcare professionals.[5] Adverse drug-drug interactions are especially concerning since polypharmacy is a common aspect of medication regimens. Addition of drugs not thoroughly tested for their off-label indications can further amplify the potential for adverse reactions.

A highly publicized and well-documented example of the association between off-label drug use and the potential for adverse effects was observed with the drug fenfluramine/phentermine (fen-phen). Fenfluramine/dexfenfluramine and phentermine, were individually approved by the FDA as appetite suppressants to be used for a short period of time to aid in weight loss.[6] Used individually, these drugs were only slightly effective, but when individuals took the drugs together for the off-label use of appetite suppression, they exhibited rapid weight loss. However, an increased number of individuals were also being diagnosed with valvular heart disease. A meta-analysis conducted by Hopkins and Polukodd examined previous data from endocardiographic studies to assess the prevalence of aortic regurgitation (AR) and mitral regurgitation (MR) related to fenfluramine or dexfenfluramine use.[7] Findings revealed a strong association between the duration of the fenfluramine/dexfenfluramine drug regimen and AR ($p < 0.00001$). Similarly, Wadden et al. reported that 30% of female participants in a retrospective clinical study who took fen-phen for 2 years also met the criteria for valvular heart disease.[8] The combination drug fen-phen had never received FDA approval, and it was discontinued in 1997 due to the number of individuals who developed heart valve disease.[6] Individuals with a history of fen-fen use were screened for AR and MR and those with subsequent valvular disease were recommended to take antibiotic prophylaxis prior to invasive dental procedures.

The use of dietary supplements, including vitamins, minerals, herbs or other botanicals, has increased among teens and adults of all ages in the U.S.[9] However, these supplements do not go through the same drug review process as prescription and over-the-counter medications and are not evaluated for safety and efficacy as they are not intended for the treatment, prevention or cure of diseases.[10] Dietary supplements are only regulated by the FDA if they have been proven to be unsafe for use.[10] Hence, the use of some dietary supplements may be considered off-label.

Dental hygienists in clinical practice not only treat patients who are utilizing drugs for off-label medical purposes, they may also employ drugs/medical devices for off-label indications in the patient care process. For example, Minimal Intervention, MI Paste™ and MI Paste Plus™ (GC America Inc., Saint Alsip, IL) are FDA approved "to be used for cleaning and polishing procedures as part of a professionally administered prophylaxis treatment."[11] Secondary indications identified by the FDA state that MI Paste™ "can be used for the management of tooth sensitivity, post scaling, root planing and bleaching and for the relief of dentinal hypersensitivity."[11] In 2012, the FDA issued a warning letter to the manufacturers of MI Varnish™ and pastes, stating that they were in violation of the Federal Food, Drug, and Cosmetic Act due to their promotion of these products for off-label purposes including the treatment of xerostomia due to Sjögrens syndrome and penetration/remineralization of sub-surface lesions in the dentition.[12]

Fluoride varnishes are used off-label in dental settings for anti-caries treatment and are endorsed by the American Dental Association (ADA).[13] The FDA-approved indications for fluoride varnish include the treatment of hypersensitivity, sealing of dentinal tubules for cavity preparations or sensitive root surfaces, and as a cavity liner.[14] Although, the use of fluoride varnish for caries prevention is preferred for young children due to reduced risk for over-ingestion, rapid adherence compared to the traditional four-minute foam and gel applications, and its higher percentage of fluoride content (5% sodium fluoride varnish compared to 1.1% sodium fluoride), use of fluoride varnish as an anti-caries treatment is not approved by the FDA.[15] There have been no studies reported in the literature to date identifying whether the off-label use of fluoride varnish is discussed with patients.

Chlorhexidine gluconate 0.12% (CHX) is an antimicrobial oral rinse and skin cleanser approved by the FDA as a preoperative skin preparation, wound and general skin cleanser, surgical scrub and antiseptic hand rinse, dental rinse for treatment of gingivitis, and as an adjunctive therapy for pocket depth reduction in patients with periodontitis.[16] Off-label, CHX has been recommended by the ADA for use in caries prevention although research on its efficacy in that capacity has been inconclusive.[17,18] Povidone iodine is approved by the FDA as a broad spectrum external antiseptic for the prevention or treatment of topical infections associated with surgery, burns, minor cuts/scrapes, or the relief of minor vaginal irritation. However, it is used off-label in clinical practice for subgingival irrigation to reduce periodontopathic bacteria within periodontal pockets.[19]

Alpha-lipoic acid (ALA), a natural supplement not regulated by the FDA, has been used for a myriad of indications including the treatment of nerve pain from diabetes or other diseases, facial pain, weight loss, certain eye conditions, high

blood glucose, memory problems, and chronic tiredness. In dentistry, ALA has been studied for the treatment of pain associated with burning mouth syndrome.[20]

Cardiac medications, anticonvulsants, and anti-asthmatics are among the most commonly prescribed drugs for indicated conditions as well as for off-label therapies.[22] Dental hygienists treat patients taking these medications on a daily basis, in addition to caring for pediatric, elderly, pregnant women and patients with cancer; all common recipients of off-label drug therapies. The provision of safe and comprehensive patient care requires dental hygienists be familiar with medications and the conditions for which they are being used. Reputable databases in which off-label indications may be found, often charge a subscription fee and it is not known if dental hygienists or dentists would support this cost for their practice, or the extent to which this resource is used.[21]

While the FDA has an established drug review process ensuring the safety and efficacy of drugs marketed in the U.S., recent advancements in evidence-based medicine and dental practice, including some off-label drug therapies, have led to treatments that may be beneficial to patient care.[23] Despite the prominence of off-label drug use, safety and ethical considerations continue to be controversial.[24, 25] Practitioners must rely on less definitive information for accessing evidence and evaluating general and oral considerations for comprehensive dental hygiene care.[24,25] The literature regarding specific off-label drug indications and their use is limited and improved strategies and tools are needed to inform clinicians about common, off-label uses of drugs that may pose risks to patients. More specific information in this area of pharmacology may assist dental hygienists with appropriate treatment modifications and assist with early identification of adverse effects or potential medical emergencies.

The purpose of this study was to examine the knowledge, attitudes, and practices of dental hygienists regarding polypharmacy and drugs used for off-label purposes in dentistry; and to identify any differences in knowledge, attitudes and practices based on level of education, years of practice and type of licensure related to polypharmacy and off-label drug use.

Methods

This cross-sectional designed study utilized a knowledge, attitude, and practice (KAP) online survey instrument. Dental hygienists' knowledge, attitudes, and practices were examined in relation to polypharmacy and off-label drug use and compared to their level of education, years of experience, and type of licensure. This study received Institutional Review Board approval (IRB-FY2016-379) from the Human Subjects Committee of Idaho State University. A convenience sample of 316 dental hygienists practicing in California was utilized for this study; 150 dental hygiene members of the Long Beach Dental Hygienists' Association (LBDHA) and 166 members of the Tri-County Dental Hygienists Association (TCDHA) received an email invitation to participate in the study. Inclusion criteria required current dental hygiene licensure by the state of California; dental hygienists with inactive licenses were excluded.

A previously designed and validated KAP survey assessing dental hygienists' KAP to dietary and herbal supplements was shortened and modified, with permission from the authors, to evaluate KAP related to polypharmacy and off-label drug use.[26] The survey instrument was pilot tested with six practicing dental hygienists for reliability by a test/retest method and five content experts assessed validity using a content validity index. The pilot tested, revised survey was administered online through Qualtrics® (Provo, UT). The 45-item survey instrument included questions pertaining to demographics (5), knowledge (8), attitudes (14) and practices (18) related to off-label drug use and polypharmacy. Likert-type, multiple choice and ordinal scale questions related to polypharmacy and off-label drugs included topics such as: discussion with patients, knowledge of therapies used in the dental office, knowledge of FDA-approved indications for drugs used in the dental office, and documentation practices. Participants were asked if suspected use of off-label drugs was investigated during reviews of the medical history and if drugs were used for off-label purposes in the dental office.

The LBDHA and TCDHA databases were used to email a cover letter asking for participation, informed consent, and provided an online link to the survey. Three reminder e-mails were sent after the initial e-mail over a 30-day period.

Data were collected online and imported into IBM SPSS Statistics version 23 (Armonk, NY). Participant characteristics were calculated using descriptive statistics and ANOVA was used to assess the differences in knowledge, attitudes and practices based on participants' level of education, years of practice, and type of licensure. Significance was set at $p \leq 0.05$ for ANOVA analyses.

Results

Demographics

Of the 316 surveys that were emailed, 107 were returned (n=107), yielding a response rate of 34%. The majority of respondents had completed an associate degree for their dental hygiene education (53%) while 42% held a baccalaureate degree as the highest academic degree earned. The majority

of participating dental hygienists (72%) practice in a general dentistry setting and 46% practiced for 15 years or less. Professional characteristics of participants are summarized in Table I.

Table I. Participants' Professional Characteristics (n=107)

Demographics	n	%
Type of DH License		
Registered Dental Hygienist (RDH)	66	81
RDH-Extended Functions	6	7
RDH-Alternative Practice (RDHAP)	1	1
RDH and RDHAP	8	10
Highest College Degree		
Associate	30	37
Baccalaureate	34	42
Master	16	20
Doctorate	1	1
Highest DH Degree		
Certificate	2	2
Associate	43	53
Baccalaureate	27	33
Master	9	11
Years of Experience		
< 5 years	9	11
5-15 year	28	35
16-25 years	14	17
26-35 years	15	19
36-45 years	12	15
> 45 years	3	4
Practice Setting		
General Dentistry	58	72
Periodontics	3	4
Education	11	14
Public Health	3	4
Corporate	2	2
Consultant	0	0
Alternative Practice	0	0
Other	2	2
No Longer Practicing	2	2

Knowledge

Results of knowledge questions related to off-label drug regulation and drugs used off-label in the dental office are presented in Table II. The mean score for questions answered correctly was 2.28 out of eight. Frequencies for raw knowledge scores (Table III) depict that 25% of participants did not answer any questions correctly, while 74% answered 3 or less questions correctly. ANOVA results of key variables analyzed with relationship to participants' knowledge are depicted in Table IV.

Table II. Knowledge of Off-Label Drugs Used in Dentistry

Knowledge Questions	Correct Response n(%)	Incorrect Response/ Don't Know n(%)
Medications approved by the FDA for specific indications can also be used for off-label indications. *(true/false)*	37 (38.5)	59 (61.5)
Medications approved by the FDA for specific indications can also be marketed for off-label indications. *(true/false)*	40 (41.7)	56 (58.3)
Which indication(s) is/are considered off-label for *MI Paste*? *(multiple choice)*	12 (12.5)	84 (87.5)
Which indication(s) is/are considered off-label for *fluoride varnish*? *(multiple choice)*	12 (12.5)	84 (87.5)
Which indication(s) is/are considered off-label for *povidone iodine*? *(multiple choice)*	27 (28.1)	69 (71.9)
Treatment of temporomandibular joint disorders (TMJ, TMD) with *Botox* is considered an off-label indication for the drug. *(true/false)*	55 (57.3)	41 (42.7)
Which indication(s) is/are considered off-label for *0.12% chlorhexidine gluconate*? *(multiple choice)*	21 (21.9)	75 (78.1)
Treatment of burning mouth syndrome with the natural supplement, *alpha-lipoic acid* is considered an off-label use of the supplement. *(true/false)*	15 (15.6)	81 (84.4)

Attitudes

Sixty five percent of participants agreed that informed consent should be obtained when using drugs in the dental office for off-label purposes, and half agreed that off-label prescribing should be illegal. Nearly half (44%) believed that FDA approval for off-label use should be pursued prior to using medications for off-label purposes. A majority of participating dental hygienists (69%) felt confident discussing medications used for

Table III. Frequency of Overall Correct Responses

Number Correct	n (%)	Cumulative %
0	24 (25.0)	25.0
1	8 (8.3)	33.3
2	26 (26.1)	60.4
3	13 (13.5)	74.0
4	12 (12.5)	86.5
5	7 (7.3)	93.8
6	5 (5.2)	99.0
7	1 (1.0)	100
8	0 (0)	100
Total	96 (100)	

Table IV. Association of Demographic Characteristics with Knowledge, Attitude and Practice*

Demographic Variable	Knowledge *off-label drugs* *F (p)*	Attitude *off-label drugs* *F (p)*	Practice *off-label drugs* *F (p)*
Type of DH License	1.569 (.214)	.050 (.825)	2.630 (.112)
Highest College Degree	.709 (.495)	.480 (.621)	.991 (.379)
Highest DH Degree	.592 (.556)	.486 (.617)	.905 (.412)
Years of Practice	2.586 (.059)	.359 (.783)	.320 (.811)
Demographic Variable		**Attitude** *polypharmacy* *F (p)*	**Practice** *polypharmacy* *F (p)*
Type of DH License		.762 (.385)	1.049 (.309)
Highest College Degree		4.775 (.011*)	.227 (.798)
Highest DH Degree		1.265 (.288)	.413 (.663)
Years of Practice		1.388 (.253)	.885 (.453)

*$p \leq 0.05$

off-label purposes with colleagues, while 30% were comfortable answering patient questions, and 41% indicated comfort in initiating discussions. Almost half (48%) of respondents did not feel confident their dental hygiene education prepared them to manage patients using medications off-label and 15% were uncertain. A large majority (85%) felt confident discussing polypharmacy with colleagues and 63% felt confident initiating these discussions with their patients. More than half (66%) of dental hygienists were confident they could inform patients about interactions between commonly used prescriptions and over the counter medications. Sixty-five percent felt confident their dental hygiene education prepared them to manage patients using polypharmacy and 35% were in disagreement or uncertain.

ANOVA results of key variables compiled in Table IV show no significant differences in participant attitudes regarding off-label drugs based on type of licensure, highest degree achieved, or years of experience. However, attitudes regarding polypharmacy differed significantly among respondents based on highest degree earned (p=.011). Dental hygienists with baccalaureate, master or doctoral degrees were more confident initiating discussions with patients and discussing polypharmacy with colleagues. This group also felt better prepared by their dental hygiene education to manage patients utilizing polypharmacy.

Practices

A total of 18 questions pertaining to practices involving off-label medications and polypharmacy comprised this section of the survey. Twenty-six percent of participants reported attending a continuing education course specifically related to medications within the last year. A majority of participants (97%) reported seeing patients who use medications for off-label purposes and 68% identified asking patients about off-label medication use. Thirty percent of the respondents indicated using medications for off-label therapies during patient care and 39% reported explaining this off-label use to their patients. Over two thirds (67%) reported no history of drug interactions with off-label medication use in dentistry and 32% reported no history of any adverse events. All of the respondents reported having patients utilizing polypharmacy. More than half (60%) identified concerns related to adverse events that were related to polypharmacy and almost half (46%) reported concerns related to drug interactions.

Discussion

Results from this study of California dental hygienists indicate an overall lack of knowledge concerning off-label drugs and their use regardless of participants' licensure, level of education, and/or years of experience. Specifically, hours worked and number of patients seen per week had no bearing on knowledge levels; a finding that may be due to content deficiencies in pharmacology, either during dental hygiene education, or later through continuing education courses.

Entry-level dental hygiene programs are required to provide instruction in pharmacology specified in the Accreditation Standards for Dental Hygiene Education Programs mandated by the Commission on

Dental Accreditation.[27] However, the standards do not specify the amount or type of instruction that should be delivered related to the specific topics in pharmacology, particularly polypharmacy or off-label drug use. Likewise, in the newly revised Compendium of Curriculum Guidelines for Allied Dental Education Programs, pharmacology topics are included but no mention is made of polypharmacy or off-label drug use.[28] References to these topics in textbooks is very limited. Depending on the textbook adopted for entry-level dental hygiene programs, inclusion of polypharmacy and off-label drug use is scanty or may not be addressed at all. In the most recent edition of "*Basic and Applied Pharmacology for the Dental Hygienist*," off-label drug use is defined and discussed early in the text but minimally referenced in chapters related to various pharmacological categories or in dental/dental hygiene settings.[29] More in-depth discussions about off-label drug use and polypharmacy and applications to dental hygiene practice should be included as part of a comprehensive pharmacology curriculum for dental hygienists.

Nearly half of respondents reported that their dental hygiene education did not prepare them to discuss off-label drug use with patients. Findings also showed a lack of confidence when answering patients' questions and initiating discussions about off-label drug use, indicating dental hygienists may not be sufficiently prepared upon entering the field of practice. Furthermore, advanced education beyond an associate's degree did not impact the level of knowledge. These findings correspond with a cross-sectional comparison between pharmacy and medical students in the Netherlands regarding knowledge of basic, applied and clinical pharmacology which demonstrated no significant differences in knowledge levels based on number of years of training and education.[30] In regards to continuing education following completion of dental hygiene school, only 26% of participants reported that they had attended a course specifically related to medications over the past year. These results indicate all dental hygienists, regardless of their level of education and experience, could benefit from review and expansion of their pharmacology knowledge.

It is possible that in countries where dental hygienists are able to prescribe drugs more emphasis may be given to this area of pharmacology. Dental hygienists in Alberta, Canada may apply for a prescriber identification number after completing a College of Registered Dental Hygienists of Alberta (CRDHA), council approved pharmacy course.[31] Course topics include: principles of pharmacology, drugs used in dental hygiene, risk management, medication errors and decision making related to medication use.[32] Upon successful course completion, dental hygienists have limited prescriptive authority for antibiotics, antifungal agents, anti-infective agents, antiviral agents, bronchodilators, epinephrine, fluoride, pilocarpine, and topical corticosteroids "for the purpose of treating oral health conditions, providing prophylaxis and treating emergencies."[33] While knowledge levels regarding off-label drugs and their uses is unclear, the CRDHA Guidelines Regarding Prescription and Non-Prescription Drugs in Dental Hygiene Practice, clearly states that dental hygienists holding a prescriber ID, "shall not prescribe medications for off-label use unless the drug is part of a research project to investigate use of the drug to treat a documented dental hygiene need. The research project must have received ethics approval from a duly constituted health research ethics board."[34] CRDHA guidelines separate prescribing drugs from administering and recommending drugs and while dental hygienists cannot prescribe drugs for off-label use, they may recommend and administer them provided certain requirements are met.

There is no literature appraising off-label drug use and polypharmacy in the discipline of dental hygiene; however, Chen et al. conducted a survey of 350 general practitioners and psychiatrists to address whether or not they were aware of the FDA labeled indications for the drugs they prescribe.[35] Results showed that while general practitioners and psychiatrists correctly identified FDA-approved drug indications about 50% of the time, 95% of these same physicians reported knowing the FDA indications of the medications they prescribe and 79% indicated that FDA labeling is an important factor in their prescribing practices. While the knowledge levels among general practitioners and psychiatrists was considerably higher than that of dental hygienists, the findings parallel those of the current study regarding discrepancies in what the medical providers thought they knew and what they were able to correctly identify.

A majority of dental hygienists (70%) indicated that over the past 30 days of practice that they had not used a medication for off-label therapy and 23% noted they used a medication off-label in 1%-13% of patient encounters. Fluoride varnish, considered an off-label anti-caries treatment for use in children, is becoming the common caries prevention treatment for all age groups and is endorsed by the ADA.[15,36] However only 15% of participants were able to correctly identify using fluoride varnish for caries prevention as an off-label application, demonstrating a lack of knowledge regarding the indications for fluoride varnish. This finding may have also contributed to the low number of dental hygienists indicating using drugs off-label over the last 30 days of practice.

Participants indicated a familiarity with polypharmacy and indicated the ability to readily identify multiple drug

regimens within their patient populations. Unlike off-label medication use, the majority (65%) of respondents felt confident that their dental hygiene education prepared them to manage polypharmacy usage in patient care. It is unclear if this confidence is related to the entry-level curriculum or clinical experiences following completion of dental hygiene education; however, it can be assumed that the ability to more easily detect polypharmacy among patients increases the perceived knowledge of this aspect of pharmacology. Though participants were more confident in discussing polypharmacy, related adverse effects due to polypharmacy were seldom noted. Considering the increased risk of drug-drug interactions and oral side effects associated with polypharmacy, careful assessment of patients' health histories, familiarity with adverse side effects and precautions for each drug are necessary components of total patient care.

Limitations to this study include the representativeness of the sample population. The sample was not randomly chosen, which may have resulted in reduced variation in data. While this survey provided quantitative data offering insight to knowledge, attitudes and practices, it did not produce the kind of data needed to create a full picture of the factors contributing to the low levels that were identified. Additionally, self-reported data cannot be independently verified. Some of the participants did not answer each question, possibly due to lack of knowledge or reluctance to accurately report actual behaviors in the clinical practice setting. A solution for skipping answers, particularly for online surveys, would be to make responses required for advancing to the next question. Subject recall bias should also be considered.

This pilot study points to issues related to knowledge, attitudes and practice concerning polypharmacy and off-label drug use in dental hygiene practice. Further, large-scale studies are needed to determine any generalization of the results. In addition, comparative studies among dental hygienists with prescriptive authority and those without may be useful in identifying differences in confidence level, approach to practice, medical history assessment procedures and patient education. Parallel studies regarding dental hygienists' knowledge of off-label drugs used in general medicine may be beneficial in planning for pharmacology courses and continuing education content. Lastly, dental hygiene program curricula and continuing education courses should be examined in terms of the depth and breadth of information provided regarding polypharmacy and off-label drug use.

Conclusion

Health care providers frequently encounter patients practicing polypharmacy and off-label medication use. Results from this cross-sectional study demonstrated dental hygienists in the state of California have limited knowledge related to off-label drug use. Additionally, results indicated no difference in knowledge, attitudes or practices based on type of licensure, highest college degree earned, dental hygiene degree, or years of experience. These findings highlight a need for including increased content in pharmacology in both entry-level dental hygiene programs and continuing education courses for practicing clinicians. More research is needed to identify factors that contribute to a positive increase in knowledge, attitudes and practices in relationship to pharmacological interventions.

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Research

Educational and Clinical Experiences in Administering Local Anesthesia: a study of dental and dental hygiene students in California

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Abstract

Purpose: The purpose of this study was to examine the differences in educational preparation and practical educational experiences between dental and dental hygiene students in the administration of local anesthesia (LA) and management of LA related complications in the state of California.

Methods: Course instructors responsible for teaching LA or the program directors of the 6 dental schools and 29 dental hygiene programs in California (n=35) were invited to participate in this study. A computer-based descriptive survey, a comparative checklist of LA instruction requirements and semi-structured interviews were used for the data collection. Descriptive statistics were used to analyze results.

Results: Eighteen LA course instructors or program directors participated in the study for a response rate of 51%. One respondent was from a dental school while 17 were from dental hygiene programs. The majority of the dental hygiene (n=16) respondents reported teaching 12 types of intraoral injections; the dental school respondent reported teaching seven injection types. Fewer student-to-student injection experiences per injection type were required by the dental school (n=7) than the dental hygiene schools (n=12) and the dental school did not indicate a minimum number of student-to-patient injection requirements for graduation. Analysis of a checklist of required elements of LA instruction and individual syllabi revealed common elements of all courses; students are expected to choose the proper local anesthetic, identify the proper injection type, and manage any LA complications. The majority of the interview participants perceived that dental hygiene students had more educational preparation in LA than their dental student cohorts and that dental hygienists were educationally prepared to administer LA safely without direct supervision.

Conclusions: Dental hygiene students in California programs appear to be well prepared through their education experiences to administer and manage complications related to local anesthesia. Consideration should be given to supporting changing the supervision requirements for the administration of local anesthesia by dental hygienists licensed in the state of California.

Keywords: local anesthesia, local anesthesia complications, direct supervision, general supervision, dental hygiene education, dental education

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Introduction

Dental hygienists have been administering local anesthesia (LA) dating back to 1971 when legislation was enacted to expand the scope of practice in the state of Washington.[1] Since then, 44 of the 50 states include the administration of LA, within the scope of practice for dental hygienists.[1] Due to restrictions and limitations within individual dental practice acts, most states require the presence of a dentist for the administration of LA however research has demonstrated that dental hygienists can administer LA safely.[2] Scofield et al. surveyed state boards and found that there were no reports of disciplinary actions against dental hygienists related to the administration of LA among the respondents.[2]

Of the 44 states allowing for the administration of LA by dental hygienists, 35 require direct supervision by a licensed dentist, seven require general supervision, one allows for indirect supervision, and 2 are a mix of general and direct supervision, depending on the geographical location of the practice setting.[1] Direct supervision is defined as requiring

the dentist to be physically present while the procedure is performed while indirect supervision means that a dentist must authorize the procedure and be in the practice setting while the procedure is performed."[3] General supervision is defined as authorizing the procedure to be performed but not required to be physically present in the practice setting. In addition to supervision requirements, there are limitations on the types of LA that dental hygienists are allowed to administer; some states allow both block and infiltration while others allow infiltrations only. [1] The state of Virginia limits the administration of block and infiltration LA to patients over the age of 18.[1]

Dental hygienists have been administering LA under direct supervision in the state of California since 1976.[1] Additionally, dental hygienists are allowed to provide other aspects of oral hygiene assessments including the preliminary examination, non-surgical periodontal therapy (NSPT), and subgingival irrigation with liquid anti-microbial agents under general supervision as defined by California code.[4] Limitations to the pain management options provided during NSPT due to supervision requirements can impact the quality of care for patients during NSPT, however research is limited regarding supervision requirements and their impact on quality pain control. A study conducted by Rich et al. examined whether or not the expansion of the scope of practice of California dental hygienists had led to greater utilization of the administration of LA, nitrous oxide and oxygen analgesia and the provision of soft-tissue curettage, over the first four years after the implementation of the law. [5] Results from the study demonstrated that the majority (90%) of the recent dental hygiene graduates were utilizing at least one of the expanded duties and that 86% of the general dentist and 100% of the periodontist respondents were delegating at least one of these duties thus demonstrating highly favorable acceptance of these expanded duties in California.[5]

Education standards for the didactic and clinical content for LA curricula in both dental and dental hygiene education programs are established by the Commission on Dental Education.[6,7] While didactic content for LA is the same for both dental and dental hygiene students, attitudinal differences regarding whether dental hygienists are qualified to administer LA vary. Gutmann et al. studied dental and dental hygiene students following a didactic LA course and found that while these students were educated together in the same class, the dental students felt the dental hygiene students were not adequately prepared to administer LA.[8] Other concerns related to the administration of LA identified in this study were in regards to causing patient discomfort, which was similar in both groups. In regards to concerns related to causing patient harm or having a LA related medical emergency, the dental hygiene students reported having less anxiety than their dental student cohorts.[8]

Medical emergencies and complications related to the administration of LA were the focus of an observational study by Brand et al.[9] A total of 103 patients received a mandibular block injection by either an oral/maxillofacial surgeon, an oral/maxillofacial resident, or a dental student. No differences were identified in the frequency of LA reactions and/or complications across the three groups. The most common observed reactions among patients was feeling tense (41.7%), clenching fists (14.5%), moaning (12.6%), turning pale (7.8%), and reacting to needle contact with a nerve (3.8%).[9] Brand et al. concluded that the administration of LA resulted in a limited number of side effects and that a thorough health history is the most effective way to identify individuals at increased risk for LA complications.[9]

A variety of training models are used to teach the administration of LA. Simulation models may be used prior to the first live patient, often student to student, injection. Results from a second study by Brand et al. demonstrated that students who had their initial experience administering LA on a training model did not differ in their self-opinions regarding their ability to administer LA over the control group. However, the student partner recipients of the injection reported that the experimental group appeared to be significantly calmer than the control group and that the injection was less painful.[10] Chandrasekaran et al. examined pre-clinical dental student anxiety levels towards administering and receiving a LA injection. Participants had neither administered nor received a LA injection from a student. Study results demonstrated that 40% of the student operators felt they could not make the patient comfortable and approximately 43% were unable to locate the insertion point and felt the need for additional supervision. Anxiety was common for both operators (46%) and recipients (51%) and nearly half of the students indicated a preference for some type of pre-clinical training model prior to the first student to student injection.[11]

The CODA authorizes the individual state regulatory bodies to determine the requirements for licensure in LA.[6,7] In the state of California, the Dental Board of California (DBC) sets the requirements for dentistry while the Dental Hygiene Committee of California (DHCC) regulates dental hygiene programs. Standards set by these regulatory bodies for dentistry and dental hygiene vary greatly. DBC mandates only that competency in LA be demonstrated for dental licentiates; alternately, the DHCC has specific regulations for LA in place in regards to the educational requirements.[12]

These requirements include:

- Thirty hours of instruction (15 didactic/preclinical and 15 clinical)
- Injection types: anterior nerve block, middle superior alveolar nerve block, anterior middle superior nerve block, posterior superior alveolar nerve block, greater palatine nerve block, nasopalatine nerve block, supraperiosteal, inferior alveolar nerve block (including Gow-Gates didactically only), lingual nerve block, buccal nerve block, mental nerve block, incisive nerve block, intraseptal
- Two injections of each type on another student during pre-clinical instruction
- Four clinical experiences per injection on four different patients (one of which may be another student)
- Competency evaluation of 75% or greater.

With respect to the variations in requirements for dental students versus dental hygiene students by state regulatory bodies in the state of California and the limited research regarding standard clinical teaching methods for LA, the purpose of this study was to determine if there was a difference in educational preparation and practical experiences between dental students and dental hygiene students in the administration of LA and management related complications.

Methods

This study was approved by the Human Subjects Committee, Institutional Review Board of Idaho State University (IRB-FY2017-101). A mixed methods approach consisting of a computer-based descriptive survey, a telephone interview and a comparative checklist was used to address the research questions. The checklist allowed for a comparison of LA course syllabi to the regulatory requirements, while the survey provided a means to gather more in-depth information about LA course content. The interview explored faculty perceptions regarding differences between dental and dental hygiene programs regarding LA didactic and clinical education.

The key study variables included LA course competencies, clinical administration requirements, didactic hour requirements, instructional experiences, practical experiences, and required competency-based performance evaluations for graduation. Additional variables included instructors' attitudes related to the instruction in dental and dental hygiene schools and the administration of LA by dental hygienists in clinical practice settings.

Program directors from the 6 dental schools and 29 dental hygiene programs in California received an email describing the study. Course instructors responsible for teaching LA were identified by the program director and invited to participate in the study. In the event the LA course instructor was unable to participate, the program director was invited to participate. Three reminders were sent to encourage participation and two $50 Amazon gift cards served as incentives for completion of the survey. Access to the Qualtrics® (Provo, UT) online survey was given after informed consent was received.

The self-designed survey was evaluated for validity and reliability prior to data collection. Validity was established using a 4-point Content Validity Index (CVI).[13] Five dental hygiene instructors with LA teaching experience were asked to rate each item for relevance using the CVI. Reliability was obtained using a test/retest method with a different group of dental hygiene instructors; 100% agreement was obtained. Modifications to the survey were made based on CVI and reliability scores, and feedback received from the content experts.

Individuals completing the survey were given the option of participating in a follow-up, phone interview scheduled at a mutually convenient time. Semi-structured interviews lasting approximately fifteen minutes were conducted and notes transcribed. The third phase of the study involved a review of the LA course syllabus. A separate email was sent to program directors and LA course instructors requesting a copy of the course syllabus. Syllabi were analyzed for similarities and differences and compared to a checklist based on the literature and regulations governing the administration of LA in the state of California.[7,14,15]

Results

Eighteen course instructors or program directors participated in the study for a response rate of 51%. One respondent was from a dental school while 17 were from dental hygiene programs. The original intent of this study was to make comparisons between dental and dental hygiene programs regarding LA didactic and clinical teaching methods. However, given the low dental school response (n=1), inferential statistics were not calculated and results are limited to descriptive statistics.

Local Anesthesia Survey

Survey respondents from the dental hygiene programs were primarily female (82%) program directors (65%) ranging in age from 35-54 years (71%), and a little less than half (47%) had been teaching for less than ten years. In comparison, the dental school respondent had taught LA for over 20 years.

In addition to demographic questions, the survey consisted of items related to LA curriculum including competency evaluation. Test scores were utilized by all dental hygiene program respondents (n=17). Additional evaluations included observations of the administration LA injection types (n=13, 77%). The dental school respondent reported using both didactic and clinical examination scores. In regards to types of educational experiences provided during LA instruction, 88% of the dental hygiene respondents (n=15) reported using visual or audiovisual aids and 77% (n=13) reported using inanimate object (fruit) injection experiences prior to the first live patient injection. The dental school respondent reported using visual or audiovisual aids in LA instruction. Simulation models were used by several participants (n=2), with 12% indicating using a simulator model when teaching all types of injections. LA instructional experiences are shown in Figure 1. Required elements for student competencies are shown in Figure 2.

Figure 1. Local Anesthesia Instructional Experiences

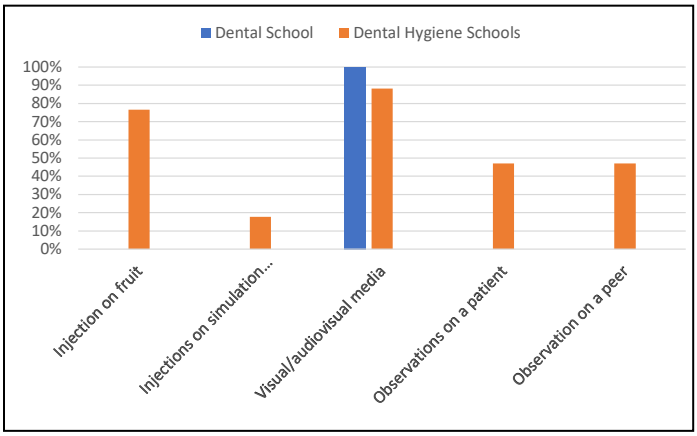
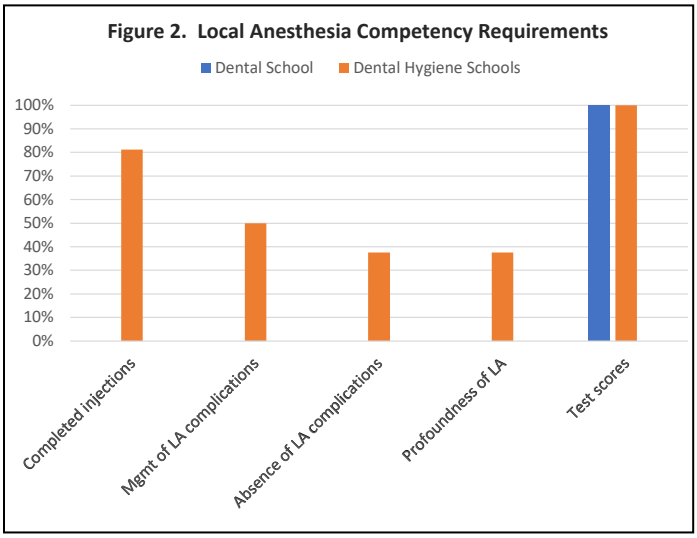


Figure 2. Local Anesthesia Competency Requirements



Participants were surveyed regarding the particular types of intraoral injections taught in the LA course. Sixteen of the 17 dental hygiene respondents reported teaching 12 types of intraoral injections; one participant noted that the Gow-Gates and the anterior middle superior alveolar nerve block injections were not taught in their curriculum. The dental school participant indicated teaching seven types of intraoral injections. In addition, the dental school required fewer student-to-student injections per type (n=7) than the dental hygiene schools (n=12). Results of the numbers of student-to-student injections administered as part of the dental and dental hygiene program educational experience are shown in Table I. Respondents were asked how many student-to-patient experiences were required prior to graduation. The majority of dental hygiene programs required three or more injections (student to patient) of each type. The dental school respondent reported there were no set number of student-to-patient injections required for graduation.

Table I. Number of Student-to Student Injections per Type

Injection	Dental School	Dental Hygiene Schools
Inferior Alveolar	1-2	1-7
Long Buccal	1-2	1-7
Gow-Gates	None	0-4
Lingual	1-2	1-7
Mental	None	1-4
Incisive	None	1-4
Intraseptal	None	1-4
Anterior Middle Superior Alveolar (AMSA)	1-2	0-7
Infra-Orbital (ASA)	1-2	0-7
Middle Superior Alveolar (MSA)	1-2	1-7
Posterior Superior Alveolar (PSA)	1-2	1-4
Greater Palatine	None	1-6

In regards to the types of procedural safety measures for LA taught, all participants (both dental and dental hygiene) indicated students performed a complete review of the patient's medical, dental, and drug history, determined any premedication needs, selected the appropriate type of LA, determined specific injection(s) and insertions site(s), prepared

the injection site with topical anesthetic, aspirated prior to depositing the anesthetic, aspirated on more than one plane, deposited the anesthetic solution slowly, and evaluated the adequacy of the anesthesia.

A little more than half of all respondents (dental school n=1; dental hygiene program n=9) indicated students received between 1 to 5 hours of didactic instruction in the management of local or systemic complications and a little more than a quarter (29%) of the dental hygiene program respondents (n=5) reported their students received 16 or more hours of instruction. In addition, the majority of the respondents from the dental hygiene and the dental school indicated that management of systemic and local complications of LA were also covered in other courses including pharmacology, dental emergencies, advanced clinical dental hygiene, periodontics, and pain control.

Respondents were asked questions pertaining to management of local and systemic complications. A local complication was defined as being localized to the region where the anesthetic was administered and included facial nerve paralysis, hematoma, needle breakage, paresthesia, pain on injection, post-anesthetic intraoral lesion, sloughing of tissues, soft tissue injury, or trismus. A systemic complication was defined as a reaction following the administration of LA and included allergic responses or overdoses. When presented with a complication (systemic or local) the students' role in management were to alert the instructor, observe and stay with the patient, explain the situation to the patient, provide post-op instruction, and monitor vital signs.

Regarding the frequency of systemic complications associated with LA in their respective programs 53% dental hygiene respondents (n=9) reported no systemic complications occurring per semester while 35% (n=6) reported 1-5 complications. In terms of local complications, 35% of the respondents indicated no local complications occurred per semester, 47% (n=8) reported 1-5 complications and 6% (n=1) indicated 11 or more local complications. Two dental hygiene participants and the dental school participant gave no response to the questions regarding complications.

Participants were asked whether students were allowed to administer LA unobserved after a specific number of injections had been demonstrated. Thirty-five percent (n=6) of the dental hygiene program respondents indicated that students could deliver LA independently after a specific number of successful injections had been observed while 53% (n=9) did not allow students to provide LA unobserved. Two dental hygiene participants and the dental school participant gave no response to the questions regarding unsupervised administration of LA.

Semi-structured Interview

Five individuals associated with dental hygiene programs agreed to participate in the qualitative portion of the study. Participants had been at their respective institutions between 2 to 23 years; one participant was a program director who was not currently teaching LA. Two participants had experience teaching in both dental and dental hygiene education programs and one was a former dental hygienist who is currently a dentist.

Participants' interpretation of the definition of direct supervision ranged from "the dentist is in the facility, but not in the operatory" to "the dentist is present from the beginning to the end of the procedure." When discussing the topic of direct supervision of LA for practicing dental hygienists, four of five participants indicated feeling it was not essential for a dentist to directly observe the administration of LA. Four of five individuals responded that they believed licensed dental hygienists are able to safely administer LA under general supervision. One participant indicated having concerns regarding patient safety and stated "although the hygienist is prepared to administer LA, they are not prepared to treat the complications that result."

When questioned whether they perceived major differences between LA education and preparation in dental versus dental hygiene educational settings, four of the five individuals indicated that more time was spent on student to student injections in laboratory settings in dental hygiene programs. One participant stated, "many of the dental schools have moved away from partner practice. They watch a video, go over landmarks, but they never actually practice on a partner. Alternately, most dental hygiene programs are required to administer injections repeatedly. After teaching in a hygiene school, dentists share their kudos for the hygiene programs and if they had that same training, they would have felt much more confident." Conversely, one participant felt that "dental students have a stronger understanding of reactions and receive more training in how to handle emergencies and emergency procedures than in hygiene school."

Participants were asked if direct supervision of dental hygienists should continue to be a requirement even if dental and dental hygiene students are taught LA theory and practice a comparable level. Four of five participants did not believe direct supervision of the licensed dental hygienist was necessary. They stated that in the event of a medical emergency, both dentists and dental hygienists would follow the same protocol and initiate the EMS system. One participant was concerned that "dental hygienists may not be trained in how to handle the emergencies that can result" while another individual stated, "the dentist and

hygienist are trained in all aspects of LA including not only technique, but also in emergency response."

Syllabus Checklist

Four participants provided syllabi for their program's LA course. The course syllabi were compared using a checklist to identify additional information about learning outcomes, methods of instruction, and evaluation not revealed in the survey. Each of the syllabi included learning outcomes pertaining to preventing, recognizing, and managing medical emergencies related to LA administration; identifying the need for and correct type of anesthetic based on medical history and the procedure; identifying the injection type for the specific procedure; and, performing injections to a minimum competency of 75% or higher. Instructional methods varied and included lecture, discussion, case studies, online and laboratory exercises, peer learning exercises, journal articles and a research project on one injection. Evaluations consisted of examinations, laboratory and homework assignments, and online modules.

Discussion

Results of this study demonstrated dental hygiene students within California were educationally prepared to select the appropriate injection sites, employ the correct techniques, and manage complications and safety issues for the administration of LA. Competencies in these areas were reflected in the course syllabi provided and noted on the LA checklist. Course requirements also reflected and, in some areas, surpassed CODA Standards.[6,7] Dental hygiene students in California had more institutional requirements related to student-to-student and student-to-patient LA experiences and there were few local and systemic complications noted which was similar to findings reported in previous studies.[2,9,16]

Considering the LA education requirements of dental hygiene students in California, most dental hygiene faculty members were in favor of general supervision for LA administration for licensed dental hygienists. While reporting of adverse LA events is rare, dental hygienists have the same requirements for cardiopulmonary resuscitation as their dentist counterparts and would have the same responsibilities for activating the emergency medical system. There are no reports in the literature of dental hygienists being unsafe while administering LA and the evidence does not support the subjective concerns expressed in the interviews in this study.[2,8,9,16]

The overall level of the educational experience dental hygiene students receive in California prepares them to work in a general supervision environment in private practice. The delivery of LA, the use of nitrous oxide oxygen analgesia and soft tissue curettage are the only designated duties requiring direct supervision for dental hygienists in California.[15] General supervision would permit dental hygienists to provide comprehensive preventive and therapeutic care for patients without the limiting requirement of the prescribing dentist's physical presence in the practice setting.

Results of this study are limited to dental hygiene programs in California and are cannot be generalized to other states. The low response rate from the 6 dental schools in spite of multiple contacts, limited the ability to make any significant comparisons between dental and dental hygiene programs. The use of a self-designed survey is an additional limitation. In general surveys are limited as they may lack depth and securing a high response rate may be difficult to control.[17] In order to balance these limitations, a CVI and reliability testing were used, and sections of the survey were available for open ended comments. Semi-structured interviews and syllabi checklists were also incorporated research protocol.

Additional studies focused on dental hygienists and LA should be considered. Broadening this study would provide a greater understanding on the depth and breadth of LA education and experiences dental hygiene students are required prior to licensure for clinical practice. It would also be valuable to include more dental schools in the study perhaps with a dentist educator as a co-investigator to achieve a higher response rate. Further research should continue to explore the use of simulation models in reducing student anxiety and increasing confidence levels and qualitative studies should be conducted among dental hygienists administering LA to understand their experiences working within various supervision levels.

Conclusion

This study examined the LA educational experiences of dental and dental hygiene students in California using surveys, interviews and a course syllabus checklist. Dental hygiene students in California appear to have comparable or enhanced LA education experiences as compared to the dental school surveyed in this study. Dental hygiene students in California programs appear to be well prepared through their education experiences to administer and manage complications related to local anesthesia and evidence suggests dental hygienists may be prepared to safely administer LA under general supervision. Consideration should be given to supporting changing the supervision requirements for the administration of local anesthesia by dental hygienists licensed in the state of California.

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Research

Dental Hygienists' Readiness to Screen for Intimate Partner Violence in the State of Texas

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Abstract

Purpose: Limited data document dental hygienists' preparedness for intimate partner violence (IPV) screening and response. The aim of this study was to assess dental hygienists' readiness to screen for IPV and provide baseline information for the realization of action toward addressing IPV.

Methods: The Domestic Violence Healthcare Provider Survey (DVHPS) instrument was distributed online to all members of the Texas Dental Hygienists' Association (n=1100). Four hundred fifteen emails were opened and 114 (n=114) surveys were returned for 28% response rate. This validated survey measures six scales: perceived self-efficacy, fear of offending patients, victim personality/traits, professional role resistance, perceptions of victim disobedience causing IPV, and psychiatric support. Descriptive statistics were used to calculate mean scores for each scale. Specific criteria were applied to interpret the level of readiness based on the scale scores.

Results: A little more than one quarter of the respondents (28%) reported having had course content related to IPV as students in their dental hygiene program curriculum, while 27% reported completing continuing education on IPV. A significant proportion of participants, 40%, were uncertain if routine IPV screening was within their professional role. They did not perceive self-efficacy in their screening capabilities (*m*=3.08 with 5.0 as the strongest), however they reported possessing a strong knowledge regarding IPV victims' personality/traits and did not blame the victims (*m*=1.92 and 1.48 respectively with 1.0 as the strongest).

Conclusion:. Results confirm earlier studies indicating the need for IPV training for oral health care professionals. Specifically, there is an evident need for training to increase dental hygienists' self-efficacy regarding IPV screening. Dental hygienists play a critical role in IPV screening and should be prepared to face the challenges presented by IPV and be available to meet the needs of IPV victims through referral to the appropriate support services.

Keywords: dental hygienist, intimate partner violence, IPV screening**,** spouse abuse, domestic violence

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Introduction

In the United States (U.S.), an estimated 20 individuals are abused physically in intimate partner violence situations every minute, every day.[1] Intimate partner violence (IPV), also known as domestic violence (DV), is experienced by both men and women; nearly 4,000,000 victims of abuse in the U.S. annually are women.[2] Over 42.4 million women have experienced IPV in the form of rape, abuse, or stalking sometime during their lifetime.[3] IPV affects women regardless of race, class, religious affiliation, age or economic status.

The state of Texas has a high incidence of IPV cases annually; 38% of women in the state of Texas reporting having experienced violence as compared to 33.3% of US women.[1,4] Additionally 75% of young adults in Texas have either experienced or know someone who has experienced dating violence.[4] In 2015, there were 158 documented cases of women killed by an intimate partner in Texas, more than 10% of the national total, with over 185,000 family violence incidents reported annually in the previous four consecutive years.[4] Accurate determination

of IPV prevalence across Texas remains difficult as the number of unreported cases remains unknown.

IPV is a health and social problem with growing recognition, producing damaging effects on individuals, families, and society. In addition to physical injuries, many IPV survivors suffer mentally and psychologically with fear, safety concerns, and post-traumatic stress disorder [PTSD].[3] Furthermore, IPV negatively affects the economy as victims lose 8 million paid working days each year, while IPV costs $8.3 billion for healthcare annually.[1]

Dental hygienists and dentists conduct routine examinations of the head, neck, and oral cavity during dental appointments, placing them in a unique position to identify and document signs of abuse.[5] Texas, along with California and North Dakota, is one of few states with mandatory IPV victim referral and reporting laws.[6] Texas law requires the reporting of suspected abuse and injury caused by a weapon, and Tex. Fam. Code § 91.003 requires healthcare providers to refer identified victims of IPV to domestic violence (DV) programs or service agencies.[7] Although some types of IPV including physical, sexual, verbal, economic, and psychological/ emotional are difficult for healthcare professionals to recognize, 75% of physical abuse occurs on the head, face, mouth, and neck.[5] Victims isolated from friends, family, and social services may present for scheduled or emergency dental appointments as a result of IPV.[7] Specific knowledge regarding IPV screening and response enhances the ability of dental hygienists' to fulfill these obligations and provide compassionate care, confidently communicate with victims, and manage victim needs.[8]

Increasing healthcare provider training, education and awareness of IPV is critical for primary prevention and effective response as it relies on the identification of risk and protective factors to prevent or care for victims of IPV. Secondary and tertiary interventions require efforts to intervene in the context of violence, and to provide referral resources for therapeutic support of survivors. Actions by healthcare providers to care for victims of IPV include documentation of signs and symptoms of abuse, respectful and compassionate communication, provision of information on community resources, and facilitation of access to services.[3] Healthcare providers, including dental hygienists, have an important role in recognizing and responding comprehensively to victims of IPV to support the safety of victims, facilitate the use of community resources, and reduce morbidity and mortality. Common deterrents to IPV response cited by healthcare professionals include lack of knowledge in identifying signs of abuse, practitioners' preconceptions and beliefs, and embarrassment or concern about offending the patient.[8] Assessment of dental hygienists' preparedness for IPV screening and intervention is requisite to the design and implementation of effective screening and intervention programs for victims of violence.

Preparation of Oral Health Professionals for IPV Screening

Standards for clinical dental hygiene practice cite the professional responsibility to evaluate patients for DV risk based on health history and clinical assessment.[9] The U.S. Preventive Services Task Force created a recommendation in the Healthy People 2020 objectives regarding Injury and Violence Prevention. It recommends increased IPV screening by healthcare providers for all women of childbearing age and increased referrals to intervention services following a positive screening.[10]

Dental hygienists, who routinely and universally screen patients, can play a significant role in identification, response, victim safety, and referral. The most recent data describing IPV curricular content in entry-level U.S. dental hygiene programs was published in 2002.[11] Despite widespread reporting and referral laws at that time, there was a lack of education and training in the curriculum for the preparation of dental hygienists to respond to this societal problem.

More recent studies have examined dental hygienists' IPV training obtained through continuing education, skill-based training, or other methods. A 2009 survey by Mascarenhas et al. indicated dentists and dental hygienists perceived a need for additional education on IPV and reported having received training exclusively through continuing education pathways.[12] Harris et al. suggested an increase in the educational preparation of dental hygienists with 92% reporting previous IPV training; however, dental hygienists reported feeling insufficiently trained to assist IPV victims.[13] Deficits identified included universal screening of patients for IPV, referral protocols, and knowledge regarding community resources. These perceived deficiencies in training reinforce the need for more effective education of dental hygienists in order to support increased awareness and ability to confidently and compassionately recognize and refer victims of IPV. Small-scale studies of training programs for dental students have resulted in improved readiness to screen for IPV as well as enhanced identification and informed response; however, similar data are unavailable for dental hygienists.[14,15]

Following a lack of training, deterrents impeding healthcare providers' ability to recognize, screen for, and refer victims of IPV include concern about offending the patient, the patient being accompanied by another person, and embarrassment in approaching the topic.[12] Confident healthcare professionals

are more comfortable questioning and engaging with patients in a caring manner about IPV, and can build a trusting relationship and positive rapport.[16] Opportunity combined with knowledge can dispel the providers' feeling of embarrassment or concern regarding offending the patient. Victims have expressed a desire for healthcare professionals to question and listen to them regarding IPV.[17]

Primary Healthcare Providers' Readiness to Screen for IPV

Studies of nurses, nursing students, medical residents, and licensed healthcare providers indicate a need for increased knowledge and preparedness for IPV screening, legal reporting, communication with victims who have disclosed abuse, and documentation.[8,18,19] Nursing students have questioned their professional responsibility related to IPV abuse screening.[8] Sundbörg et al. assessed the barriers faced by nurses in the IPV screening process and identified the presence of preconceived ideas pertaining to IPV victims, and a lack of confidence related to appropriate timing for asking questions related to IPV.[20] Results indicated nurses were more likely to screen for IPV when they knew how to recognize physical signs of abuse, could develop a relationship with the patient in a supportive environment, and were confident in their abilities to question and discuss IPV.[20] LaPlante et al. studied 147 residents across medical specialties and found 50% of residents' reported barriers to routine IPV screening that included inadequate training and feelings of being unprepared for counseling victims of IPV; however all respondents recognized IPV screening as a professional responsibility.[18] The researchers developed and implemented a two-hour course based on reported barriers for the residents and found an increase in knowledge and preparedness for IPV screening following the intervention. Healthcare professionals with training on IPV demonstrate improved perceived knowledge and preparedness for comprehensive response; however, the effects of training can diminish over time.[21]

The Domestic Violence Healthcare Providers Survey (DVHPS) is a published research instrument with strong psychometric properties used to assess health care providers' attitudes, beliefs, and self-reported behaviors related to the identification and management of IPV. Previous studies in Nigeria, Uganda, and Sweden employing the shortened version of the Domestic Violence Healthcare Providers Survey (DVHPS) found healthcare professionals' perceived self-efficacy and attitudes regarding IPV varied by discipline, gender, and age of the provider.[22-24] Males, those with increased years of practice experience, and older providers were less likely to screen for IPV and tended to blame the victim more than their counterparts. Healthcare professionals with higher perceived self-efficacy were more likely to screen for IPV. In Nigeria, social workers were most likely to screen, followed by doctors, nurses/midwives, and others.[22] In Uganda, nurses and midwives, predominately female professions, were more likely to screen than doctors, a predominately male profession.[23] Because gender and profession were significantly linked with professional roles and placing blame on the victim, the conclusions support a need for systematic training in IPV screening.[22,23]

A survey of nurses and physicians in a rural U.S. health network by Roush et al. using the shortened version of the DVHPS, found over half of the survey respondents had diagnosed at least one new IPV case in the previous year.[25] These respondents were considered to be more knowledgeable and reflected more positive attitudes, beliefs, and behaviors toward victims when compared to health care providers studied previously. One reason proposed for indicated readiness to screen for IPV was increased attention to the problem through media, campaigns, and healthcare organizations.[25]

The purpose of this study was to assess and describe the readiness of dental hygienists in the state of Texas to screen for IPV. The findings of this study, coupled with current evidence regarding comprehensive and effective response to IPV, were used to design a model for educational programming to improve the preparedness of dental hygienists' in screening, identification, interaction and response to victims of this recognized social problem.

Methods

Following approval of the study by the Human Subjects Committee of Idaho State University, a census survey of all Texas Dental Hygienists' Association's [TDHA] members (n=1100) was conducted. Members agreeing to answer the survey comprised the sample. The following inclusion criteria determined eligibility: dental hygienists holding an active license to practice in the state of Texas who provide oral healthcare services to patients a minimum of one day per month in a public or private setting. Exclusion criteria included dental hygienists practicing less than one day a month; participants with a faculty license, as it is not a full privilege license in Texas; participants with a suspended or retired dental hygiene license.

The DVPHS shortened version online survey, was used for data collection. Permission to utilize the DVHPS was obtained from the authors of the instrument. The original DVHPS instrument was developed and validated in the U.S. by Maiuro et al. to assess healthcare providers' attitudes, beliefs, and self-reported behaviors related to the identification and management of IPV.[26] The purpose of the shortened survey was to determine

providers' readiness to screen in terms of knowledge and self-efficacy.[27] The instrument consists of 22 items measuring the following six scales: perceived self-efficacy (six items), fear of offending patients (four items), victim personality/trait (five items), professional role resistance (three items), victim disobedience (two items), and psychiatric support (two items). Factorial stability, internal consistency, and concurrent validity of the shortened DVHPS were determined in separate studies by John et al. and Lawoko et al.[22,27]

The response to each survey item used a 5-point Likert-type scale allowing participants to express their degree of agreement or disagreement with each statement. The response choices for each question in the DVHPS were strongly disagree (1), disagree (2), uncertain (3), agree (4), and strongly agree (5). The first scale, perceived self-efficacy, and scale six, psychiatric support were positively keyed and increased scores indicate better preparedness to screen for IPV. The remaining scales (fear of offending patients; victim personality/traits; professional role resistance; victim disobedience causing IPV) were negatively keyed and lower scores indicate better preparedness.

Predetermined criteria were created by the study Principal Investigator (PI) in consultation with original authors of the instrument to interpret the participant's level of readiness based on mean response scores for each scale. Criteria were reviewed and deemed acceptable by the Maiuro research team responsible for developing the original DVHPS instrument.[26] Higher scores (mean ≥ 4) in perceived self-efficacy (scale 1) and psychiatric support (scale 6), signified a high level of self-efficacy and adequate access to psychiatric support services for patients. Mean scores of 2.1 to 3.9 indicated uncertainty, and mean scores ≤ 2 denoted a low level of self-efficacy and inadequate access to psychiatric services.

In the remaining scales, fear of offending patients (scale 2), victim personality/trait (scale 3), professional role resistance (scale 4), and victim disobedience (scale 5), mean scores of ≤ 2 signified participants had no fear of offending the patient, place blame on the victim for abuse, or question whether IPV screening is within the scope of dental hygiene practice. Mean scores of 2.1 to 3.9 indicated uncertainty, and a mean of ≥ 4 denoted fear of offending patients, blame of abuse on the patient, and unawareness of IPV as a part of the dental hygiene scope of practice.

Results

A total of 415 members of the TDHA opened the survey link and there were 114 respondents yielding a response rate of 28%. Of those responding, 19 did not meet inclusion criteria; two additional respondents did not start the survey, and three respondents only answered demographic and qualifying questions, for a total of 90 completed surveys to be included in the analysis.

The majority of participants were over 40 years of age, had practiced dental hygiene for more than 15 years, and possessed a bachelor's degree or higher. Only 28% of the respondents' reported their entry-level dental hygiene curriculum had contained IPV content. A majority of the respondents (67%) indicated a lack of continuing education on IPV post-graduation, as it is not state mandated.

Descriptive statistics for each of the six scales assessed by the DVHPS are presented in Table I. Mean scores were: self-efficacy, 3.08; fear of offending patients, 2.57; victim personality/trait, 1.92; professional role resistance, 3.62; victim disobedience, 1.48; and, psychiatric support, 2.55.

Table I. DVHPS Scales: Mean, Median, Mode

Scales	M	Mode	SD
1: Perceived self-efficacy	3.08	3.00	0.61
2: Fear of offending patients	2.57	2.25	0.71
3: Victim personality/trait	1.92	1.0	0.68
4: Professional role resistance	3.62	3.33	0.67
5: Victim disobedience	1.48	1.0	0.56
6: Psychiatric support	2.55	3.0	1.01

Note: Scale 1 and 6 are positively keyed with the desirable mean being a 5. Scales 2-5 are negatively keyed with the desirable mean being a 1.

Table II includes frequency of responses for each survey item within the six scales assessed by the shortened version of the DVHPS. Within scale 1, self-efficacy, the majority of respondents disagreed/strongly disagreed (62.2%) that they have "no time to ask" patients about IPV during dental hygiene appointments. When asked, most respondents (68.9%) did not perceive they had available information about IPV management or advocates for their patients who were identified as IPV victims, while 56.7% disagreed/strongly disagreed they had access to social workers and community advocates to assist their patients. Most respondents reported being uncertain about making referrals (30%) or disagreed/strongly disagreed (35.6%) that they possessed the ability to make appropriate referrals for IPV.

Within the second scale, fear of offending patients, 64% of respondents did not agree that asking about IPV was an invasion of privacy, and 70% did not agree questioning is

Table II. Frequency of Responses to Items within DVHPS Scales* (n=90)

Scale	Item	Strongly Agree	Agree	Unsure	Disagree	Strongly Disagree	Missing	Total
1 (Q1-6)	1. No time to ask	2 (2.2%)	7 (7.8%)	25 (27.8%)	48 (53.3%)	8 (8.9%)	0	90
	2. Strategies to help	4 (4.4%)	31 (34.4%)	45 (50.0%)	5 (5.6%)	5 (5.6%)	0	90
	3. Make appropriate referrals	7 (7.8%)	24 (26.7%)	27 (30.0 %)	24 (26.7%)	8 (8.9%)	0	90
	4. Access to information	4 (4.4%)	12 (13.3%)	12 (13.3%)	48 (53.3%)	14 (15.6%)	0	90
	5. Access to advocates	8 (8.9%)	13 (14.4%)	18 (20.0%)	33 (36.7%)	18 (20.0 %)	0	90
	6. DH manage IPV	10(11.1%)	46 (51.1%)	32 (35.6%)	1 (1.1%)	1 (1.1%)	0	90
2 (Q7-10)	7. Afraid of offending	2 (2.3%)	29 (33.3%)	14 (16.1%)	35 (40.2%)	7 (8.0%)	3	87
	8. Invasion of Privacy	1 (1.1%)	8 (9.2%)	22 (25.3%)	47 (54.0%)	9 (10.3%)	3	87
	9. Abuse questioning is demeaning	1 (1.1%)	4 (4.6%)	21 (24.1%)	50 (57.5%)	11 (12.6%)	3	87
	10. Abuse questioning is upsetting	1 (1.1%)	16 (18.4%)	43 (49.4 %)	24 (27.6%)	3 (3.4%)	3	87
3 (Q11-15)	11. Victim benefits from abuse	0 (0.0%)	5 (5.8%)	9 (10.5%)	31 (36.0%)	41 (47.7%)	4	86
	12. Victims choose to be	1 (1.2%)	4 (4.7%)	6 (7.0%)	31 (36.0%)	44 (51.2%)	4	86
	13. Violence takes two	0 (0.0%)	5 (5.8%)	10 (11.6%)	33 (38.4%)	38 (44.2%)	4	86
	14. Personalities cause abuse	2 (2.3%)	6 (7.0%)	16 (18.6%)	26 (30.2%)	36 (41.9%)	4	86
	15. Passive-dependent personalities	0 (0.0%)	14 (16.3%)	25 (29.1%)	27 (31.4%)	20 (23.3%)	4	86
4 (Q16-18)	16. Not my place	2 (2.4%)	9 (10.6%)	24 (28.2%)	39 (45.9%)	11 (12.9%)	5	85
	17. Investigating the cause	2 (2.4%)	8 (9.4%)	25 (29.4%)	32 (37.6%)	18 (21.2%)	5	85
	18. None of my business	1 (1.2%)	9 (10.6%)	22 (25.9%)	41 (49.2%)	12 (14.1%)	5	85
5 (Q19-20)	19. Stepping out of roles	0 (0.0%)	1 (1.2%)	7 (8.2%)	27 (31.8%)	50 (58.8%)	5	85
	20. Victim was disobedient	0 (0.0%)	0 (0.0%)	3 (3.5%)	32 (37.6%)	50 (58.8%)	5	85
6 (Q21-22)	21. Access to referral services	8 (9.4%)	14 (16.5%)	24 (28.2%)	27 (31.8%)	12 (14.1%)	5	85
	22. Mental health services	7 (8.2%)	4 (4.7%)	23 (27.1%)	29 (34.1%)	22 (25.9%)	5	85

*Scale 1 = Perceived self-efficacy, 2 = fear of offending patient, 3 = victim/personality traits,
4= professional role resistance, 5 = victim disobedience, 6 = psychiatric support.

demeaning to patients. However, most respondents strongly agreed/agreed (35.6%), or were uncertain (16.1%) about being afraid to offend patients when inquiring about IPV. Nearly half of the respondents (49.4%) were uncertain if questioning the patient on IPV would upset the patient.

With regards to the third scale, victim personality/traits and the fifth scale, victim disobedience, 5 responders (6%) indicated agreement that IPV victims benefit from the abusive relationship or they would leave; victims choose to be victims, or victims benefit from the abusive relationship. Furthermore, one responder agreed that stepping out of traditional roles warrants abuse, however none of the respondents agreed that a victim's behavior causes violence in the relationship.

When considering the fourth scale, professional role resistance, 29% of the respondents were uncertain whether investigating the cause of IPV was within the scope of practice for health care providers, while 12% perceived it was not a part of health care practice. Many participants expressed uncertainty regarding asking about IPV with 28% responding that it was not their place and 26% that it was none of their business.

Regarding psychiatric support (scale 6), 28% of respondents were uncertain if their office/practice had adequate resources for referral services, while 46% disagreed that they had adequate access to referral services for their patients when IPV is identified. Only 13% strongly agreed/agreed they had adequate access to community or mental health services that might benefit these patients.

Discussion

IPV abuse often occurs repeatedly for the victim, thus training health care professionals to routinely screen, identify and respond to victims of IPV is critical to preventive and response efforts aimed at reducing the occurrence, morbidity and mortality of IPV.[3] The dental hygiene appointment provides an ideal opportunity for early detection and prevention of trauma if professionals are trained to recognize and report abuse, refer victims, and provide compassionate communication.[12]

The low percentage of participants reporting having IPV curricular content in entry-level programs' closely reflected findings reported in the 2005 survey of U.S. dental hygienists.[11,28] This finding, however, is significantly lower than practicing dental hygienists' retrospective perceptions of curriculum content reported in subsequent studies.[12,13] The number of participants reporting having attended continuing education (CE) with IPV content was also substantially lower. Most participants in this study reported practicing dental hygiene for over 15 years; therefore, their recollection of curricular content might have been a factor. Little progress has occurred during this time to assess entry-level preparation of dental hygienists to effectively identify and respond to victims of IPV based on a deficiency in existing literature on IPV content in dental hygiene educational programs. A survey of U.S. dental hygiene programs is needed to document current IPV curricular content for entry-level dental hygienists.

Participant responses to the questions on the DVHPS in this study, indicated four areas in which dental hygienists' lacked confidence regarding IPV screening: self-efficacy; fear of offending patients; professional role resistance; and scale psychiatric support. These areas of uncertainty can lead to dental hygienists' failure to screen or address signs of IPV, despite the dental hygienists' optimum position for abuse recognition.[11-13, 28]

This lack of confidence may be related to their lack of education and training. Dental hygienists who have completed IPV trainings, possess higher self-efficacy and are more likely to screen, intervene, and refer victims of IPV.[14] Additionally, study findings in dentistry and other health care disciplines support the effectiveness of a brief training course in improving preparedness for IPV screening.[18,28] Healthcare professionals confident in screening, early detection, and effective interventions can reduce the risk of violence and abuse without providing further harm to the patient. It is critical that clinicians be aware of effective screening tools and know how to access resources in the healthcare setting and community in order to keep victims safe.[29] Dental hygienists responding to this survey expressed inadequate access to agencies, advocates, community and mental health services for referral of patients identified as IPV victims. A healthcare professional's ability to quickly refer a victim to a specialist or shelter for medical treatment, coupled with identification and intervention has been shown to be lifesaving.[2]

When asked if abuse-related questioning was offensive to IPV victims, the majority of this survey's participants indicated that they were either uncertain or agreed they feared offending patients. Findings regarding apprehension about offending or upsetting patients by questioning them on IPV are potential barriers to implementation of universal screening and align with previous published studies of dental hygienists and other health care providers.[12,25] Practitioners need to be aware that IPV victims have expressed a desire to have health professionals question and listen to them regarding IPV.[17]

Regardless of health care providers' mandated reporting requirements for IPV in Texas, many of the respondents in this study were unsure if addressing IPV was within their scope of practice. Screening for IPV should be an interprofessional effort for healthcare professionals. However, a significant proportion of these respondents were either unsure or did not think IPV was within the professional role of the dental hygienist, or believed IPV was none of the clinician's business if the abuse was not revealed to them by the patient.[13] Previous research indicated nurses did not perceive IPV screening and victim intervention was within their scope of practice, leading to failure to screen and refer victims.[8,20] These findings indicate that interprofessional educational efforts should be pursued.

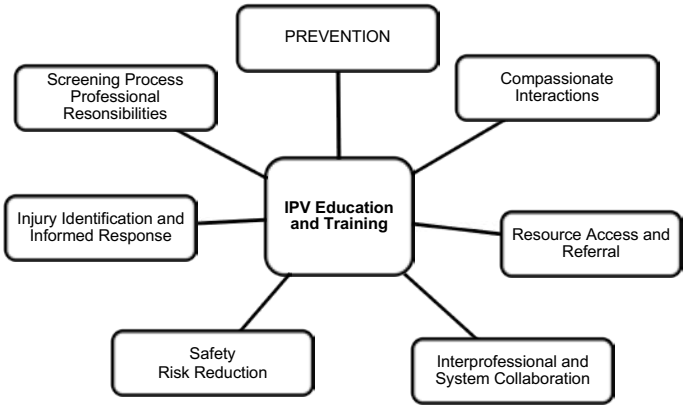
Participants' responses to the DVHPS indicated a strong level of knowledge and awareness regarding victim actions not triggering violence and not placing blame on the victim for experiencing IPV. The vast majority of respondents in this study were females, so this factor may have affected their perceptions and ability to empathize with their patients. Earlier studies suggest that male healthcare providers are more likely to perceive personality and disobedience as triggers for abuse.[22,24]

Results from this study support previous research indicating that despite receiving some training on IPV, the majority of dental hygienists perceive themselves as inadequately prepared to address and assist victims of IPV and are uncertain/disagree

whether IPV is within their scope of practice.[12,13] Common across previous studies is the lack of confidence expressed by dental hygienists. Barriers to screening identified include fear of offending the patient when questioning about abuse and inadequate knowledge and preparation on IPV screening and response. Findings from this study are also similar to those of Harris et al. indicating respondents' perception of inadequate referral services.[13]

Dental hygienists possess a strong level of knowledge and awareness regarding IPV and do not blame the victim for IPV abuse. However, the need for additional training to increase dental hygienists' self-efficacy; specifically including IPV content on recognition, assessment, and referral of IPV victims, as well as compassionate communication with confidence is supported by the results from this study. Findings of this study combined with other research regarding dental hygienists and IPV provides the foundation for a model integrating educational interventions to enhance dental hygienists' preparedness to routinely screen and effectively respond to IPV. Figure 1 provides a visual representation of suggested content for IPV Educational Intervention Training.

Figure 1. Proposed Brief Educational Intervention Model for IPV Training for Dental Hygienists



Limitations

This study was conducted using a sample of dental hygienists who were members of the TDHA and responses from professional association members might not be reflective of the preparedness of all dental hygienists in Texas. Also, there are 1,000 members of the TDHA and 12,900 dental hygiene licentiates in the state of Texas. Results from the 28% (n=114) response rate cannot be generalized beyond this sample. A follow-up question was posted on the TDHA Facebook page to determine potential reasons for the low response rate in this study. Patterns of non-respondents could not be determined with this unstructured, anonymous query of TDHA members. The most frequent responses cited for not completing the survey included: I do not see many patients who are victims in my practice, and I did not see or receive the email sent by TDHA.

Participants also could have answered survey questions based on their perceptions of expected responses instead of individual beliefs. Maiuro et al. validated the full survey in the U.S, however, the shortened version was validated in Sweden and Nigeria and may contain cultural phrases appropriate for those countries.[26,27]

Conclusion

Findings of this study support previous research establishing a need for healthcare professionals to acquire additional IPV-related education to foster sensitive interactions, safety, injury prevention, adequate healthcare, and provision of guidance for IPV victims. Research indicates healthcare providers' knowledge gaps in this area can be overcome with specific education and training on IPV. Specifically, there is an evident need for training to increase dental hygienists' self-efficacy regarding IPV screening.

Dental hygienists play a critical role in IPV screening and should be prepared to face the challenges presented by IPV and be available to meet the needs of IPV victims through referral to the appropriate support services. An educational model can be used to enhance screening, identification, response, and interaction of dental hygienists with victims of IPV. Future studies focused on testing this educational model with healthcare providers can enhance and advance interprofessional efforts.

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