



American  
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Association

# Journal of Dental Hygiene

December 2021 • Volume 95 • Number 6

- Caregivers' Comprehension of the Terms Decay and Cavities:  
A qualitative analysis
- Attitudes of Virginia Dentists Toward Dental Therapists: A pilot study
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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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# Defining the Profession in the 21st Century



Catherine K. Draper, RDH, MS

As a writer and an editor, I spend a considerable amount of time every day working with words. Small changes in a word choice or tense can make a big difference in the meaning conveyed in a manuscript. The wrong word choice can lead to misunderstanding or misleading the reader. However, looking past the written word, it is important to look at how word choice impacts all aspects of life, especially when we consider our professional identity. How we identify ourselves within healthcare impacts the future of the dental hygiene profession. While there are many opportunities for dental hygienists to expand access to preventive oral health care services, and participate as members of interprofessional health care teams, some of the challenges to these opportunities can come from how we perceive ourselves. Do we see ourselves as “hygienists” providing “gentle cleanings,” or do we see ourselves as oral health care professionals providing comprehensive, preventive oral health care services? While most of us will say the latter, unfortunately the public perception is that we primarily “clean teeth” and also scold them about flossing.

This image was brought into clear focus recently when the Illinois Dental Society’s lobbyist, Dave Marsh was quoted in the news media stating, “I just don’t feel anybody with a two-year associate degree is medically qualified to correct your health. They are trained to clean teeth. They take a sharp little instrument and scrape your teeth.... That’s all they do.”<sup>1</sup>

As incorrect as Mr. Marsh’s comments are, every time we allow others to advertise our services as “dental cleanings”, or even “deep cleanings,” we continue

to reinforce this perception. Rather than remaining silent, as a profession we must work to change these perceptions from within, as well as in the eyes of the public.

Word choice can have a lasting impact on our professional identity. We know that oral health is essential to overall health and well-being, and that as oral health care professionals, we are essential health care providers. However, we must promote and see ourselves as the oral health care professionals we are, as opposed to being part of a larger dental industry which has become focused on cosmetic procedures and smile design. While promoting and advancing oral health care certainly involves economics, the focus should be on increasing access to essential oral health care services in a cost-effective manner, rather than a business venture.

Reflecting over the past twenty years, we have published numerous manuscripts and studies on the pivotal role dental hygienists are ready to play in addressing oral health disparities. In this issue we have three manuscripts focusing on the education, career paths and scholarly work opportunities available as the profession moves beyond the associate degree.

We now have state legislation allowing for mid-level oral health providers in twelve states with ongoing legislation in nine additional states.<sup>2</sup> Some form of direct access to dental hygiene care is now available in forty-two states.<sup>2</sup> The opportunities outside of clinical practice are expanding and we have the education and skills to meet the complex oral health needs of a diverse population. We provide oral care that extends far beyond “cleaning teeth.” It is time that we define ourselves as the essential oral health care providers that we truly are.

**Catherine K. Draper, RDH, MS** is the Managing Editor of the *Journal of Dental Hygiene* and a faculty member in the Biological and Health Sciences Division, Foothill College, Los Altos Hills, CA, USA.

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# Caregivers' Comprehension of the Terms Decay and Cavities: A qualitative analysis

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Melissa Sullivan, MS, RDH; Julia Richman, DDS, MSD

### Abstract

**Purpose:** Tooth decay and cavities are the most common oral health consequences for young children that may result from inadequate oral health literacy (OHL) or understanding of their caregivers. The purpose of this study was to describe the understanding of terms related to decay and cavities among caregivers of preschool-aged children.

**Methods:** English-speaking caregivers with children aged <6 years were recruited from two private dental practices located in Washington State. A qualitative analysis was performed using responses regarding the terms decay and cavities as part of the 36 item Oral Health Literacy Inventory for Parents (OH-LIP). Responses were recorded, transcribed, coded, and assigned to domains and categories.

**Results:** Responses from 111 participants were included in the analysis. About one fifth of the participants (19.8%, n=22) indicated that they did not know what decay was or provided an incorrect response. The majority (71.2%, n=79) made the association that decay was something bad that happens to the teeth. However only a minority of the participants (9%, n=10) correctly identified decay as destruction of the tooth surface because of bacterial action. When asked to define the word cavities, more than half (68.5%) indicated that cavities were something harmful to teeth, while only about one quarter (27%, n=30) correctly identified cavities as resulting from the decay process.

**Conclusions:** Knowledge disparities related to the terms decay and cavities among caregivers suggest that more education is needed regarding the tooth decay process and factors causing dental caries to ensure timely preventive services are received. Gaps in oral health literacy should be addressed by health care professionals. Dental hygienists are in an ideal position to educate caregivers as well as non-dental health care professionals who provide services to caregivers and children.

**Keywords:** dental caries, tooth decay, health literacy, oral health literacy, pediatric oral care, qualitative analysis, behavioral research

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### Introduction

Dental caries among preschool-aged children in the United States (US) remains a public health concern. Despite early promotion efforts such as establishing a dental home, recommending the first dental visit by age one, and the integration of collaborative approaches with medical professionals,<sup>1</sup> dental caries among young children continues to occur.<sup>2</sup> In 2015-2016, 21.4% children aged 2-5 years were reported to have active dental caries while 8.8% had untreated dental caries.<sup>2</sup> Untreated dental caries can negatively impact growth and development, learning, and overall health.<sup>3</sup> Caregivers' oral health knowledge and

overall awareness of the child's dentition may play a critical role in preventing a potential dental emergency. Divaris et al.<sup>4</sup> found that a caregiver's reported oral health status for their young child generally correlated to the treatment needed. For example, children of caregivers who reported their child's oral health status as fair or poor were more likely to present with extensive treatment needs. Additionally, a small proportion of the caregivers with children under 2 years who indicated the child had good health status, had actually underestimated the child's treatment needs.<sup>4</sup> Similarly, Talekar et al. found that caregivers perceived a poor oral health status if they felt that

the child needed treatment or preventive dental care, and if the child's general health was less than excellent.<sup>5</sup> Conversely, if the child was caries free, caregivers perceived that as having better oral health.<sup>5</sup>

Caregivers' understanding of oral health has a significant impact on oral health behaviors and the adoption of professional recommendations for themselves as well as their child. Caregivers must be able to understand and apply health and oral health information so that the child receives appropriate and timely preventive services. This process, known as oral health literacy (OHL), has been defined as, "...the degree to which individuals have the capacity to obtain, process and understand basic oral craniofacial health information and services needed to make appropriate health decisions."<sup>6</sup> Baskaradoss et al. found that caregivers' poor OHL was related to untreated dental caries among children as well as a greater lifetime of dental caries and treatment needs than caregivers who were identified as having adequate OHL.<sup>7</sup> Miller et al. also identified an association with caregivers' OHL and the child's oral health status.<sup>8</sup> When examining the financial impact to the health care system, Vann et al. found that young children of caregivers with low OHL had higher expenditures for emergency dental care than caregivers with higher levels of OHL.<sup>9</sup>

The Rapid Estimate of Adult Literacy in Dentistry-30 (REALD-30) is a word recognition test<sup>10</sup> that has been used to measure OHL among adults with young children<sup>4,9-10</sup> Within the last decade, Richman et al. developed a 36-item Oral Health Literacy Inventory for Parents (OH-LIP), which focuses on pediatric oral health literacy by assessing word recognition, vocabulary, and comprehension of caregivers.<sup>11</sup> Richman et al. administered the OH-LIP inventory among 45 caregivers of children who attended a Head Start program and found that 48% of caregivers demonstrated a misunderstanding of the term decay.<sup>11</sup> In fact, the comprehension of decay had the most incorrect responses of all terms in the inventory. Although "decay" is not a technical term, it is used in the vernacular frequently, and as such is a critical oral health related word. Understanding and comprehending the decay process is important for healthy, at-home oral hygiene and diet choices for both caregiver and child. While the OH-LIP allows for the evaluation of correct and incorrect responses of term recognition and vocabulary, examining the comprehension of terms is of equal importance.

Tooth decay and cavities are the most common oral health consequences for young children that may result from inadequate OHL or understanding of their caregivers. The purpose of this study was to answer the question, "What are caregivers' comprehension and understanding of the terms

decay and cavities related to children's oral health?" through the qualitative analysis of caregivers' responses on the OH-LIP inventory.

## Methods

A qualitative analysis was performed on responses from the Oral Health Literacy Inventory for Parents (OH-LIP) made by consenting, English-speaking caregivers with children aged <6 years. Participants were recruited from two private dental practices in Washington State from February to August 2012. The OH-LIP instrument is a multi-part oral health literacy inventory that has been examined previously for face and content validity.<sup>11</sup> The inventory contains 36- terms related to pediatric oral health and consists of three components: word recognition (part I), vocabulary knowledge (part II), and comprehension (part III).<sup>11</sup> The OH-LIP was conducted by one of two interviewers both of whom were trained to administer the instrument. Interviews were recorded and transcribed, and the transcriptions were coded by one investigator to eliminate inter-examiner variability.

To evaluate word recognition, caregivers were asked to read the terms aloud. Vocabulary knowledge was assessed by the examiner reading the terms aloud and the caregiver providing a definition. Comprehension by caregivers was measured by brief passages from oral health literature.<sup>11</sup> This was not designed as an exhaustive measure of comprehension, however it provides a way to measure whether the caregiver understands the basic term far more than reading recognition alone. For example, another OH-LIP term "erupt" led many caregivers to suggest it meant an abscess, pus, or an infection versus a tooth coming into the mouth, even though they were able to read the term correctly. Caregivers were not asked to select from multiple options defining the term but were asked to define a term using their own words.

Participants' responses to the OH-LIP inventory were audio recorded, transcribed, and verified for accuracy.<sup>12</sup> The focus of this investigation was to qualitatively analyze caregivers' comprehension (part three of the OH-LIP) regarding the terms, "decay" and "cavities." The data used for this study was from a larger set of data collected by one of the investigators of the current study. The institutional research compliance office of Old Dominion University deemed the study as "not human subjects research" since the data was collected and provided to the authors without identifiers.

## Data Analysis

Demographic data was analyzed using descriptive statistics including counts and percentages. A general inductive approach was used to qualitatively analyze responses from

the OH-LIP-III for the terms decay and cavities. The general inductive approach establishes meaning of the raw text to the research question or objectives, creates themes or categories from the raw text, and summarizes themes or categories, which may develop into a model or theory.<sup>13</sup> The following approach was used: 1) Each term was coded based on the level of content related to “decay” and “cavities” to create the main themes; 2) Domains were created based on common responses and patterns observed for each of the themes; 3) Responses were categorized based on the participants’ own words and corresponding term definitions. One investigator completed the initial review of responses associated with each term and created domains and categories. Next, two other investigators independently assessed and assigned responses to the predetermined categories by the first investigator. After this process was completed for both terms, the investigators reviewed responses and assignments together to assess the level of agreement with categories. For the term “decay,” the investigators were inconsistent 33 times out of the 111 responses, and for “cavities” 26 times out of the 111 responses. For responses that were inconsistently assigned by the investigators, it was discussed until a mutual agreement was met for the category assignment.

## Results

Demographic data and word inventory responses were provided for the caregiver participants (n=114); three participants did not provide responses to the word items “decay” and “cavities” and were excluded from the analysis. Descriptive statistics showed the majority of the participants were female (85%), between 18 and 35 years of age (97%), identifying as Caucasian or White (76%), Non-Hispanic (88%), with English as the primary spoken language at home (86%). More than half (67%) of the respondents reported a household income of less than \$40,000 and 90% of caregivers reported obtaining at least a high school degree or GED or higher. (Table I).

All participants (n=111) responded correctly when asked to say the words “decay” and “cavities” aloud from the full list of thirty-six words used in the inventory. Participants were then asked to define each word in the inventory to the best of their ability. Each word definition was given a score of “not correct,” “partially correct,” or “fully correct.” Fewer than 10% of the participants provided a fully correct response to the words, “decay” (6.3%) and “cavities” (5.4%). The majority had a partially correct response for “decay” (74.7%) and “cavities” (71.2%). Each participants’ response (definition of the term) was categorized and placed under one of the established domains based on the collective themes found in the responses for the terms “decay” (Table II) and “cavities” (Table III).

**Table I. Participant demographics (n=111)\***

Caregiver Characteristic	Category	n (%)
<b>Sex</b>		
	Female	94 (85)
	Male	16 (15)
<b>Age (years)</b>		
	18-25	33 (29)
	26-35	64 (55)
	46-55	3 (3)
<b>Race</b>		
	Caucasian or White	78 (76)
	African American, African, or Black	5 (5)
	American Indian or Alaskan Native	1 (1)
	Native Hawaiian or Pacific Islander	6 (6)
	Asian or Asian American	8 (8)
	Other	4 (4)
<b>Ethnicity</b>		
	Hispanic or Latino	13 (12)
	Not Hispanic or Latino	97 (88)
<b>Education Level</b>		
	Some high school	12 (11)
	High school degree or GED	31 (28)
	Some college	35 (32)
	College degree or graduate school	33 (30)
<b>Primary language at home</b>		
	English	95 (86)
	Other	16 (14)
<b>Annual household income</b>		
	under \$10,000	18 (16)
	\$10,000-\$39,999	56 (51)
	\$40,000-\$69,999	24 (22)
	\$70,000-\$99,999	11 (10)
	\$100,000 or above	1 (1)

\* Responses to all categories does not equal n=111



**Table II. Participant responses and domains for the term “decay” (n=111)**

Domain	Category	Sample responses
1 Do not know or incorrect response (n=22)	a. Do not know the meaning (n=9)	“I’m not too sure.” “I don’t know what that is.”
	b. A flaw on your tooth (n=13)	“Decay is the wearing of the tooth.” “Black stuff on your teeth.”
2. Teeth going bad (n=79)	c. When teeth are rotting (n=70)	“Decay is teeth that are rotting.” “Part of your tooth is dying.” “Your tooth falling apart.”
	d. When teeth are not brushed (n=9)	“What happens to your teeth if you don’t take care of them.” “Decay is what happens when you don’t brush your teeth.”
3. Disease on tooth (n=10)	e. Decay is caused by bacteria or infection (n=10)	“A tooth that has an infection.” “Decay is the germs that eat away at the tooth.”

**Table III. Participant responses and domains for the term “cavities” (n=111)**

Domain	Category	Sample responses
1. Do not know or incorrect response (n=5)	a. Do not know (n=5)	“I don’t know how to explain cavities.”
2. Something that harms the teeth (n=76)	b. Bad teeth; holes in the teeth (n=27)	“Makes your teeth bad.” “Holes in your teeth that cause pain.”
	c. Bacteria, germs, or bugs (n=11)	“Bacteria in the teeth.” “It’s some type of germs that the teeth have.”
	d. Not taking care of teeth (n=16)	“A sign you’re not brushing enough.” “What your teeth get when you don’t brush very good.” “What happens to your teeth when you don’t brush.”
	e. Eating sugar (n=22)	“Cavities are what you get from eating sugar.” “When you eat too much sugar.”
3. Cavity is a result of decay (n=30)	f. Caused by decay (n=30)	“Cavities are a result of decay.” “That’s teeth that have started decaying.”

The investigators then analyzed the participants’ responses to the terms decay and cavities, to examine their understanding and comprehension. Domains were developed based on common themes from the responses for each term.

**Participant responses to the decay term**

**Domain 1. Do not know**

Nearly one-fifth of the participants (19.8%, n=22) indicated that they did not know what decay was or provided a definition that was incorrect or unrelated. Some stated they did not know the definition of decay while others concluded that decay was some type of flaw in the tooth structure. For example, “*Decay is the wearing of the tooth.*”

**Domain 2. Teeth going bad**

A majority of the participants (71.2%, n=79) made the association that decay was something bad that happens to the teeth. Most of the respondents described decay as a tooth dying, falling apart, or rotting. A few of the respondents perceived the term decay as something that happens to the teeth when there was no oral hygiene care. In fact, one respondent stated, “*What happens to our teeth if you don’t take care of them.*”

**Domain 3. A disease on the tooth**

Fewer than one-fifth of the participants (9%, n=10) identified decay as being caused by bacteria, germs, or infection. These respondents correctly identified decay as destruction of the tooth surface because of bacterial action. One respondent indicated that decay was a “*Tooth that has an infection*” (Table II).

**Participant responses to the cavity term**

**Domain 1. Do not know or incorrect response**

Only a few of the participants (4.5%, n=5) indicated that they did not know or could not explain the term cavities. These

respondents simply stated, “*I don’t know,*” or provided an incorrect response when asked to define the term.

### ***Domain 2. Something that harms the teeth***

Two-thirds of the participants (68.5%, n=76) indicated that cavities were something that is harmful to teeth. Nearly, one-half of the respondents in this domain associated the term cavities with “*bad teeth or holes,*” or “*bacteria, germs, or bugs.*” One respondent reported, “*Holes in your teeth that cause pain.*” The other respondents in this group associated cavities with poor oral hygiene, “*A sign you’re not brushing enough,*” or eating a high sugar diet, “*Cavities are what you get from eating sugar.*”

### ***Domain 3. A cavity is the result of decay***

Over one-quarter of the participants (27%, n=30) made the association between decay and cavities. All respondents in this domain identified cavities as a result of the decay process. One respondent stated, “*That’s teeth that have started decaying*” (Table III).

## **Discussion**

Dental hygienists provide care in a variety of clinical settings including community health and public health centers, schools,<sup>14</sup> and medical settings.<sup>15</sup> As oral health care professionals, they play a critical role in educating caregivers as well as non-dental professionals on the impact of the caregivers’ OHL as it relates the child’s oral health status. Findings from this study revealed that only 5-6% of the respondents were able to provide a fully correct response to the definition of the terms decay and cavities. In addition, fewer than 10% of the respondents were able to clearly make the connection that tooth decay is caused by bacteria or infection and only about 25% of the caregivers were able to make the association between decay and cavities. In an earlier study by Richman et al., decay was found to be the most misunderstood term in the comprehension portion of the OH-LIP inventory among caregivers attending two Head Start programs.<sup>11</sup> This finding was the motivation for the current study to determine whether similar results would be evident among caregivers attending a private dental office. Based on the findings of this study, comprehension of decay and cavities is still misunderstood by caregivers of children under the age of six years. Findings from the current study also demonstrate that the understanding and comprehension of the terms decay and cavities is inadequate, regardless of population settings (i.e. Head Start or private dental office), which further highlights concerns related to dental cavities and untreated decay among children observed at the national level.<sup>2</sup>

Caregivers’ OHL and understanding of the dental caries process impacts the oral health outcomes of the children in their care. Furthermore, mothers’ and/or caregivers’ oral hygiene habits and behaviors are translated to the child underscoring the importance of starting conversations about healthy oral hygiene behaviors during the prenatal period. In fact, these early conversations have been recommended by national guidelines and policies as a means to increase positive oral health outcomes for the child.<sup>16-17</sup>

In this study, caregivers were able to recognize the causes, symptoms, and oral hygiene behaviors to reduce the risk of decay and cavities; however, there was inadequate comprehension of the bacterial process. Similarly, in a focus group conducted by Lotto et al., participants were able to associate dental caries with negative short and long-term consequences for the child such as problems with permanent teeth, discrimination, and psychological damages.<sup>18</sup> In addition, parents also agreed with the importance of proper oral hygiene and dietary behaviors but reported deviating from these practices based on the behaviors of the child.<sup>18</sup> For example, in terms of toothbrushing, one participant reported asking the child about toothbrushing but did not actually follow-up to ensure the toothbrushing was performed due to other responsibilities.<sup>18</sup> This suggests that while parents may be aware of the practices needed to prevent dental caries, due to other extenuating factors, they maybe unable to implement those practices. Horowitz et al., identified a similar finding concerning assistance and careful monitoring of toothbrushing among children in a focus group conducted among caregivers in the state of Maryland.<sup>19</sup> Focus group participants reported not forcing the child to brush their teeth if it was not desired by the child; thus, not recognizing the importance of proper oral hygiene care in preventing dental caries.<sup>19</sup> Similar to findings in the present study, participants in the Horowitz et al. study were aware of the behavioral causes of dental caries but did not make the connection to the potential severity of the disease. In addition, none of the participants in the focus groups were able to connect the bacteria aspect of the disease process; particularly, the vertical transmission from mother to child.<sup>19</sup> Vertical transmission of dental caries is a common mode of spreading disease from mother to child or family members to child; thus, it is imperative for caregivers to comprehend the negative impacts of bacterial transmission.

Utilizing the explanatory model interview catalogue (EMIC) in a Hispanic population, Rivera et al., also found that caregivers were aware of the causes of dental caries such as the consumption of sugary foods and inadequate toothbrushing and were able to communicate the symptoms of dental caries such as tooth color change and pain.<sup>20</sup> Caregivers also believed the

risk of dental caries could be lowered by daily toothbrushing,<sup>20</sup> which was a similar finding in the current study.

Findings in this study demonstrated an incomplete and inaccurate understanding of the process of tooth decay and cavities. Simply indicating that decay is a rotting tooth does not imply comprehension of what is causing the outcome, such as frequent exposures to cariogenic foods and drinks. Dental and non-dental health care providers should be cognizant of utilizing the following practices to improve caregivers' understanding: use of simple language and open communication to confirm instructions; encourage questions to ensure the caregiver's understanding; and provide oral health literature that increases understanding of common dental terms.<sup>11</sup>

## Limitations

This study had limitations. The data was collected in 2012 from two private dental practices in one state. While the data used to conduct the qualitative analysis was dated, to the best of the investigators' knowledge, only two studies<sup>11,12</sup> have been conducted utilizing the OH-LIP instrument. The OH-LIP instrument is unique in that it captures knowledge and comprehension of parents with young children, which differs from other OHL tests such as the REALD-30. Findings from this study also highlight the need for focusing efforts on increasing caregivers' understanding and comprehension of dental terms. Another limitation may be due to the nature of the OH-LIP inventory and the potential of social desirability bias among the participants. The caregivers may have responded to the knowledge and comprehension portions of the OH-LIP inventory interview based on what they believed was socially acceptable. However, given these limitations, this study builds on previous research in examining caregivers' comprehension of tooth decay and cavities and the results suggest that more discussion related to the dental caries process is needed to increase comprehension in this population.

## Conclusion

There are disparities in caregivers' understanding and comprehension of the common oral health terms "decay" and "cavities". While caregivers may be able to recognize causes and how to reduce the risk of decay and cavities, understanding of the process is inadequate. All health care providers, including dental hygienists and dentists, who provide care to mothers, caregivers and children play an essential role to ensure that the messaging of the dental caries process is understood. Assessing understanding can be easily integrated by asking caregivers open-ended questions

regarding the content discussed during the visit. Limiting the amount of content presented at each care appointment may also be helpful to ensure better comprehension. Future studies may consider focusing on the role of these oral health literacy interventions on pediatric oral health outcomes over time.

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# Attitudes of Virginia Dentists Toward Dental Therapists: A pilot study

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### Abstract

**Purpose:** The purpose of this pilot study was to determine perceptions of Virginia (VA) dentists toward mid-level dental providers, specifically dental therapists (DT), and determine whether membership in the American Dental Association (ADA) membership affected attitudes.

**Methods:** A convenience sample of 1208 dentists in the state of VA were invited to participate in an electronic survey. The instrument consisted of 11 Likert type scale questions assessing attitudes toward DTs. Additional items included the appropriate level of education and supervision of a DT, and five demographic questions. Descriptive statistics were used to analyze the data. A one-sample t-test was used to determine statistical significance for the Likert scale items.

**Results:** An overall response rate of 12% was obtained (n=145). Most respondents were male (73%), members of the ADA (84%), and over the age of 40 (65%). Results suggest that most participants did not perceive (M=1.90,  $p<0.001$ ) that a DT was needed in VA, and did not support (M=2.08,  $p<0.001$ ) a DT model provider. Most participants (M=2.01,  $p<0.001$ ) were not comfortable having a DT perform authorized procedures or ever employing one in their practice (M=1.82,  $p<0.001$ ). Comfort having a DT perform authorized procedures ( $b=.63$ ,  $p<0.001$ ), but not years of practice ( $b=-.09$ ,  $p=0.18$ ), was significantly associated with support for this mid-level provider. Additionally, a lower tolerance towards DTs was associated with an increased likelihood of membership in the ADA ( $b=.14$ ,  $p=0.04$ ).

**Conclusions:** Virginia dentists surveyed did not perceive a need for DTs and generally reported unfavorable attitudes towards this mid-level provider. Findings support the need for more research with a larger, more diverse sample population.

**Keywords:** dental therapists, mid-level providers, access to care,

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### Introduction

*Oral Health in America: A Report from the Surgeon General*, highlighted the importance of oral health to general health over twenty years ago.<sup>1</sup> Oral disease has been described as a “silent epidemic,” and poor oral health is associated with other serious complications impacting overall health and well-being.<sup>1</sup> The report also identified lack of access to care as one of the major barriers to achieving optimal oral health.<sup>1</sup> However, many Americans continue to face multifaceted barriers, including limited income, lack of dental insurance coverage, and living in underserved areas with a shortage of dental professionals leading to disparities in oral health care.

According to the Health Resources and Services Administration, approximately 56 million people in the United States

(US) live in a designated dental health professional shortage areas.<sup>2</sup> To exacerbate the access to oral health care challenges, research studies project that by 2025, all states are expected to have a shortage of dentists.<sup>3</sup> A 10% increase in the demand for dentists, coupled with only a 6% increase in the supply is expected nationally by 2025.<sup>3</sup> Conversely, an oversupply of dental hygienists has also been projected.<sup>3</sup> It is possible that the number of dental health professional shortage areas could be reduced if the roles of dental hygienists were expanded to compensate for the shortage of dentists.

There are 99 designated dental health professional shortage areas in the state of Virginia (VA).<sup>2</sup> In 2013, the VA Department of Health Behavioral Risk Factor Surveillance Survey found

that one-third of Virginians reported not having their teeth cleaned within the previous year.<sup>4</sup> Moreover, over a third Virginians reported lacking dental insurance to cover routine dental care.<sup>5</sup> An expansion in the role of the dental hygienist, such as the dental therapy workforce model, could be a potential solution to the projected shortage of dentists in VA.

In response to the Surgeon General’s report in 2000, new workforce models were developed for dental hygienists to expand their scope of practice and potentially address some barriers related to access to care, particularly for those living in rural or underserved areas.<sup>6</sup> The American Dental Hygienists’ Association (ADHA) defines a mid-level oral health practitioner as, “a licensed dental hygienist who has graduated from an accredited dental hygiene program and who provides primary oral health care directly to patients to promote and restore oral health.”<sup>7</sup> A variety of mid-level dental providers (MLDPs) exist or are proposed with different levels of education and supervision (Table I).<sup>8-11</sup> Some MLDP models are dental hygiene-based, which means the provider is dually licensed as a dental hygienist and a dental therapist, while other models require no dental hygiene training. The most common MLDP is the dental therapist (DT).

**Table I. Mid-level dental providers and scope of practice** <sup>8-11</sup>

Model	Supervision	Examples of Permitted Procedures
Dental Health Aide Therapist (DHAT)	General supervision	Preventive care and education Basic restorations Prophylaxis (cleanings) Non-surgical/simple extractions
Dental Therapist (DT)	General or indirect supervision depending on the procedure	X-rays Fluoride Varnish Sealants Restoration of primary and permanent teeth Placement of temporary crowns Extract primary teeth
Advanced Dental Therapist (ADT)*	General supervision	All dental hygiene procedures All dental therapy procedures, plus: Complete an oral evaluation and create a treatment plan Perform simple extractions of diseased teeth
Dental Hygiene Therapists (DHT)*	Direct Supervision	All dental hygiene procedures, plus: Prepare and restore decayed primary and permanent teeth Prepare and place stainless steel crowns Extract primary teeth and nonsurgical extraction of periodontally diseased permanent teeth

\*Dental hygiene-based models: dually licensed as dental hygienists and dental therapists

Minnesota signed the first MLDP workforce model into law in 2009 with two categories of practitioners, a DT and an Advanced DT (ADT).<sup>8</sup> Both models provide preventive and restorative procedures under the supervision of a licensed dentist in underserved settings throughout the state.<sup>10</sup> The DT provides care under general or indirect supervision depending on the procedure; however, the ADT can perform all services under general supervision.<sup>9,13</sup> Currently, DTs and ADTs are authorized to practice statewide in Minnesota, while dental health aide therapists (DHAT) practice in tribal communities in Alaska, Washington, Oregon, and Idaho.<sup>12</sup> Dental therapists, ADTs and DHATs follow specific regulations outlined by their respective state dental practice acts. In Maine, MLDP legislation was passed in 2014; however, there are no DTs currently practicing in the state. Vermont Technical College is working to develop a dental therapy program, as legislation was passed in 2016 in that state. More recently, dental therapy laws were passed in New Mexico, Connecticut, and Nevada.<sup>12</sup> Scope of practice, education, and supervision may differ per state; however, the overall goal of the MLDP is to increase access to dental care for underserved populations.<sup>7</sup>

While there are currently 11 states allowing dental therapy in some capacity,<sup>6</sup> research has shown mixed attitudes and opinions towards MLDPs joining the dental team.<sup>14-21</sup> In 2015, the American Dental Association (ADA) released a statement regarding the accreditation of dental therapy education programs, stating, “the ADA believes it is in the best interests of the public that only dentists diagnose dental disease and perform surgical and irreversible procedures.”<sup>21</sup> A survey of Minnesota dentists identified concerns regarding the level of education and training DTs and ADTs receive, with less than one third (31%) reporting they would trust the quality of work performed by one of the MLDPs.<sup>14</sup> In Tennessee, 50% of dentists reported

DTs could provide care in the underserved areas; however over half of the respondents (61%) believed DTs would have a negative impact on the dental profession.<sup>16</sup> In a follow-up survey of dental school faculty four years later, there was a 20% increase in those who reported feeling comfortable with DTs providing care for their patients as well as a 20% decrease in dental faculty members indicating a need for significant oversight of DTs.<sup>17,18</sup>

A MLDP, such as a DT, could be one solution to address the access to dental care problem in VA. However, attitudes of dentists may impact future legislation if it is determined that a DT is a viable option for the oral health needs in VA. Research describing the attitudes of dentists toward DTs have been conducted in other states; however, no studies have assessed the attitudes of VA dentists.<sup>14-21</sup> Dentists will play a role in the future employment, supervision, and education of any MLDP model discussed for the state. The purpose of this study was to assess the attitudes of VA dentists towards MLDPs, specifically, DTs. A secondary aim was to determine whether membership in the American Dental Association (ADA) influenced dentists' attitudes towards MLDPs.

## Methods

A descriptive survey design was used to explore the attitudes of a convenience sample dentists licensed in VA towards MLDPs. Upon Institutional Review Board approval from Old Dominion University, an investigator designed questionnaire "Attitudes of Virginia Dentists Toward a Mid-Level Dental Provider," was emailed to 1208 dentists whose addresses were purchased from an online email database (dentistlistpro.com). The survey was adopted with permission from a previously validated instrument,<sup>17</sup> and included researcher developed items. Eleven questions assessed attitudes of participants toward a DT using a seven-point Likert type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The seven-item scale showed adequate internal reliability with a Cronbach's coefficient alpha of  $\alpha = 0.73$ . Seven of the eleven questions focused on general attitudes of dentists towards the DT mid-level provider model, and the remaining four questions focused on respondent attitudes toward a DT relative to the participant's own dental practice. Participants were also asked to respond to items regarding supervision and education of the DT, whether a DT model accommodated the oral care needs of the underserved, two open-ended questions regarding advantages and/or disadvantages to a DT, as well as five demographic questions (gender, age, years of practice, predominant practice setting, and professional association membership). A panel of dental hygiene faculty reviewed the researcher developed items to establish face validity and

clarity of instructions. Modifications were made based on feedback from the panel. An online questionnaire software (Qualtrics; Provo, UT, USA) was used to create the survey for online distribution, and three reminders were sent to the sample over a period of six weeks.

## Statistical Analysis

Descriptive statistics were used to analyze response frequency. A one-sample t-test was used to determine statistically significant differences for Likert-type scale questions that were compared to a neutral rating of 4. Significance was set at the .05 level. Responses from the open-ended questions were coded based on reported advantages and disadvantages of a DT. The principal investigator analyzed the open-ended responses to develop five major themes. Responses were assigned to one of the five themes. The open-ended responses were sent to a second investigator prior to frequency analysis to establish content validity and reliability. A multiple linear regression model was used to determine the relationship between respondents' years of practice, comfort in having a DT perform authorized procedures in their office setting, and support of a DT mid-level provider model in VA. Additionally, a multiple linear regression was performed to determine whether membership in the ADA was associated with predicting support for a DT.

## Results

Of the 1208 licensed dentists in VA, 145 (n=145) completed the online survey for a response rate of 12%. The majority of participants were male (73%), over 40 years of age (65%), and worked in either a solo (54%) or group (37%) dental practice. Most participants (64%) reported practicing dentistry for more than 20 years, with 29% reporting practicing between 10-19 years. Only 7% of participants reported practicing for less than 10 years (Table II). The vast majority of participants (84%) reported ADA membership, and 75% reported accommodating the underserved in their practice (Table II). Regarding the supervision requirements for a DT, most (70%) indicated direct supervision should be required. Opinions regarding the level of education required for a DT varied; a little more than half (58%) of indicated a master's degree would be the appropriate level while about one-third (34%) indicated a bachelor's degree would be appropriate (Table III).

Results from the Likert type questions on attitudes and general perceptions of participants toward the DT are shown in Table IV. T-test analysis results revealed participants did not perceive ( $M = 1.90$ ,  $SD = 1.48$ ) that a DT was needed in VA ( $d = -2.10$ , 95% CI [-2.35 to -1.86],  $t(144) = -17.11$ ,  $p < 0.001$ ).

**Table II. Sample demographics (n= 145)**

Category	n	%
<b>Gender</b>		
Male	106	73.0
Female	32	22.0
Do not wish to disclose	7	5.0
<b>Age (years)</b>		
Under 29	1	1.0
29-39	21	14.0
40-49	40	28.0
Over 50	83	57.0
<b>Years Practicing Dentistry</b>		
Less than 10	10	7.0
10-19	42	29.0
20-29	30	21.0
More than 30	63	43.0
<b>Primary work setting</b>		
Community/Public health	1	1.0
Education	7	5.0
Free/Safety net clinic	2	1.0
Group practice	55	38.0
Solo practice	78	54.0
Other	2	1.0
<b>American Dental Association membership</b>		
Yes	122	84.0
No	23	16.0
<b>Accommodation of underserved in practice setting</b>		
Yes	109	75.0
No	36	25.0

Additionally, respondents were significantly more likely to disagree ( $M=2.08$ ,  $SD=1.56$ ) than agree that a DT mid-level provider model could be part of the solution to access to care in VA ( $d=-1.92$ , 95% CI [-2.17 to -1.66],  $t(144)=-14.83$ ,  $p<0.001$ ). Similarly, more respondents disagreed ( $M=2.08$ ,  $SD=1.85$ ) than agreed that it is important for VA to adopt legislation for a DT mid-level provider model ( $d=-1.92$ , 95% CI [-2.23 to -1.62],  $t(144)=-12.56$ ,  $p<0.001$ ) (Table V).

Most respondents ( $M=4.88$ ,  $SD=2.14$ ) indicated an understanding of the range of services performed by a DT ( $d=.88$ , 95% CI [.53 to 1.23],  $t(144)=4.96$ ,  $p<0.001$ ). However, most participants did not agree ( $M=2.74$ ,

**Table III. Supervision and education required for a dental therapist (n=145)**

	n	%
<b>Level of supervision that should be required for a DT</b>		
Direct	102	70.0
General	29	20.0
Indirect	14	10.0
No supervision needed	-	-
<b>Level of Education that should be required for a DT</b>		
Certificate	6	4.0
Associate degree	5	3.0
Bachelor's degree	50	34.0
Master's degree	84	58.0

$SD=1.65$ ) that the evidence supported that a DT could perform high quality work ( $d=-1.26$ , 95% CI [-1.53 to -.99],  $t(144)=-9.19$ ,  $p<0.001$ ). More respondents agreed than disagreed ( $M=4.63$ ,  $SD=2.19$ ) that the public will perceive that the dentist is less important if a DT is permitted to perform a wide range of procedures ( $d=.63$ , 95% CI [.28 to .99],  $t(144)=3.49$ ,  $p=0.001$ ). Most respondents ( $M=4.53$ ,  $SD=2.36$ ) also indicated that DTs should be restricted to practicing in acknowledged underserved areas in VA ( $d=.53$ , 95% CI [.14 to .92],  $t(144)=2.71$ ,  $p=0.007$ ).

Moreover the vast majority of participants indicated ( $M=2.01$ ,  $SD=1.66$ ) discomfort in allowing a DT to perform authorized procedures on patients in their practices ( $d=-1.99$ , 95% CI [-2.26 to -1.71],  $t(144)=-14.42$ ,  $p<0.001$ ) and were more likely to disagree than to agree ( $M=2.09$ ,  $SD=1.56$ ) that delegating some work to a DT would improve their own job satisfaction ( $d=-1.91$ , 95% CI [-2.17 to -1.65],  $t(144)=-14.51$ ,  $p<0.001$ ). Results also suggest significantly more VA dentists disagreed ( $M=2.33$ ,  $SD=1.82$ ) that employing DTs in their dental office would be cost-effective ( $d=-1.67$ , 95% CI [-1.97 to -1.37],  $t(144)=-11.05$ ,  $p<0.001$ ) and were not supportive of ( $M=1.82$ ,  $SD=1.50$ ) employing a DT in their practice ( $d=-2.18$ , 95% CI [-2.43 to -1.93],  $t(144)=-17.51$ ,  $p<0.001$ ).

Sixty-six participants responded to the open-ended question on potential advantages of DTs while 73 responded to the open-ended question on potential disadvantages. Responses concerning potential advantages were categorized according to the following themes: expanding care to the underserved (41%), lower costs for patients (4%), generate profit for the dental office (4%), care to Medicaid patients (2%), and no potential foreseen advantages (45%). Similarly, responses regarding potential disadvantages were further



**Table IV. Perceptions regarding dental therapists (n=145)**

	1. Strongly disagree	2.	3.	4.	5.	6.	7. Strongly agree
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
A mid-level dental provider is needed in Virginia.	62.76 (91)	13.10 (19)	9.66 (14)	7.59(11)	2.76(4)	1.38(2)	2.76 (4)
A mid-level dental provider, such as a dental therapist, could be part of the solution to the problem of access to care in Virginia.	53.79 (78)	19.31 (28)	8.97 (13)	8.28 (12)	4.83 (7)	2.07 (3)	2.76 (4)
It is important for Virginia to adopt legislation for a dental therapist model.	64.83 (94)	11.72 (17)	4.83 (7)	4.14 (6)	4.14 (6)	4.83 (7)	5.52 (8)
I have an understanding of the services dental therapists may perform.	11.72 (17)	8.28 (12)	7.59 (11)	11.03 (16)	8.97(13)	18.62 (27)	33.79 (49)
There is evidence dental therapists can perform high quality work.	33.79 (49)	14.48 (21)	17.24 (25)	21.38 (31)	7.59 (11)	2.07 (3)	3.45 (5)
The public will think the dentist is less important if dental therapists are allowed to perform a wide range of procedures.	14.48 (21)	7.59 (11)	10.34 (15)	9.66 (14)	15.17(22)	11.03 (16)	31.72 (46)
Dental therapists' practice should be restricted to acknowledged underserved areas in Virginia.	20.69 (30)	4.14 (6)	8.97 (13)	15.17 (22)	6.21 (9)	8.28 (12)	36.55 (53)
I would be comfortable having a dental therapist perform authorized procedures on my patients.	61.38 (89)	15.86 (23)	3.45 (5)	8.97 (13)	3.45 (5)	3.45 (5)	3.45 (5)
Being able to delegate some work to a dental therapist would make my job more satisfying.	55.17 (80)	17.24 (25)	8.97 (13)	8.97 (13)	4.14 (6)	2.76 (4)	2.76 (4)
Having dental therapists in my practice will be a cost-effective addition to the dental office.	50.34 (73)	17.24 (25)	10.34 (15)	9.66 (14)	2.07 (3)	4.14 (6)	6.21 (9)
I would employ a dental therapist in my practice.	66.21 (96)	13.79 (20)	7.59 (11)	4.83 (7)	2.76 (4)	1.38 (2)	3.45 (5)

categorized into the following themes: safety concerns for the patient (21%), lower quality of care (38%), difficulty differentiating between complex and simple procedures (7%), lack of willingness to practice in underserved populations (10%), competition with patient pool (21%), and negative public perception of DTs (4%) (Table VI).

A multiple linear regression analysis was conducted to determine if years of practice and comfort in having a DT perform authorized procedures were statistically associated with participants' support for a DT (Table VII). For this analysis, comfort ratings were defined by responses to the Likert scale statement, 'I would be comfortable having a

dental therapist perform authorized procedures on my patients' and support was defined by responses to the statement, 'A mid-level dental provider is needed in Virginia.' Results from the linear combination of years of practice and comfort having DT perform authorized procedures revealed 39% of variance in ratings of support for a DT ( $F(2, 142) = 45.23, p < 0.001$ ). The analysis revealed comfort having DTs perform authorized procedures in their practice ( $b = .63, p < 0.001, 95\% \text{ CI } [.44, .68]$ ), but not years of practice ( $b = -.09, p = 0.18, 95\% \text{ CI } [-.32, .06]$ ), was significantly associated with support of a DT.

A second multiple linear regression analysis was completed to determine if an association existed between participants'

**Table V. One Sample t-test results comparing mean values of responses to neutral rating (n=145)**

	Test Value = 4					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
A MLDP is needed in Virginia.	-17.113	144	.000	-2.103	-2.35	-1.86
A MLDP, such as a dental therapist, could be part of the solution to the problem of access to care in Virginia.	-14.829	144	.000	-1.917	-2.17	-1.66
It is important for Virginia to adopt legislation for a dental therapist model.	-12.558	144	.000	-1.924	-2.23	-1.62
I have an understanding of the services dental therapists may perform.	4.961	144	.000	.883	.53	1.23
There is evidence dental therapists can perform high quality work.	-9.189	144	.000	-1.255	-1.53	-.99
The public will think the dentist is less important if dental therapists are allowed to perform a wide range of procedures.	3.491	144	.001	.634	.28	.99
Dental therapists' practice should be restricted to acknowledged underserved areas in Virginia.	2.713	144	.007	.531	.14	.92
I would be comfortable having a dental therapist perform authorized procedures on my patients.	-14.423	144	.000	-1.986	-2.26	-1.71
Being able to delegate some work to a dental therapist would make my job more satisfying.	-14.512	144	.000	-1.910	-2.17	-1.65
Having dental therapists in practice will be a cost-effective addition to the dental office.	-11.052	144	.000	-1.669	-1.97	-1.37
I would employ a dental therapist in my practice.	-17.513	144	.000	-2.179	-2.43	-1.93

membership in the ADA, and comfort in having a DT perform authorized procedures, and participants' tolerance toward a DT (Table VII). Ratings were defined by the same responses to statements as defined previously. Results from the linear combination of membership in the ADA and comfort having a DT perform authorized procedures revealed 40% of variance in ratings of tolerance toward a DT ( $F(2, 142)=47.30, p<0.001$ ). Both membership in the ADA ( $b=.14, p=0.04, 95\% \text{ CI } [.03, 1.07]$ ) and comfort in having a DT perform authorized procedures ( $b=.62, p<0.001, 95\% \text{ CI } [.44, .67]$ ) were statistically associated with tolerance toward DTs. Participants who indicated membership in the ADA and decreased comfort in having DTs perform authorized procedures were more likely to be intolerant toward the DT mid-level provider model.

## Discussion

Disparities in oral health care continue to affect many in underserved groups in the US; socioeconomic status, gender, ethnicity, race, geographic location, and access to care are

important contributors to these disparities.<sup>22</sup> To increase the number of dental professionals available in underserved areas, policy makers in VA are exploring the DT mid-level provider model as a solution to difficulty finding a dentist, cost of treatment, and location of the care provider.<sup>23</sup> Recently, VA has made strides toward addressing one barrier, the cost of treatment for low-income adults, with the inclusion of a comprehensive dental benefit for Medicaid beneficiaries in the 2020 state budget.<sup>24</sup> Given this new policy, there likely will be a greater demand for dental services, and the use of a mid-level provider, such as the DT, may be one way to meet this increased demand. However, results from this study indicate that dentists in the state of VA have unfavorable attitudes toward the DT workforce model.

The majority of responses regarding DTs were overwhelmingly negative. Dentist participants were neither open, nor willing, to consider adding a DT to their practice, nor did they support potential legislation for a DT provider in VA. Over one half of all participants strongly disagreed with each survey statement concerning the DT model. As the majority of respondents were members of the ADA, attitudes

**Table VI. Responses regarding potential advantages and disadvantages of dental therapists (n=139)**

	n	%
<b>Potential advantages (n=66)</b>		
Expanding care to the underserved	27	41.0
Lower costs for patients	4	6.0
Generate profit for the dental office	4	6.0
Care to Medicaid patients	1	2.0
No potential advantages	30	45.0
<b>Potential disadvantages (n=73)</b>		
Safety concerns for the patient	15	21.0
Lower quality of care	28	38.0
Difficulty differentiating between complex and simple procedures	5	7.0
Lack of willingness to practice in underserved populations	7	10.0
Competition with patient pool	15	21.0
Negative public perception of dental therapists	3	4.0

appeared to be in alignment with previous literature related to DT providers.<sup>14-18,20</sup> Attitudes also aligned with the ADA's opposition to the DT provider model, which focuses on the lack of evidence supporting improvements in oral health as a result of treatment provided by DTs.<sup>26</sup> Additional concerns from the ADA include the cost of training and licensure, as well as the possible overpopulation of DTs in urban rather than underserved rural areas.<sup>26</sup> Similarly, Abdelkarim et al., also found overall negative attitudes among Mississippi dentists toward the DT workforce model.<sup>20</sup>

Over half of respondents agreed the public would perceive dentists to be less important if DTs were allowed to perform

**Table VII. Summary of Multiple Linear Regression Analysis\***

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	1.170	.320		3.656	.000
Years of Practice	-.132	.097	-.090	-1.361	.176
Comfort	.558	.059	.626	0.499	.000
Constant	.142	.342		.414	.679
ADA Membership	.551	.263	.136	2.099	.038
Comfort	.554	.058	.621	9.549	.000

\*Dependent Variable: A MLDP is needed in Virginia.

a wide range of restorative procedures. Similarly, Blue et al., found Minnesota dentists were concerned that DTs would interfere with patient relationships with dentists and lead to a loss of respect.<sup>14</sup> Interestingly, a follow-up study among Minnesota dental faculty demonstrated that once there was exposure to DTs, significantly greater acceptance followed.<sup>17</sup> Results suggest dentists may possess unfavorable attitudes toward a DT because of unfounded concerns from a lack of familiarity and exposure to this workforce model. Another explanation for the negative attitudes may be the potential competition for the patient pool. Dentists may fear they will lose patients to mid-level providers who can provide similar care at a lower cost.

The open-ended responses also revealed an overwhelming impression of “no potential advantages” to a DT provider model in VA and “lower quality of care” was the most frequently cited. In addition to lower quality care, results suggest patient safety was a major concern of participants. Blue et al., also found most Minnesota dentists did not trust the quality of work performed by DTs.<sup>14</sup> Likewise, Abdelkarim et al. found Mississippi dentists also questioned the education and quality of care performed by DTs.<sup>20</sup> These findings suggest that a major barrier cited for accepting a DT in the dental community is uncertainty regarding the quality of education. In 2020 the first dental therapy program in Alaska was accredited by the Commission on Dental Accreditation (CODA)<sup>27</sup> signifying a major step for dental therapy education. It is noteworthy that both of the DT programs in Minnesota were developed prior to the development of CODA standards; however, these programs have served as educational models and meet the current accreditation standards.<sup>28</sup> Moreover, Minnesota DTs must pass the same clinical competency exam as dentists for the services they are permitted to provide as a requirement for licensure.<sup>28</sup> A majority of the participants in this study indicated that a DT should be educated at the master's degree level followed by a bachelor's degree, similar to the findings of Ly et al.<sup>19</sup>

Regarding supervision levels, most participants (70%) believed DTs required direct supervision which is concerning since direct supervision, requirements could negatively impact access to care in VA, a major goal of this workforce model. Respondents in this study do not believe there is a need for DTs in VA and there is no evidence regarding the quality of the work provided by DTs. However, a review of the safety, quality and cost-effectiveness of dental therapy found the model to be a safe, effective, high quality approach to increase access to care and

health equity.<sup>29</sup> In 2014, the Minnesota Department of Health released a report of the early impacts of DT and safety aspects of the model in the state;<sup>30</sup> four years later there were 86 licensed DTs and none were disciplined for quality of care or safety concerns.<sup>28</sup> A 2010 review of DHATs in Alaska reported that the DHATs were performing procedures within their scope of practice safely and providing quality care.<sup>31</sup> Restorations placed by dentists and DHATs were compared and found to have no difference in deficiencies between the groups.<sup>31</sup> Currently, DHATs provide care to over 40,000 Alaskans, increasing the access to care to those living in rural areas.<sup>27</sup>

When examining predictors of DT support, interestingly, years of practice was not found to be a predictor of DT support; however, comfort in allowing a DT to perform procedures on patients in the dental practice was a predictor. It was hypothesized that while some dentists may never use a DT in their own practice (lack of operatories or a small patient pool), they could still support the concept of this provider model for underserved areas in VA. Findings did not support this hypothesis as participants who were uncomfortable with DTs in their own practice were not supportive of DTs practicing in VA. Based on this analysis, the comfort levels of VA dentists regarding the effective and safe care provided by DTs would need to be increased in order for dentists to be supportive of this mid-level provider in any setting.

Membership in ADA was associated with intolerance towards the DT provider model and results suggest that participants support ADA's negative position on dental therapy.<sup>21,28</sup> To overcome these negative perceptions against dental therapy, more research is needed to evaluate the longitudinal impact DTs on the provision of safe, high-quality, cost-effective care to underserved populations and the impact on the oral health care workforce.

This study had limitations. The use of a convenience sample did not include all dental licentiates in the state and may have impacted the sample demographics. Additionally, dentists who did not favor a DT model could have been more likely to respond, resulting in an overrepresentation of negative attitudes. Another limitation was the lack of females or younger dentists in the sample. Future studies should have a more representative sample of dentists to increase validity and reliability of results. While this study focused on the attitudes of VA dentists toward DTs, it did not investigate the knowledgebase regarding this MLDP. Future studies should determine the knowledgebase of dentists regarding dental therapy and whether knowledge of the provider model influences attitudes and support. Studies should also assess the attitudes of VA dentists toward DTs after more research is published about the impact of DTs in other states. Finally,

attitudes of VA dental hygienists should be studied as a comparison to the attitudes of VA dentists.

## Conclusion

Results from this pilot study suggest participants had overall negative attitudes toward a dental therapy provider model in VA. Results further suggest participants attitudes are congruent with the position of organized dentistry, which does not support DTs. Barriers to the acceptance of DTs relate to the uncertainty about quality of care and safety for the public. It is possible that an increase in the knowledge base regarding dental therapy and more exposure to DTs in practice would lead to more favorable attitudes towards this workforce model among dentists in VA. Findings underscore the need for more research with a larger and more diverse sample population.

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# Dental Hygienists' Attitudes and Experiences with Public Health Supervision in Iowa

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### Abstract

**Purpose:** Iowa is one of 42 states with a direct access dental hygiene workforce model. Public health supervision (PHS) in Iowa allows dental hygienists (DH) to provide services in community settings without a prior examination from a dentist. The purpose of this study was to assess the current PHS workforce in Iowa and add to the body of evidence on direct access DH care.

**Methods:** A 40-item mixed-mode survey was administered to all DH working under PHS in Iowa (n=126). Consent letters were mailed with directions to an online survey. Follow-up letters were sent to non-responders with an enclosed paper copy of the survey. Univariate analyses were performed to analyze the data.

**Results:** The response rate was 52% (n=62), with 69% (n=42) of participants currently providing services under PHS. The most common employer categories were local public health agencies (59%), community health centers (CHCs) (20%), and nonprofit clinics (10%). The most common types of services provided under PHS were dental screenings (95%), fluoride varnish (91%), and sealants (50%). The majority of supervising dentists worked in private practice (61%) and CHCs (27%). Most supervising dentists (71%) accepted some referrals; however, a majority of PHS participants (71%) reported that it was somewhat or very difficult to find dentists to accept patient referrals.

**Conclusions:** Most PHS DHs were employed by government agencies, however the majority of supervising dentists worked in private settings. Although most supervising dentists accepted at least some patient referrals, PHS DHs still experienced a high degree of difficulty referring patients for care.

**Keywords:** access to care, direct access, public health dental hygienists, health disparities, oral health, workforce models

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### Introduction

Oral health is linked to overall systemic health, yet millions of Americans go without routine dental care each year.<sup>1</sup> Dental diseases can be prevented or treated if a patient has access to dental healthcare professionals. However, accessing dental care can be difficult due to barriers including cost of care, language, fear, distance, taking time off work, or being under or uninsured.<sup>1</sup> In addition to patient barriers, the dental workforce is often geographically maldistributed, with many counties having fewer than one dentist per 5,000 people, a threshold that classifies a county as a dental Health Professional Shortage Area (HPSA).<sup>2</sup> It has been estimated that over 7,000 additional dentists would be needed in the United States (U.S.) to eliminate all dental HPSAs.<sup>3</sup>

As part of the solution to provider shortages and other barriers to care, many new workforce models have emerged that utilize non-dentist members of the oral health workforce. These workforce models include dental therapists, expanded function dental assistants, and direct access dental hygienists.<sup>4</sup> Direct access models allow dental hygienists (DH) to provide services within their scope of practice without the need for a dentist to be physically present. This arrangement creates the opportunity for DHs to practice in community based settings in order to bring services closer to at-risk populations.<sup>2</sup> This model also expands potential employment options for the dental hygiene workforce, which is increasingly a concern as national projections suggest that there will be more DHs than jobs available by 2025.<sup>3</sup> To date, 42 states allow direct

access to dental care.<sup>5</sup> Within these direct access states, there is considerable variation in the types of allowable services as well as the level of supervision that is required under state scope of practice acts.<sup>6</sup> Many states require a collaborative agreement with the supervising dentist, which sets guidelines and allows the DHs to see patients without prior dental exam or direct supervision, whereas some states allow DHs to practice fully independently.<sup>4</sup> States also differ in the qualification requirements for providing direct access care. For example, Colorado has no additional requirements beyond an active license whereas Oregon requires 2,500 hours of supervised dental hygiene employment and 40 hours of approved continuing education credits.<sup>4</sup>

Iowa implemented a direct access model, public health supervision (PHS), in 2004. From 2004 to 2017, the size of Iowa's PHS workforce grew from 14 to 95 DHs, making up approximately 5% of the total dental hygiene workforce in Iowa.<sup>7</sup> To qualify as a PHS DH, a licensed DH is required to have a minimum of one-year clinical experience and a written supervision agreement with a dentist. This allows Iowa's PHS DHs to provide services in community-based settings consistent with their supervision agreement and within their scope of practice.<sup>8</sup> Iowa's direct access requirements are much less extensive than other states' as Iowa does not require a bachelor's or master's degree and there are no set clinical hour prerequisites.<sup>8</sup> In addition, Iowa's scope of practice guidelines for DHs have been identified as "satisfactory" with regard to how DHs can utilize their skills to improve access to care, on a continuum ranging from restrictive, limiting, satisfactory, favorable, or excellent.<sup>9</sup> Iowa's PHS DHs may perform screenings, communicate oral hygiene education, and provide therapeutic or preventive services such as oral prophylaxis or fluoride varnish, silver diamine fluoride, or sealant application.<sup>8</sup> To date, no studies have been published on direct access DHs in Iowa.

Several studies have evaluated various aspects of direct access DHs.<sup>10-13</sup> A qualitative study conducted in Massachusetts explored practice factors and participants' attitudes about their work in public health and found that key barriers to success as public health DHs were Medicaid limitations, third party reimbursement restrictions, and issues finding a collaborative dentist.<sup>10</sup> Two studies of Kansas' extended care permit (ECP) model have explored attitudes and practice factors. A 2009 study showed that 60-70% of direct access respondents reported they disagree or strongly disagree that access to dental services for children, seniors, immigrants, special needs, and low-income populations is adequate.<sup>11</sup> Comparatively, a 2017 Kansas study showed similar findings in addition to mentioning barriers to care

like directly billing to Medicaid, physical requirements of the job, and financial viability; it was noted that providers that had more years of direct access experience perceived more barriers to providing services.<sup>12</sup> In addition, a workforce study of Maine public health DHs showed that half of their independent practice workforce were employed in rural areas.<sup>13</sup> Unlike Kansas, Maine public health DHs treat more adults than children, and about 60% reported difficulty finding a dentist to would accept their patient referrals.<sup>13</sup>

Despite the widespread use of direct access dental hygiene models across the U.S., the body of research about these workforce models is limited. Previous studies commonly assessed career satisfaction, patient populations served, and services provided, referral patterns, and participant attitudes and experiences working in this model. However, several factors merit further exploration, including the source of employment and working relationships with the supervising dentists. The purpose of this study was to build upon the small body of evidence on direct access dental hygiene workforce models by assessing the current PHS DH workforce in Iowa, including the employment environment, practice settings, scope of practice, and motivations for working in this career field.

## Methods

A mixed-mode survey was administered in July-September 2019 to all (n=126) PHS DHs in Iowa with active licenses and PHS status. The Iowa Department of Public Health provided the research team with the names and work addresses of the potential participants. An email was sent to all Iowa PHS DHs (n=126) by the Oral Health Consultant of the Iowa Department of Public Health to inform them about the survey. A paper consent letter was mailed to all Iowa-licensed PHS DHs; a personalized link to the online survey was included in the letter. At two and four weeks following the initial fielding, additional reminder mailings were mailed to the non-respondents including a paper copy of the survey. Responses were collected for eight weeks in both modes. A software program (Qualtrics, Provo, UT, USA) was used to administer the electronic survey.

The 40-item instrument was developed using close-ended, open-ended, and 4-point Likert scale questions; the latter used responses from "very satisfied" to "very dissatisfied." Survey items were either adapted from other sources<sup>7,10,11,13,14</sup> or original to this survey. The survey instrument included items regarding employment status and type, scope of practice utilized, compensation methods, relationship with their supervising dentist, motivation for working under public health supervision, and job satisfaction. The survey instrument was pretested by four content experts for clarity and relevance of questions; changes were made based on feedback.



Data were analyzed with SPSS Version 23 (IBM, Armonk, NY, USA) using univariate analyses. The project was approved by the Institutional Review Board of the University of Iowa (#201906752).

## Results

Of the potential PHSDH study participants (n=126), 62 completed the survey, yielding a 52% response rate after excluding undeliverables. More participants completed the survey on paper (62.3%), versus online (37.7%). Out of the 62 responses, 42 (68.8%) were actively providing services under public health supervision. The remainder of the results were based on the population of PHDHs actively providing care (n=42).

Among the respondents, 52.4% held an associate degree, and 97.6% (n=40) identified as White. The survey did not ask regarding gender as it has been previously shown that 99% of Iowa dental hygienists are female.<sup>15</sup> The highest proportion respondents were age 40-49 years (35.9%). Most (71.6%) had worked clinically as a registered dental hygienist for 10 years or more, while a little more than half (54.7%) had been working under PHS for 5 or fewer years. Sample demographics are shown in Table I.

### Employment Patterns

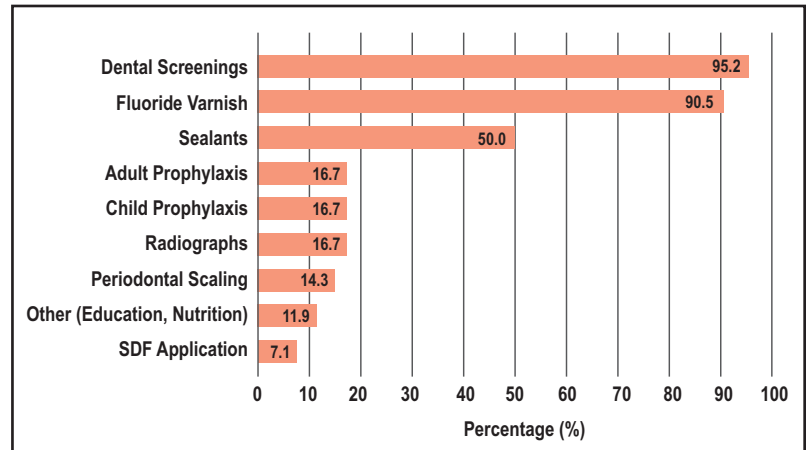
When asked about the number of current jobs, 83.3% of respondents held one job in dental hygiene, and 97.6% held one job under PHS. The most common employer types were local public health agencies (58.5%), community health centers (CHCs) (19.5%), and nonprofit clinics (9.7%). The least common employer types were nursing homes (2.4%) and private dental practices (0%) (Table I).

When asked about their motivation to start working under PHS, 54.8% chose to become a PHS DH on their own (n=23) while 45.2% (n=19) were encouraged to do so by their employer. Of those who were self-motivated to become a PHS DH, the most common motivating factors were an interest in working in public health settings (n=11), the increased job flexibility (n=4), and increased autonomy (n=2). Among self-motivated PHS DHs, 66.7% had a somewhat or very difficult time finding work as a PHS DH the last time they looked for employment in public health. Nearly all the participants (97.6%) were somewhat or very satisfied with their work under PHS (Table I).

### Professional Responsibilities

Regarding the types of services provided under PHS, most respondents reported providing dental screenings (95.2%), fluoride varnish (90.5%), and sealants (50.0%). Only 7.1% of respondents reported applying silver diamine fluoride (SDF) under PHS (Figure 1). The average amount of time spent working was 34 hours per week, and nearly half (48.7%, n=20) reported they spent more than three-quarters of their working time providing PHS clinical services.

**Figure 1. Types of services provided by PHS respondents\* (n=42).**



\* Multiple response options possible; sums do not equal 100%

### Compensation and Billing

Most respondents (73.8%) were paid an hourly wage, and 23.8% were paid via salary; none were paid based on commission. Regarding how public health supervision services are billed, most respondents had services billed by their employer (81.0%) and/or were paid by a program grant (50%) (Table I).

### Working Relationships with Supervising Dentist and Referral Patterns

Among public health supervision respondents, a majority (61.0%) of their supervising dentists worked in private practice, followed by 26.8% in CHCs. The amount of communication between the PHS DH and supervising dentist varied, with the highest proportion (38.1%) stating that they communicate several times throughout the year. Most (88.1%) of the respondents found it somewhat or very easy to find a supervising dentist and most (82.9%) were very satisfied with their working relationship with their supervising dentist (Table II).

Regarding patient referrals, 21.4% of participants reported that their supervising dentist accepted all patient referrals, 50.0% accepted some referrals, while 28.6% did not accept any referrals. Additionally, 71.4% of participants reported it was somewhat or very difficult to find a dentist to accept patient referrals. When making a referral, two thirds (66.7%) of the respondents worked directly with the patient to find a

**Table I. Demographic and employment characteristics of respondents (n=42).**

Variable	n	%
<b>Highest level of education completed</b>		
Dental hygiene certificate	8	21.4
Associate degree	22	52.4
Bachelor's degree	10	23.8
Master's degree or higher	1	2.4
<b>Years worked as a dental hygienist</b>		
0-9	11	18.3
10-19	19	31.6
20-29	6	10.0
30-39	18	30.0
40-49	6	10.0
<b>Years providing services under PHS</b>		
0-5	23	54.7
6-10	7	16.6
11-15	12	28.5
<b>Age in years</b>		
20-29	1	2.6
30-39	7	17.9
40-49	14	35.9
50-59	9	23.1
60-69	8	20.5
<b>Number of current jobs as a dental hygienist</b>		
One	35	83.3
Two	4	9.5
Three or more	3	7.1
<b>Number of current jobs working under PHS</b>		
One	41	97.6
Two	1	2.3
Three or more	0	0.0
<b>Employer Type</b>		
Local Public Health Agency	24	58.5
Community Health Center	8	19.5
Non-Profit Clinic	4	9.7
Free Dental Clinic	2	4.8
Other	2	4.8
Nursing Home	1	2.4
Private Dental Practice	0	0.0
<b>Total hours per week working as a dental hygienist</b>		
10 or less	4	9.5
11-19	2	4.7
20-29	3	7.1
30-39	18	42.8
40+	15	35.7

Variable	n	%
<b>Weekly percentage of time spent providing clinical services under PHS</b>		
0-25%	13	31.7
26-50%	7	17.0
51-75%	1	2.4
76-100%	20	48.7
<b>Weekly percentage time spent providing clinical services not under PHS</b>		
0%	22	53.7
1-25%	3	7.3
26-50%	4	9.7
51-75%	3	7.3
76-100%	9	21.9
<b>Reimbursement method for PHS services*</b>		
Employer organization bills for services	34	80.9
Paid through program grant	21	50.0
Dentist employer bills for services	1	2.4
Volunteer only	1	2.4
Other	3	7.1
<b>Compensation method</b>		
Hourly	31	73.8
Salary	10	23.8
Volunteer	1	2.4
Commission/Production	0	0.0
<b>Initiator of the PHS designation</b>		
Self	23	54.8
Employer	19	45.2
<b>Reason(s) for working under PHS*</b>		
Interest in working in public health	11	50
Increased flexibility	4	18.2
Increased autonomy	2	9.1
Career growth opportunity	1	4.5
Other	4	18.2
<b>Ease of finding employment as PHSDH**</b>		
Very easy	0	0.0
Somewhat easy	6	33.3
Somewhat difficult	9	50.0
Very difficult	3	16.7
<b>Satisfaction with type of work under PHS</b>		
Very satisfied	24	57.1
Somewhat satisfied	17	40.5
Somewhat dissatisfied	1	2.4
Very dissatisfied	0	0.0

\*Respondents could select all that apply; percentages sum to >100%.

\*\*Question answered only by self-initiated PHSDHs (n=23).

dentist and half (50.0%) provide patients with a list of local dentists to contact (Table II).

## Discussion

The purpose of this study was to assess the current PHS DH workforce and describe the self-reported experiences of Iowa's PHS DHs. Demographic results showed that PHS DH respondents were typically older, with only one respondent under age 30. This may indicate that the more experienced DHs prefer to work in public health or that PHS DH employers have a preference toward more experienced practitioners. This finding may also indicate that there is limited interest or knowledge from new graduates regarding this career option. Findings from the state of Kansas are similar to Iowa in that 74% of their public health DHs are older than 40 years.<sup>11</sup>

Iowa's PHS hygienists were most frequently employed by governmental agencies such as local public health agencies and CHCs. Conversely, most supervising dentists work in private practice settings. This could be due to the fact that fewer dentists are employed at local public health agencies, so PHS DHs must seek a supervising dentist elsewhere. Despite being employed by local public health agencies and CHCs, the most common locations where PHS DHs provide services were preschools, elementary schools, and Head Start Programs. The respondents were also employed through federal public health programs such as Women, Infants, and Children (WIC) centers demonstrating that children are receiving more PHS services in Iowa than adults.<sup>16</sup> Very few respondents worked in nursing facilities, which could be due to multiple barriers such as patient cooperation and medical complexity, as well as service-related barriers such as increased appointment times for patient visits. These findings were similar to Maine where over 90% of Independent Practice Dental Hygienists provided services in school-based programs and only 3% served nursing homes and long-term care facilities.<sup>13</sup> However, Oregon's Extended Practice Permit Dental Hygienists provide most of their services at residential care facilities followed by primary and secondary schools.<sup>17</sup>

Regarding the types of services provided by Iowa PHS DHs, the most commonly provided services were screenings, fluoride varnish, and sealants, which is consistent with other states and is in line with the fact

**Table II. Supervising dentist and referral factors among respondents (n=42).**

Variable	n	%
<b>Supervising dentist practice setting</b>		
Private practice	25	61.0
Community Health Center	11	26.8
Teaching institution	2	4.9
Other	3	7.3
<b>Frequency of communication with supervising dentist</b>		
Daily	9	21.4
Weekly	6	14.3
Monthly	6	14.3
Less than monthly, more than annually	16	38.1
Annually or less frequently	5	11.9
<b>Ease of finding supervising dentist</b>		
Very easy	20	47.6
Somewhat easy	17	40.5
Somewhat difficult	3	7.1
Very difficult	2	4.8
<b>Supervising dentist acceptance of PHS referrals</b>		
Yes, all referrals	9	21.4
Yes, some referrals	21	50.0
No	12	28.6
<b>Satisfaction with the working relationship with supervising dentist</b>		
Very satisfied	34	82.9
Somewhat satisfied	5	12.2
Somewhat dissatisfied	2	4.9
Very dissatisfied	0	0.0
<b>Dentist referral method*</b>		
Work with patients to find dentist	28	66.7
Give patient a list of local dentists	21	50.0
Refer to supervising dentist	9	21.4
Other	5	11.9
<b>Ease of finding dentists to accept referrals</b>		
Very easy	5	11.9
Somewhat easy	7	16.7
Somewhat difficult	15	35.7
Very difficult	15	35.7

\*Respondents could select all that apply; percentages sum to >100%.

that most are providing services in school-based settings.<sup>13</sup> Very few Iowa PHS DHs reported applying silver diamine fluoride (SDF). However, it is expected that more PHS DHs are currently utilizing SDF application as this duty was only allowed for PHS use in the year that the survey was fielded.<sup>8</sup>

There was an almost even split between those who were self-motivated to become a PHS DH and those who were encouraged to do so by their employer. The most important reason for pursuing PHS among those who were self-motivated was a personal interest in public health, which could present opportunities to educate public health-minded dental hygiene students during their education or early in their careers. However, job availability appears to be a limiting factor as 67% of the respondents had a difficult time finding employment as a PHS DH the last time they looked for work. Comparatively, a 2014 study found that 58% of registered DHs in Iowa reported having a somewhat or very difficult time finding work in clinical practice, indicating that the difficulty in finding employment may be broader than the PHS DH workforce.<sup>7</sup>

When asked about billing and compensation, most PHS respondents had their clinical services billed by their employer because Iowa does not allow DHs to directly bill for services. However, in Maine, where DHs can bill for services rendered, 18% bill themselves and 71% have an employer bill for reimbursement.<sup>13</sup> This indicates a potential barrier to PHS DHs as they must rely on a third party to bill for payment; if PHS DHs in Iowa were permitted to directly bill for reimbursement, it could allow for greater flexibility and offer more employment opportunities given that many respondents indicated difficulty finding work.

A majority of supervising dentist respondents accepted at least some patient referrals from their PHS DH. However, PHS DHs also reported difficulty finding dentists to accept patient referrals, suggesting that the quantity of patient referrals may be greater than the number the supervising dentists were willing to accept. In a Maine study, the majority of public health hygienists also expressed challenges finding a dentist to accept patient referrals.<sup>13</sup> Low dentist participation in Medicaid is a well-known issue, and may likely be a key factor driving referral difficulty for all public health hygienists. Studies have suggested that dentists may not choose to participate in Medicaid due to the poor or low reimbursement rates.<sup>18</sup> In 2016, 40% of Iowa's dentists reported refusal to participate in any state-offered insurance plans; in addition, many Iowa dentists who do accept Medicaid limit the patients they will see to children or those with a previous patient relationship.<sup>19</sup>

Regarding the working relationship with their supervising dentist, most respondents found it relatively easy to find a supervising dentist to work with. This is consistent with results from Kansas, Minnesota, and New Mexico where a majority of public health hygienists indicated similar ease in finding a supervising dentist.<sup>11,14</sup> In contrast, public health hygienists in Massachusetts reported more difficulty finding a supervising dentist due to issues with malpractice insurance providers.<sup>10</sup> There was considerable variation in the frequency of communication between PHS DHs and supervising dentists, with the greatest number communicating less than once a month but more than annually. Conversely, 40% of the ECP holders in Kansas communicate with their supervising dentist daily.<sup>11</sup> A majority of PHS respondents had high levels of satisfaction with their job and supervising dentist relationship. These findings were consistent with results from Kansas where 96% reported high satisfaction with their supervising dentist's support.<sup>11</sup>

There are several limitations to this study. The target population and response rate to the survey was small, with 42 active PHS DH respondents out of 126 potential participants. There was also a limited amount of diversity within the sample population (98% White). In addition, all survey research is subject to several types of bias; response bias could impact results if survey respondents differed systematically from nonrespondents and recall bias may impact respondents' ability to remember past events accurately.

Future research should explore in greater detail on the motivations and barriers to DHs working under PHS including how compensation methods and referral acceptance affects their success and satisfaction as well as the employment environment for positions working under PHS. Other research could investigate the ways dental hygiene programs prepare their students to serve in alternative practice settings and possible improvements that could be made to the curriculum. Future studies should also examine the outcomes of direct access dental hygiene workforce models on measures of access to care for underserved populations. One promising study found an association between broader state scope of practice for DHs and improved population oral health;<sup>9</sup> however, further research is needed on state-level impacts.

## Conclusion

This study of Iowa's growing workforce of PHS DHs demonstrated that most DHs were employed by government agencies, whereas most supervising dentists worked in private settings. Although most supervising dentists accepted at least some patient referrals, PHS DHs still indicated a high degree of difficulty referring patients for care. Results from this

study contributed to knowledge gaps in direct access dental hygiene models, particularly in the areas of employer types and working relationships. Additional research is needed to investigate barriers to care with direct access dental hygiene services in Iowa and other states to ultimately improve access for the underserved.

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# Resin Infiltration Therapy: A micro-invasive treatment approach for white spot lesions

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### Abstract

**Purpose:** The demand for esthetic dentistry has led to the development of new treatments for white spot lesions (WSLs). Microinvasive therapies, such as resin infiltration, have been used to treat demineralized enamel. Recently, resin infiltration using the active ingredient triethylene glycol dimethacrylate (TEGDMA), has been used to restore WSLs. The purpose of this narrative review is to evaluate the evidence on TEGDMA, an innovative resin that has been introduced, as an alternative dental material for treating WSLs.

**Methods:** A review of the literature was conducted using key words pertaining to WSLs and resin infiltration including cosmetic dentistry; dental caries; dental materials; general dentistry; sealants; technology for patient care. Evidence was incorporated from biomedical data bases including PubMed and the Cochrane Library, which formed the framework for the review.

**Results:** Based on the synthesis of the evidence, resin infiltration using TEGDMA is an effective alternative treatment option for WSLs. Studies suggest that the outcomes for micro-invasive procedures using resin infiltration may vary depending on the depth of the lesion.

**Conclusion:** Resin infiltration, using TEGDMA, removes minimal amounts of enamel and preserves the hard tissue surrounding the WSLs. Additionally, TEGDMA restores the natural fluorescence, hardness, and texture of intact enamel. Future studies are needed to assess the long-term clinical effects of resin infiltration using this material on both permanent and primary dentition.

**Keywords:** white spot lesions, demineralized enamel, triethylene glycol dimethacrylate, resin infiltration, micro-invasive dentistry, cosmetic dentistry

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### Introduction

White spot lesions (WSLs) are the first sign of a subsurface enamel porosity due to demineralization.<sup>1</sup> These lesions exhibit an opacity on the tooth surface and contribute to esthetic complications.<sup>1</sup> Demineralization can occur as a result of several intrinsic (ie hypocalcification; fluorosis), as well as, extrinsic (biofilm accumulation; orthodontic brackets; extended exposure to bacteria) factors.<sup>2,3</sup> Prolonged biofilm accumulation allows the acidic byproducts from the bacteria to create micro-porosities within the enamel surface, which results in the development of WSLs.<sup>3</sup> When the acid challenge is removed, saliva becomes saturated in calcium

and phosphate allowing the ions to be reabsorbed into the demineralized area, resulting in net mineral gain and repair of the hydroxyapatite structure.<sup>4</sup>

White spot lesions are commonly seen on the facial surfaces of enamel, resulting in an increased concern for esthetics. These lesions may appear as irregular, milky-white opacities on the surface of enamel.<sup>3</sup> Patients with fixed orthodontic brackets are at higher risk for experiencing enamel demineralization. This is especially evident in orthodontic patients with poor oral hygiene practices, which can lead to the development of a WSL.<sup>3</sup> White spot lesions that form during orthodontic

treatment can become problematic for both patients and oral health care providers.

White spot lesions have been treated with a variety of modalities including dietary interventions, topical fluoride products, and microabrasion.<sup>1</sup> Although dietary control is effective for prevention, it does not directly reverse the effects of WSLs once formed. Fluoride has been shown to reduce caries in both permanent and primary dentitions by remineralizing tooth surfaces depleted of minerals, such as a WSL.<sup>1</sup> Self-care methods of delivery include dentifrices and oral rinses that contain fluoride. Professionally applied methods include fluoride gels, varnishes, and silver diamine fluoride products. Microabrasion has been shown to improve the appearance of WSLs by removing the defective outer layer of enamel using chemical erosion and mechanical abrasion.<sup>5</sup> Minimally invasive removal of enamel allows for the possibility of remineralization, allowing saliva to reach deeper into the enamel surface and restore the WSL over time.<sup>5</sup> However, if a WSL is left untreated, it may reach the clinical end point of cavitation, and require a more invasive approach including resin-based restorative materials, porcelain veneers, or crowns. While restorative treatments like crowns and veneers must be provided by a licensed dentist, treatment with resin infiltration may be performed by a licensed dental hygienist.

Micro-invasive strategies such as pit and fissure sealants and resin infiltration have been used to arrest early cavitated lesions.<sup>1</sup> Components used in pit and fissure sealants include resin materials and glass ionomer cements.<sup>1</sup> Sealants are applied onto phosphoric acid-etched enamel to act as a barrier between the susceptible tooth surface and acid production, therefore preventing mineral loss from the tooth. Resin infiltration uses low-viscosity light cured resin to treat WSLs. The technique allows the resin to permeate into the hydrochloric acid-etched WSL by capillary action and stops the progression of demineralization by obstructing the pathway of acids produced by bacteria.<sup>6,7</sup> Research has shown that the infusion of the resin into the pores of the tooth, also replaces lost tooth structure and improves the esthetic appearance of the WSL.<sup>8</sup>

Numerous studies have been conducted to determine the effectiveness of resin infiltration compared to other restorative treatments on WSLs. Recently, a resin infiltration method using the active ingredient triethylene glycol dimethacrylate (TEGDMA), has been used to restore WSLs.<sup>2,9,10,11</sup> Currently, there are limited studies that synthesize published data on TEGDMA, comparing it to various other therapeutic and preventive modalities for WSLs. The purpose of this narrative review is to evaluate the evidence on TEGDMA, an innovative resin, as an alternative dental material for treating WSLs.

## Methods

A narrative review using deductive reasoning was used to gather evidence related to the topic. Search strategies used in formulating this narrative review were scientific data bases such as PubMed and the Cochrane Library, limiting the criteria to articles that have been published within the last five years. Key words such as cosmetic dentistry; dental caries; dental materials; general dentistry; sealants; technology for patient care, were used to find randomized control trials and systematic reviews on this topic. The strengths of the evidence used in this review were based on the articles' validity and reliability.

## Results

Research has examined how effective resin infiltration penetrates within the enamel.<sup>9</sup> Depth of resin penetration could be a key determining factor for the creation of a diffusion barrier and the esthetic effects of resin infiltration.<sup>9</sup> In a study by Paris et al. seventy extracted human teeth (n=70) were classified according to the International Caries Detection and Assessment System (ICDAS).<sup>12</sup> Half of each tooth was etched with 37% phosphoric acid, the same type of etchant used to prepare the tooth surface for sealants.<sup>12</sup> The other half was etched with 15% hydrochloric acid, the etchant used to prepare a demineralized lesion for resin infiltration.<sup>12</sup> It was found that etching with 15% hydrochloric acid gel for two minutes eroded the  $\leq 50$   $\mu\text{m}$  surface layer sufficiently, which resulted in nearly complete penetration of the resin.<sup>12</sup> In contrast, 37% phosphoric acid eroded less sufficiently and resulted in reduced penetration depths, at a level that was both clinically and statistically significant ( $p < 0.05$ ).<sup>12</sup> Resin infiltration has also been shown to penetrate deeper with the use of 15% hydrochloric acid etchant, when compared to treatments using fluoride or casein phosphopeptide with the use of a 37% phosphoric acid etchant.<sup>13</sup>

Triethylene glycol dimethacrylate resin can be infiltrated into hypomineralized enamel, which masks the white discoloration and produces a more uniform appearance of the enamel.<sup>1</sup> In addition to improved esthetics, conclusions from a systematic review by Manoharan et al. reported that resin infiltration using TEGDMA did not induce post-operative sensitivity or pulpal inflammation.<sup>2</sup> When the microscopic pores within the enamel were filled with the resin infiltrate, marginal gaps and leakage were no longer present, resulting in reduced sensitivity.<sup>2,14</sup>

A number of studies have reported that resin infiltration fills the micro-porosities and brings the tooth's fluorescence, hardness, and texture back to values of sound enamel.<sup>2,10,15</sup> An *in vitro* study by Markowitz and Carey used a fluorescent



camera to assess the brightness intensity on extracted caries-free third molars.<sup>15</sup> In this study, a 1mm x 4mm area on the facial surface was treated with lactic acid for two weeks to create a demineralized white spot lesion.<sup>15</sup> Half of the lesion was then treated with resin infiltration and the other half was untouched. The fluorescent camera captured the ability of the resin to fill micro-porosities and mask white spot discoloration.<sup>15</sup> Mean brightness intensity readings for intact enamel prior to treatment, after demineralization, and after treatment with resin infiltration were measured. Prior to resin infiltration, the brightness intensity value of intact enamel was 159.6.<sup>15</sup> After the enamel was etched with lactic acid, the artificial white spot lesion showed a value of 123.4.<sup>15</sup> Following resin infiltration therapy, the brightness intensity value was 160.9, which brought the value back to that of intact enamel, a finding suggesting that resin infiltration therapy has the potential to restore enamel to its original state, thus improving the appearance of WSLs.<sup>15</sup>

A study by Taher et al. evaluated resin infiltration therapy's ability to restore the micro-hardness and texture of demineralized enamel.<sup>10</sup> The hardness of caries-free extracted premolars (n=20) was measured using the Vicker's surface hardness test before and after treatment with resin infiltration.<sup>10</sup> It was found that the premolars treated with resin infiltration had approximately the same microhardness as sound enamel.<sup>10</sup> In regards to texture, scanning electron microscopy was used to examine micro-porosities in enamel and it was found that the micro-porosities appeared occluded and the enamel surface was smooth following resin infiltration using TEGDMA.<sup>10</sup> Findings from Taher et al. also suggest that resin infiltration has the ability to restore both hardness and texture back to that of intact enamel, thus restoring structure, function, and esthetics.<sup>10</sup>

Research studies have also examined the ability of resin infiltration to restore WSLs occurring during orthodontic treatment.<sup>5,16,17</sup> Gu et al. conducted a randomized clinical trial on post-orthodontic patients who presented with WSLs to assess resin infiltration versus micro-abrasion on the improvement of WSLs.<sup>5</sup> In this split-mouth design study, one side of the mouth was treated with resin infiltration, and the opposite side with microabrasion.<sup>5</sup> A Crystaleye spectrophotometer was used to measure WSLs at different stages starting at baseline, one week, six months, and twelve months.<sup>5</sup> The resin infiltration group showed a significant decrease in WSLs at one week ( $p < 0.0001$ ), however no significant changes were reported at six or twelve months ( $p = 0.0549$ ).<sup>5</sup> Conversely, the micro-abrasion group showed a decrease in WSLs with a significant change from one week to six months ( $p = 0.0003$ ), but no significant difference from six

to twelve months ( $p = 0.0996$ ).<sup>5</sup> Gu et al. also found that resin infiltration was more effective in decreasing lesion size when compared to microabrasion, though no visual difference was observed between the two groups at the twelve month follow-up. Results showed that both treatments had similar masking of WSLs at twelve months; however, resin infiltration was found to be more effective for both immediate and long-term esthetics ( $p < 0.001$ ).<sup>5</sup>

Resin infiltration therapy has also been used to treat WSLs due to fluorosis. Garg et al. measured the effects of resin infiltration on three cases of mild to moderate fluorosis treated with resin infiltration using TEGDMA.<sup>11</sup> In this study, eighteen fluoresced spots were measured using visual assessment with digital photographs, a colorimeter and spectrophotometer.<sup>11</sup> The assessment tools were used at four different stages: pre-operative, post-bleaching prior to resin infiltration, post-infiltration, and at a twelve-month follow-up.<sup>11</sup> It was found that 78% (n=14) of the WSLs treated with resin infiltration using TEGDMA, were within an acceptable range ( $p < 0.001$ ).<sup>11</sup> The remaining 22% (n=4) were found to be unacceptable as the WSLs were not completely masked at the post-infiltration stage.<sup>11</sup> However, at the twelve month stage, three of the four lesions improved and were found to be in the acceptable range, resulting in an overall success rate of 88%.<sup>11</sup> Resin infiltration with TEGDMA was found to be significant in maintaining the appearance of WSLs for at least twelve months ( $p < 0.001$ ).<sup>11</sup> All of the participants saw an improvement in the appearance of their teeth over the course of the study and reported an increase in their self-esteem.<sup>11</sup>

It is important to consider that the outcomes for micro-invasive procedures using resin infiltration may not always reach the desired esthetics. One limitation of resin infiltration is that optimal results are not permanent, therefore bleaching is recommended prior to resin infiltration and every 12-18 months thereafter to maintain the desired color of tooth structure.<sup>18</sup> If an area of demineralization extends deep within the enamel, resin infiltration may not mask the WSL entirely. In order for resin to reach the full depth of the demineralized enamel, dental clinicians should apply the etchant for two minutes.<sup>2</sup> Deeper enamel defects and demineralized WSLs previously treated with resin infiltration may be resistant to the etchant.<sup>2</sup> Acid etching may be repeated in two-minute intervals up to two additional times to achieve the desired outcome.<sup>2</sup>

Medium-grit disks have been used to remove the superficial layer of enamel prior to resin infiltration.<sup>19</sup> This step is often used on patients who have undergone resin infiltration therapy in the past, making their enamel surface more resistant to the etch.<sup>19</sup> Although, the use of the disk would allow deeper penetration of the etch into the enamel surface, it may

also have the potential to irreversibly remove a thin layer of tooth structure, making the treatment more invasive in some cases.<sup>19</sup> The application technique for application of resin infiltration using TEGDMA adapted from Manoharan et al.<sup>2</sup> is shown in Figure 1. An example of maxillary central incisors treated with resin infiltration is shown in Figure 2.

**Figure 1. Resin infiltration technique using TEGDMA<sup>2</sup>**

**Application Technique for Resin Infiltration**

1. Isolate the teeth with a gingival barrier.
2. Place a 15% hydrochloric acid gel on the demineralized surface for two minutes.
3. Apply 99% ethanol solution for 30 seconds to achieve dryness and improve penetration.
4. Apply TEGDMA with a micro brush for three minutes.
5. Remove excess resin with a cotton roll.
6. Light cure for 20 seconds.
7. Repeat steps 4-6 to further occlude any microscopic gaps.
8. Finish and polish.

**Figure 2. Before and after images of resin infiltration of the maxillary central incisors\***



\* Image courtesy of Shanae Lowrance, DDS; Lowrance Dental, Rockwall, TX, USA

It is important to note that there are differences in treating primary versus permanent teeth with resin infiltration.<sup>2</sup> Primary enamel is less mineralized and more porous than permanent enamel, and as a result, the resin has been shown to have a greater diffusion coefficient when applied to primary enamel.<sup>2</sup> In a study by Paris et al., confocal microscopic images were used to measure lesion and penetration depths of resin infiltration for both primary and permanent teeth.<sup>20</sup> Primary teeth exhibited better penetration of the resin than permanent teeth after a one minute application of resin infiltration.<sup>20</sup> Therefore, dental clinicians are encouraged to treat each case individually, and not adhere to a single protocol for application. The number of in vivo studies in the literature examining the long-term effects resin infiltration has on the esthetic appearance of the tooth of is limited, therefore more research is needed in this area.

## Conclusion

Evidence suggests that resin infiltration using TEGDMA is an effective minimally invasive treatment option for WSLs. Resin infiltration, using TEGDMA has been shown to remove minimal amounts of enamel while preserving the hard tissue surrounding the WSL. Triethylene glycol dimethacrylate also restores the natural fluorescence, hardness, and texture of intact enamel. Future research is needed to assess the long-term effects of resin infiltration using TEGDMA and determine whether resin infiltration is effective in reducing the staining that can occur during tetracycline therapy and other etiologic factors that may lead to intrinsic staining. Further studies should also evaluate other newer restorative resin-based therapies that are being developed to treat WSLs.

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# Critical Issues in Dental Hygiene Education

## Implant Maintenance Curriculum Content in Dental Hygiene Education

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### Abstract

**Purpose:** Dental implants have become a common treatment option for the replacement of missing teeth. The purpose of this study was to identify the curriculum content used for teaching dental implant maintenance within entry-level dental hygiene programs in the United States.

**Methods:** An electronic questionnaire was distributed via five mailings in March and April of 2020 to accredited entry-level dental hygiene program directors (n=329) in the United States. The survey instrument evaluated curriculum content related to dental implant maintenance within dental hygiene programs at both the associate and baccalaureate levels. Results were analyzed using descriptive statistics and Chi square tests of association ( $p=0.01$ ).

**Results:** A total of 86 responses were received for a response rate of 26.1%. Most programs (98.80%, n=82) provide didactic instruction on dental implant maintenance, while less than half (45.8%, n=38) include laboratory instruction in maintenance therapy. On average, students worked with 3.41 implant patients during their clinical education (range = 0-20). Most respondents indicated that clinical competencies are not required for implant maintenance. There were no statistically significant differences found in the curriculum content for teaching dental implant maintenance between associate degree/certificate and baccalaureate entry-level programs.

**Conclusions:** Varied approaches in the assessment and maintenance of peri-implant health were identified among the dental hygiene programs surveyed. These findings may provide an opportunity for program directors to assess their curriculum and create protocols and competencies related to dental implant maintenance. Future research is needed to investigate the curriculum content and evaluate whether programs are implementing maintenance approaches that promote implant health.

**Keywords:** dental implants, implant maintenance therapy, curriculum, dental hygiene process of care, dental hygiene education

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### Introduction

The percentage of the United States (US) population with dental implants for the replacement of missing teeth has increased significantly from 0.7% in 2000 to 5.7% in 2016 and is projected to be as high as 23% by 2026.<sup>1</sup> An estimated 3 million people in the US have at least one dental implant and about 500,000 implants are placed annually.<sup>2</sup> Dental implants are now considered a viable and predictable treatment option for tooth replacement.<sup>1-3</sup> Implants can serve to preserve adjacent teeth and surrounding bone and enhance the masticatory function and quality of life for patients suffering from tooth loss ranging from a single tooth to fully edentulous.<sup>1-3</sup>

Maintaining peri-implant health is critical for the long-term survival of the implant.<sup>4,5</sup> Inflammatory diseases caused by biofilm accumulation can compromise the health of

dental implants.<sup>6,7</sup> Inflammation surrounding an implant that is limited to the adjacent mucosa is defined as peri-implant mucositis, while progression of the inflammation leading to bone loss is defined as peri-implantitis.<sup>6,7</sup> Dental professionals assess implant health during the process of care and screen for clinical signs of inflammation, bleeding upon probing, increased pocket depths, suppuration, mobility, and radiographic bone loss.<sup>8,9</sup> Peri-implant health is evidenced by the absence inflammatory signs and symptoms, probing depths of 4-5mm or less, and no radiographic evidence of bone loss.<sup>6,8</sup> Risk factors for peri-implant mucositis and peri-implantitis include history of periodontal disease, poor biofilm control, irregular maintenance visits, residual cement, occlusal overload, tobacco use, diabetes, and connective tissue

disease.<sup>5,6,10</sup> Regularly scheduled, nonsurgical maintenance therapy is provided in an effort to address these risk factors.

The prevalence of peri-implant related diseases remains high; rates vary based upon the study and criteria. Peri-implant mucositis affects between 42.5% to 50% of implants while peri-implantitis impacts 12-43% of implants.<sup>7,11</sup> Research is limited regarding the long-term survival of dental implants and disease rates may be difficult to track;<sup>12</sup> implant failure and survival rates are determined based upon the presence of the implant in the mouth at the time of the study.<sup>13</sup> Research studies have shown that between 9-16.6% of implants will fail within ten years of placement.<sup>14</sup> Given the high incidence of peri-implant diseases, success and survival rates should be considered when evaluating dental implants and their long term prognosis.<sup>15</sup>

As preventive oral health specialists, dental hygienists manage and maintain periodontal health through the diagnostic, preventive and therapeutic services which relate specifically to dental implant maintenance.<sup>16</sup> Continuing care visits play a key role in implant success by reducing bacterial biofilm and promoting implant health; however, the frequency of implant maintenance visits should be based upon individual patient needs.<sup>4,11,17</sup> Early diagnosis and intervention are crucial components of preventing implant failure. Dental hygienists can play a key role in implant maintenance in addition to facilitating care through patient education and a multidisciplinary approach to referrals.<sup>5,6,18</sup>

The US dental hygiene educational standards established by the Commission on Dental Accreditation (CODA) do not specifically state how entry-level dental hygiene programs must prepare graduates to assess and maintain dental implants. Standard 2-13 states that “graduates must be competent in providing the dental hygiene process of care,” and Standard 2-14 states that “graduates must be competent in providing dental hygiene care for all types of classifications of periodontal diseases, including patients who exhibit moderate to severe periodontal disease.”<sup>19</sup> The dental hygiene process of care includes the management of oral conditions, with implant maintenance in this category. Dental hygienists must have the knowledge base and clinical skills to assess, plan dental hygiene therapies, implement care, evaluate results, and document the care of implants and management of peri-implant disease.<sup>16</sup> Entry-level dental hygiene programs must decide the extent to which dental implant maintenance is included within their curriculum and the associated clinical requirements.

The integration of implant dentistry into predoctoral dental and dental hygiene curriculum has increased over the past few decades in order to remain current with the needs of

the population.<sup>23-28</sup> Curriculum guidelines for dental implant education were first developed for dental hygiene programs in 1995 and can serve as a guide.<sup>26</sup> The recommendations include biological and scientific research of implantology, client assessment and education, diagnosis, treatment planning, and implant selection, implant surgery and postsurgical care, implant prosthodontic procedures, implant evaluation and maintenance protocols, and ethical considerations.<sup>26</sup> An emphasis was placed on a multidisciplinary approach and the need for highly trained dental hygienists and specialists with advanced education or experiences in implant dentistry.<sup>20,26,27</sup>

There is a gap in the literature regarding curriculum content related to dental implant maintenance in entry-level dental hygiene programs in the US, however, in a study conducted in the United Kingdom and Ireland the implant maintenance curriculum in dental hygiene and dental therapy programs has been evaluated.<sup>22</sup> All programs reported the provision of implant training by way of didactic lecture within their curricula, and over half (n=9) of the 14 programs required students to demonstrate competence related to the non-surgical management of peri-implantitis or peri-implant mucositis.<sup>22</sup> Challenges to developing dental implant curriculum within predoctoral dental programs and dental hygiene programs in the United Kingdom and Ireland included a lack of suitable cases, funding, trained staff, time within the program, and high ratios of students to teachers.<sup>20-22</sup> Difficulties were also cited regarding the challenges related to following peri-implant related diseases that may progress over a longer period of time beyond the duration of enrollment in the educational program.<sup>22</sup>

Other studies have shown that dental hygiene practitioners' confidence in monitoring and maintaining peri-implant related tissues may be dependent upon the educational experiences in school, training on the job, and professional development; thus, placing a high level of importance upon the educational experience.<sup>27,28</sup> Moreover, simulations and clinical experiences have also been shown to affect the confidence and satisfaction levels of dental students regarding their overall educational experience.<sup>29</sup> Regardless of the education or hours of training, dental practitioners must stay current by critically evaluating the literature and current evidence to determine the best practices when managing patients with dental implants.

Since curriculum guidelines were first developed,<sup>26</sup> dental implant training has steadily increased; however, CODA has not included a standard or specific competency for implant maintenance within entry-level dental hygiene programs. Given the growing number of implants placed each year, inclusion of implant maintenance therapy within the dental hygiene curriculum should be considered. It is essential for

graduates entering the workforce to have the knowledge and clinical skills necessary to provide comprehensive care for patients with dental implants, yet little is known about the curriculum content related to dental implant maintenance in entry-level dental hygiene programs in the US. Therefore, the purpose of this study was to identify the curriculum content used for teaching dental implant maintenance within associate degree/certificate and baccalaureate entry-level programs in the US.

## Methods

An exploratory descriptive research design was used to evaluate the dental implant maintenance curriculum content within entry-level dental hygiene programs in the US. The 33-item questionnaire was adapted with permission from a previous study performed to evaluate the current teaching methods of dental implant maintenance within dental hygiene and dental therapy schools in the United Kingdom and Ireland.<sup>22</sup>

The following variables were analyzed: didactic instruction (5 items); laboratory experiences (3 items); clinical instruction/experiences and competencies (13 items); barriers (6 items); curriculum and accreditation requirements (4). Demographic items included role in the program and type of educational program/degree awarded. Respondents were also provided with an opportunity to provide open-ended comments on accreditation requirements for implant maintenance.

The instrument was evaluated by five experts in dental and dental hygiene education to establish content validity; a Content Validity Index (CVI) and a score of 0.80 or greater was sought for each item.<sup>29</sup> Reliability of the instrument was tested with a test-retest method by a secondary panel of experts to ensure consistency of results. The survey instrument and research questions were analyzed by a statistician to confirm correlation between the two, evaluate validity, and confirm the statistical analysis plan. Feedback provided by all experts was utilized and minor modifications were made. Institutional Review Board approval was granted by the University of Idaho Human Subjects Committee (IRB#-FY2020-218).

Dental hygiene program directors from 329 entry-level dental hygiene programs in the US (n=329) were invited to participate in the electronic survey. Five mailings from March to April 2020 were distributed through an online survey program (Qualtrics; Provo, UT, USA). The self-administered survey contained a consent statement; all responses were confidential. Descriptive statistics and a Chi square test of association were used to analyze the data. Probability was established at 0.01 to prevent a type 1 error.

## Results

A total of 86 surveys were returned for a response rate of 26.1% (n=86). Of the surveys returned, 82 were completed and included in the data analysis (n=82). Nearly three quarters (74.7%, n=62) of the respondents identified themselves as program directors, while others (34.9%, n=29) identified themselves as clinic coordinators. Some respondents identified themselves as fulfilling both roles of program directors and clinic coordinators. Most of the respondents (73.5%, n=61) were from associate degree/certificate programs while the remainder (25.3%, n=21) were from baccalaureate programs.

### *Didactic Instruction*

The majority (98.8%, n=82) of respondents indicated that didactic instruction on dental implants was part of the curriculum; approximately 6.25 average contact hours were dedicated to didactic instruction on dental implants (range = 1-24 hours). Regarding specific content, nearly all (98.8%, n=82) respondents indicated didactic instruction on the assessment of peri-implant related diseases, professional implant maintenance (95.2%, n=79), and dental implant self-care (96.4%, n=80). Other topics included within the didactic curriculum were implant types and materials, treatment planning, contraindications, surgical placement, assessment of implant health, rationale for referral, and implant maintenance throughout the dental hygiene process of care. A chi square test of association was used to determine relationships between the responses to the item related to didactic content on implant self-care and the type of degree offered (associate degree/certificate versus baccalaureate). However, the associations between the different types of educational institutions and responses for this item were not statistically significant ( $X^2=0.71$ ,  $df = 1$ ,  $p = 0.40$ , Cramer's Phi = 0.09).

### *Laboratory Instruction*

Fewer than half (45.8%, n=38) included pre-clinical instruction within the laboratory setting on implant maintenance. Further analysis of the data showed that 41.0% (n=25) of the associate degree/certificate programs and 61% (n=13) of the baccalaureate programs had instruction in the laboratory setting; typodonts were used by 44%(n=23) of the associate degree/certificate programs and in 23% (n=3) of the baccalaureate programs. A chi square test of association was used to determine associations between these responses and degree offered, however the difference was not statistically significant ( $X^2 = 1.61$ ,  $df = 1$ ,  $p = 0.21$ , Cramer's Phi = -0.21). Programs with laboratory experiences on dental implants indicated whether simulation training was used and over half of the associate degree/certificate programs (52.0%, n=13) and over one quarter of the baccalaureate programs (30.8%, n=4)

used simulators. However, this difference was not statistically significant ( $X^2 = 1.56$ ,  $df = 1$ ,  $p = 0.21$ , Cramer's Phi = -0.20).

### ***Clinical Experiences***

Regarding the number of direct patient experiences, most (87.8%,  $n=72$ ) respondents reported, on average, that students worked with 3.41 patients with implants during their clinical education. Aspects of clinical experiences were analyzed with yes/no responses and categorized by program type. Programs required clinical experiences using radiographs to screen for implant diseases, utilizing hand instrumentation around dental implants, and teaching patients how to use self-care aides to maintain dental implants. However, most programs did not require the use of ultrasonic instrumentation or air polishing for biofilm reduction. Respondents were divided regarding probing implants and providing experiences related to irrigating with antiseptics. Responses to items directed toward clinical experiences are shown in Table I.

A chi square test of association was used to determine relationships between clinical experiences and type of degree offered; however, no outcomes were statistically significant (Table II). Additionally, within the clinical experience items, respondents were asked items related to the performance of clinical competencies and dental implant maintenance skills. Most indicated that dental implant clinical competencies were not required (Table I). Of those who required competencies, the specific assessments were associated with periodontal disease staging and grading, air polishing, debridement, irrigation, instrumentation, and self-care recommendations. Additional areas included the dental hygiene process of care and the assessment of implant health.

### ***Educational Barriers***

Over half (58.5%,  $n=48$ ) of the respondents indicated barriers in educating students about dental implant maintenance associated within the curriculum. Examples included lack of trained faculty, calibration, time, patients, and funding; lack of patients was the most concerning barrier cited by nearly three quarters of the respondents (74.4%,  $n=61$ ). A chi square test of association was used to determine whether there was an association between these responses and the type of degree offered. However, the findings were not statistically significant (Table III).

### ***Curriculum Development and Accreditation***

Regarding the further development of dental implant maintenance content in the program curriculum, a majority (89.0%,  $n=73$ ) indicated that they would be considering it in the next five years. Further analysis of the data showed that most (90.2%,  $n=55$ ) associate/certificate degree programs

and 85% ( $n=18$ ) baccalaureate programs were supportive of expanding the curriculum. A chi square test of association was used to determine whether there was an association between these responses and type of degree offered; however, the difference was not statistically significant ( $X^2=0.32$ ,  $df = 1$ ,  $p = 0.57$ , Cramer's Phi = -0.06). Respondents in favor of expanding the curriculum indicated an interest in enhancing laboratory or simulation experiences; expanding didactic instructional hours; and increasing clinical experiences related to air polishing, ultrasonic scaling, and patient education. Respondents also recognized the need to update dental implant curriculum regularly. Respondents not in favor of further developing the curricular content (11.0%,  $n=9$ ) commented the dental implant curriculum is already comprehensive and clearly defined and had recently been updated.

Attitudes towards accreditation requirements for didactic instruction were divided with 51.2% ( $n=42$ ) indicating no change and 48.8% ( $n=40$ ) indicating the need for a change. Regarding the inclusion of a clinical requirement for implant maintenance in the accreditation standards, over half (63.4%,  $n=52$ ) responded "no" and 36.6% ( $n=30$ ) responded "yes." Further analysis of the data showed that 62.3% ( $n=38$ ) of the associate degree/certificate programs and 66.6% ( $n=14$ ) of the baccalaureate programs responded "no" clinical accreditation changes were needed; however, these differences between program types were not statistically significant ( $X^2=0.13$ ,  $df = 1$ ,  $p = 0.72$ , Cramer's Phi = -0.04). Respondents were provided an opportunity to comment on accreditation standard requirements for implant maintenance in entry-level dental hygiene programs. Notable comments are shown in Table IV.

## **Discussion**

To the best of the authors' knowledge the curricular content specific to dental implant maintenance in entry level dental hygiene programs in the US has not been previously assessed. Inclusion of dental implant maintenance in the dental hygiene curriculum serves to support the approximately 500,000 new implants placed annually in the US.<sup>2</sup> However, the curricular content and scope related to dental implant maintenance varies. Several key findings from the results are worthy of discussion.

Nearly all respondents indicated their program provides students with direct clinical experiences with implant patients and students on the average had 3.41 patient experiences. The number of patient encounters can vary greatly depending on the location of the program and the populations served. As the projected prevalence of dental implants in the US population is 23% by 2025, providing dental hygiene students with adequate clinical training continues to present challenges. The main barrier cited in this study was the limited number

**Table I. Responses to items related to clinical experiences for dental implant maintenance (n=82)**

Statement	Associate/Certificate (n=61)*	Bachelor's (n=21)	Associate/Certificate (n=61)*	Bachelor's (n=21)
	Yes	Yes	No	No
	n (%)	n (%)	n (%)	n (%)
Q14. Are students having direct clinical experiences with patients to maintain dental implants?	56 (91.8)	21 (100.0)	5 (8.2)	—
Q16. Does the dental hygiene curriculum require students to probe dental implants as part of the periodontal assessment in the clinical setting?	38 (62.3)	15 (71.4)	23 (37.7)	6 (28.6)
Q17. Are students required to use radiographs to screen for peri-implant related diseases within the clinical setting?	57 (93.4)	20 (95.2)	4 (6.6)	1 (4.8)
Q18. Are students required to assess risk factors for peri-implant related diseases within the clinical setting?	56 (91.80%)	20 (95.2)	5 (8.2)	1 (4.8)
Q19. Does the dental hygiene curriculum require students to produce a biofilm free surface around dental implants with ultrasonic instrumentation within the clinical setting?	18 (29.5)	8 (38.1)	43 (70.5)	13 (61.9)
Q20. Does the dental hygiene curriculum require students to produce a biofilm free surface around dental implants with hand instruments within the clinical setting?	47 (78.3)	17 (81.0)	13 (21.7)	4 (19.0)
Q21. Does the dental hygiene curriculum require students to produce a biofilm free surface around dental implants with air polishing within the clinical setting?	22 (36.1)	8 (38.1)	39 (63.9)	13 (61.9)
Q22. Does the dental hygiene curriculum provide experiences related to irrigation with antiseptics around dental implants to promote peri-implant health within the clinical setting?	31 (51.7)	17 (81.0)	29 (48.3)	4 (19.0)
Q23. Are students required to recommend self-care aids to patients with dental implants within the clinical setting?	59 (98.3)	21 (100.0)	1 (1.7)	—
Q24. Are students required to teach patients how to use the recommended self-care aids to maintain dental implants within the clinical setting?	56 (91.8)	19 (90.5)	5 (8.2)	2 (9.5)
Q25. Does your dental hygiene program require students to perform any clinical competencies related to dental implant maintenance within the clinical setting?	8 (13.1)	2 (9.5)	53 (86.9)	19 (90.5)

\* n=60 for Q20, Q22, Q23



**Table II. Chi square test of association for items related to dental implant clinical experiences (n=82)**

Statement	Valid n	X <sup>2</sup> or Exact Test	df	p	Cramer's Phi
Q14. Are students having direct clinical experiences with patients to maintain dental implants?	82	1.83	1	0.18	0.15
Q16. Does the dental hygiene curriculum require students to probe dental implants as part of the periodontal assessment in the clinical setting?	82	0.57	1	0.45	0.08
Q17. Are students required to use radiographs to screen for peri-implant related diseases within the clinical setting?	82	0.09	1	0.77	0.03
Q18. Are students required to assess risk factors for peri-implant related diseases within the clinical setting?	82	0.27	1	0.60	0.06
Q 19. Does the dental hygiene curriculum require students to produce a biofilm free surface around dental implants with ultrasonic instrumentation with the clinical setting?	82	0.53	1	0.47	0.08
Q 20. Does the dental hygiene curriculum require students to produce a biofilm free surface around dental implants with hand instruments within the clinical setting?	81	0.06	1	0.80	0.03
Q 21. Does the dental hygiene curriculum require students to produce a biofilm free surface around dental implants with air polishing within the clinical setting?	82	0.03	1	0.87	0.02
Q 22. Does the dental hygiene curriculum provide experiences related to irrigation with antiseptics around dental implants to promote peri-implant health within the clinical setting?	81	5.53	1	0.02	0.26
Q 23. Are students required to recommend self-care aids to patients with dental implants within the clinical setting?	81	0.35	1	0.55	0.07
Q 24. Are students required to teach patients how to use the recommended self-care aids to maintain dental implants within the clinical setting?	82	0.04	1	0.85	-0.02
Q 25. Does your dental hygiene program require students to perform any clinical competencies related to dental implant maintenance within the clinical setting?	82	0.19	1	0.66	-0.05

**Table III. Chi square test of association for items related to dental implant educational barriers (n=82)**

Statement	Valid n	X2 or Exact Test	df	p	Cramer's Phi
Q 27. Are there barriers to educating students about dental implant maintenance?	82	0.77	1	0.38	1.00
Q 28. Is a lack of trained faculty a barrier for dental implant maintenance instruction?	82	0.59	1	0.44	-0.09
Q 29. Is a lack of calibration among faculty a barrier for dental implant maintenance instruction?	82	0.03	1	0.85	0.02
Q 30. Is a lack of time within the curriculum a barrier for dental implant maintenance instruction?	82	0.44	1	0.51	0.07
Q 31. Is a lack of patients with dental implants a barrier for dental implant maintenance instruction?	82	0.88	1	0.35	-0.10
Q 32. Is a lack of funding a barrier for dental implant maintenance instruction?	82	1.48	1	0.23	0.13

of patients in the clinic population with dental implants. This may be related to demographics, socioeconomic status of the patient population, or affiliation with a dental school or the type of clinical setting. To overcome this barrier, programs can enhance or foster the learning experience by integrating typodonts with dental implants, or simulation training into their laboratory curriculum. However, only few respondents indicated using this learning approach. A further complication is that student experiences appear to be focused on prevention of dental disease and tooth loss versus maintenance protocols and procedures for patients with dental implants. It is important to provide students with comprehensive clinical experiences which parallel what is found in clinical practice even if it requires additional effort to expand the patient population or alternatively incorporate simulated experiences. Perhaps patients with dental implants should be considered in the same manner as periodontal, special needs, geriatric, radiographic, and pediatric patient experiences and competencies.

The therapeutic services taught to maintain dental implants within the dental hygiene educational setting varied. Considering the high incidence of peri-implant related diseases affecting approximately 50% of implants, early detection and non-surgical management of peri-implant related diseases is an essential aspect of the dental hygiene process of care.<sup>7</sup> Even though most programs require students to probe implants within the clinical setting, many do not make this a requirement. The literature emphasizes the importance of lightly probing around implants to ensure not to damage the epithelial attachment

**Table IV. Open-ended comments regarding accreditation requirements for dental implant maintenance**

<i>"The requirements are sufficient and implant care is embedded and it is not necessary to prepare students to maintain implants."</i>
<i>"A clinical accreditation requirement may not be feasible for all students due to limited populations with implants in some populations."</i>
<i>"A simulation or laboratory requirement is more attainable for all programs."</i>
<i>"Students graduate as minimally competent to practice and their dental hygiene education is just the tip of the iceberg of what they will learn in practice and through CE courses; we can't teach everything to competence; some grads will see patients with implants while others might not ever see another implant."</i>
<i>"Accreditation requirements guide instruction and promote competence, one related to dental implant maintenance is important."</i>

with an appropriate periodontal probe suited for titanium to document a baseline pocket depth,<sup>19</sup> although probing around dental implants has historically been questioned in the dental community. It is important to remember that peri-implant probing is considered one of the methods used to assess peri-implant health and screen for peri-implant related diseases.<sup>4,7,8</sup>

Further, most programs implement hand instrumentation with implant scalers, yet results varied on the use of air polishing devices, ultrasonic implant scalers, and antiseptics

which help to reduce biofilm around implants and reduce inflammation or risk of disease.<sup>9,30,31</sup> Air polishing could be considered a sustainable treatment option for peri-implant related diseases; however, only a limited number of programs surveyed utilize these devices.<sup>31,32</sup> Cost of the air polishing devices and powders and the associated aerosols may be a consideration. Ultrasonic devices with an implant scaler tip may also reduce the bacterial biofilm around implants to promote peri-implant health but were not reported as a common component of dental hygiene curriculum.<sup>30,32</sup> Respondents were divided on the use of antiseptics, and more baccalaureate programs integrated their use over associate/certificate programs. However, chemotherapeutic agents have been cited in the literature as being a necessary adjunct to mechanical debridement for peri-implant disease.<sup>30</sup> While the literature supports the use of air polishing devices, ultrasonic scaling devices, and the use of antimicrobials as therapeutic modalities to decontaminate the peri-implant tissue,<sup>7,30,32</sup> these treatment modalities were not incorporated into all of the education programs in this study.

There was also considerable variation in the overall curriculum content in terms of the number of contact hours dedicated to didactic instruction of dental implants, inclusion of laboratory instruction, number of implant patient encounters, and the type of therapeutic services rendered. A lack of consistency could be linked to a lack of accreditation standards and competencies developed for this area of patient care. As defined by CODA Standards 2-13 and 2-14, students must be competent in implementing the dental hygiene process of care and treating all types of the new classifications of periodontal diseases.<sup>19</sup> The most recent classification of periodontal and implant-related diseases identifies each disease separately, yet the competencies outlined by CODA do not mention dental implants specifically. This lack of a specific standard allows the individual dental hygiene program to determine the required experiences related to implants.<sup>19,33</sup> It is not known if and how these educational experiences are implemented. A recent study of dental implant maintenance practices among dental hygiene practitioners in the US found there are a variety of approaches to dental implant maintenance.<sup>34</sup> In addition, clinicians varied greatly in the way in which they acquired knowledge regarding caring for patients with dental implants.<sup>34</sup> The study results also reinforced the need to integrate evidence-based practices and establish standards pertaining to dental implant maintenance beginning with the dental hygiene curricula.<sup>34</sup> An accreditation requirement related to dental implant maintenance may help to guide dental hygiene programs in their effort to promote competence. Considering that approximately 9-16.6% of dental implants fail ten years

after placement,<sup>14</sup> dental hygienists educated with the skills to help in the identification and management of peri-implant related diseases could improve the overall success rate.

This study had limitations. The low response rate may increase the possibility of a non-response error.<sup>35</sup> Possible causes of the low response rate include issues related to invitational emails for surveys, not taking the time to participate, or issues related to the COVID-19 pandemic. This survey occurred during the spring, 2020 when program directors and clinic coordinators were encumbered by many disruptions in classroom and clinical schedules. To prevent this non-response error, the participants received five invitations to participate in the study, and the online questionnaire was designed to be concise, easy to read and complete. Another consideration was the limited amount of demographic data collected. Additional information regarding the program setting and location would have enriched the understanding of parameters associated with curriculum experiences and barriers associated with dental implant maintenance education.

Future research could include repeating this study with the inclusion of additional demographic questions. This may help to better understand dental implant maintenance curriculum and patient experiences as they pertain to barriers and limitations. Additional research should include the perceptions of dental hygiene clinical faculty and students to determine recommendations for improvement in the didactic, laboratory and clinical experiences. Examining the perspectives of dental hygiene practitioners would provide a dynamic qualitative study to determine their recommendations for clinical guidelines and appropriate educational preparation to promote implant health.

## Conclusions

This study examined dental implant maintenance education among associate/certificate and baccalaureate degree, entry-level dental hygiene programs in the US. Study results indicated that various approaches were used to assess and maintain peri-implant health, however data were not statistically significant when analyzing differences between associate/certificate and baccalaureate programs. Findings from this study may provide an opportunity for curriculum assessments and the creation of protocols and competencies related to dental implant maintenance. Future research is needed to investigate the curriculum content and evaluate whether dental hygiene education programs are implementing maintenance approaches that promote implant health.

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# Critical Issues in Dental Hygiene Education

## The Baccalaureate as the Minimum Entry-Level Degree in Dental Hygiene

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### Abstract

A growing body of evidence indicates the baccalaureate degree is needed for dental hygiene (DH) graduates to address the changes in oral health delivery and health systems, develop the societal expectations of a professional, and practice to the full extent of their education. Transitioning from the associate to the baccalaureate as the minimum entry-level degree in DH will better prepare graduates to address the increasingly complex oral health care needs of the public. The higher degree prepares the dental hygienist to serve in roles that will improve access to high-quality care and allow for interprofessional collaboration as a part of a health care team. A higher entry-level degree is also needed to advance the public perception of DH and its recognition as a unique health care profession. However, reported student barriers to the entry-level baccalaureate degree include time and funding constraints, and the belief that the associate degree education is sufficient for clinical practice coupled with a lack of perceived value/benefit of the higher-level degree. This narrative literature review examines relevant policies, standards, and survey data to assess the support for the baccalaureate degree as minimum entry-level education in DH. As the roles for dental hygienists expand to meet the needs of the changing population demographics, the health care market demands for a baccalaureate degree educated dental hygienist will follow. More research is needed to document the value of the baccalaureate-prepared dental hygienist.

**Keywords:** dental hygiene, dental hygiene education, baccalaureate, bachelor's degree, dental hygiene practice, workforce models

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### Background

The American Dental Hygienists' Association (ADHA) has supported the concept of raising the entry-level education to the baccalaureate degree for dental hygiene (DH) since 1986.<sup>1</sup> The Canadian Dental Hygienists' Association (CDHA), as well as a growing number of regulatory bodies in the European Union (EU) and European Economic Area (EEA) also provide support for the baccalaureate degree as the minimum entry-level to practice dental hygiene.<sup>2,3</sup> This support is predicated on the belief that education has a significant impact on the knowledge and competencies of the dental hygienist similar to other health care professionals. A higher entry-level education to the profession is also needed to advance the public perception of DH as having its own unique research base, body of knowledge, and scope of practice. Consumers expect a high level of knowledge and skill in their oral health care providers and will continue to demand a high level of quality services from these practitioners. Also, the growing clinical knowledge

and mounting complexities in the provision of oral health care services mandate that dental hygienists possess the educational preparation to meet these demands.

In this narrative review of the literature, the authors assess the support for the baccalaureate degree to be the minimum level of entry to the profession. Ultimately, this transition to a higher level of education can also benefit the public by reducing the overall costs of care through models that emphasize prevention and health promotion-based care. Considering the rapid change in both the oral and general health care arenas, transformation in dental hygiene curriculum and competencies is critical.<sup>4</sup> Additionally, with more states allowing the public to have direct access to dental hygienists, higher levels of education are needed to expand the roles DH plays in all areas of the health care system as primary, rather than allied, health care providers.<sup>4</sup>

## ***Educational Programs and Professional Standards***

Currently, entry into the dental hygiene profession is through certificate, diploma, and associate and baccalaureate degree programs, with the majority awarding an associate degree. In 2019 there were 327 institutions with dental hygiene programs.<sup>5</sup> A majority (80.1%, n=262) of all programs awarded associate degrees, whereas fewer than one-fifth (15.3%, n=50) granted baccalaureate degrees in dental hygiene (BSDH).<sup>5</sup> A small number of institutions (3.1%, n=10) offered baccalaureate degrees not specific to DH.<sup>5</sup> Approximately 65% of the dental hygiene programs are offered at community and technical colleges.<sup>5</sup> Associate degree programs, in general, required a minimum of one year of college-level coursework or the completion of specific prerequisites.<sup>5</sup>

The Commission on Dental Accreditation (CODA) sets the standards for dental education programs, including DH.<sup>6</sup> While the thirty-member commission includes representation from all communities of interest, only one member is from dental hygiene and is appointed by the ADHA. When comparing associate and baccalaureate degree programs, it is worth noting that the accreditation standards are the same regardless of the degree awarded. However, in a recent report of program data, baccalaureate degree programs tended to offer more clinical hours devoted to patient care (591 hours versus 541 hours) than associate degree programs and more didactic hours on written communication, chemistry, oral health education/preventive counseling, and patient management.<sup>5</sup>

### ***Challenges to Standardizing Entry-Level for Dental Hygiene***

In the American Dental Education Association (ADEA) “Advancing Dental Education in the 21st Century” project, introduced in 2015, recommendations were made to address the challenges in dental education to meet the oral health care needs of the public as part of larger health education and delivery systems.<sup>7</sup> Among those recommendations were “to transition to the baccalaureate degree for entry into practice” and “to increase dental hygienists’ role in regulating dental hygiene education and practice.”<sup>7</sup> One of the challenges in advancing the dental hygiene profession and standardizing entry-level for dental hygiene is that the profession is underrepresented within CODA.<sup>8</sup> While other health professions control their own accreditation processes and standards, CODA commission members, primarily outside of the DH profession, control DH education standards. In addition, the licensure process that regulates qualifications and practice within each state, effectively remains controlled by dentists and other individuals outside of the profession, rather than dental hygienists. As of February 2019, twenty

states within the United States have DH advisory committees within the state boards of dentistry or boards of dental examiners; however, only five of the twenty states have varying degrees of self-regulating boards.<sup>9</sup> Only one state, California, has a fully self-regulating licensing board.<sup>10</sup> The Dental Hygiene Board of California also has oversight of all dental hygiene education programs in the state.<sup>10</sup>

Responsibilities of the Commission on Dental Accreditation include formulating and adopting guidelines for accrediting allied dental education programs.<sup>6</sup> Implicit in the CODA mission language is that DH, as an allied health profession, lacks autonomy and is a dependent auxiliary to the dental profession. Also, minimum entry-level into DH practice and the termination of education through a certificate, diploma, and associate degree, further supports the concept of DH as an allied health profession.<sup>11</sup> While the associate degree education may take less time than a baccalaureate degree, there is concern that the shorter timeframe will not adequately prepare graduates that are ready to address expanding scopes of DH practice. Also, dental hygienists might benefit from holding at least an equivalent degree, to be perceived as equals by other health professionals when working interprofessionally.<sup>12</sup>

Student perceived barriers to the baccalaureate degree for entry into the profession have been cited in the literature as being due to overall cost and time constraints, along with the belief that an associate degree is sufficient for clinical practice coupled with a lack of value/benefit in an advanced degree.<sup>13-15</sup> However, many associate educated dental hygienists have already completed a considerable number of college level courses as pre-requisites to program entry. In a pilot study of dental hygiene education programs, it was found that dental hygienists in community college education programs are completing coursework and contact hours far exceeding the associate degree they receive.<sup>16</sup> Transitioning these programs to baccalaureate degree programs can eliminate this discrepancy and give graduates a terminal degree that correctly reflects their level of education.

The evolution of DH scope of practice requires graduates to be better prepared to confront the challenges encountered beyond the education and competence of an allied health professional. For example, a majority (84%) of the state dental hygiene regulatory bodies have policies allowing for direct access of DH services in a wide range of health care settings without the presence or direct supervision of a dentist.<sup>17</sup> In addition, 18 states have practice acts containing statutory or regulatory language allowing Medicaid to reimburse dental hygienists directly for services rendered.<sup>18</sup> The current expectations of the entry-level graduate dental hygienist include an ever-expanding

collaborative care model that reflects the growth, complexity of DH practice and requires expertise that comes from education beyond the associate degree.<sup>1</sup>

### ***Projections, Growth and Outcomes***

Dental hygiene has been cited as one of the fastest-growing professions in the United States (US).<sup>19</sup> According to the National Center for Health Workforce Analysis, the employment of dental hygienists will grow by 20-28%, representing a faster than average projected rate than seen in most health care professions.<sup>20</sup> In contrast, the demand for dentists nationally outpaces the supply in all 50 states and the District of Columbia.<sup>20</sup> With dental student debt upon graduation averaging \$247,000, most new graduates cannot afford to open a private practice or work in low-income or rural communities.<sup>21</sup> Also, the high cost of dental education may impact future applicant pools.<sup>21</sup> In light of these issues affecting access to care, it is logical to educate the dental hygienist at the baccalaureate level for entry into the profession. The entry-level baccalaureate degree will provide a workforce capable of treating the increasingly complex chronic conditions of a diverse population and the ability to practice in a variety of settings using sophisticated technology and information management systems.

Consequently, dental hygiene programs need to design broader curriculum plans with advanced education and skills to prepare all graduates for expanding roles and services.<sup>22</sup> An expanded curriculum at the baccalaureate level will provide the necessary education to address workforce changes and prepare interested graduates for master's level programs such as the Advanced Dental Therapist (ADT) mid-level provider.<sup>4,22</sup> Mid-level provider models like the ADT were created to prepare dental hygienists to work in underserved areas as a means of addressing access to care issues.<sup>22</sup> Also, these workforce models were created to prepare the dental hygienist for critical shortage roles in other delivery settings such as corporate, community-based, hospital, long-term care facilities, school-based, or mobile settings.<sup>22</sup> Most clinical dental hygienists holding an associate degree would be ineligible for entry into these types of programs without earning a baccalaureate degree.<sup>23</sup>

### ***Increasing Need for Qualified Dental Hygiene Faculty***

A pool of well-qualified DH educators with master's and doctoral degrees will be necessary to address the demand for services and projected growth rates for dental hygienists. In a 2018-19 survey of degrees held by dental hygiene faculty in the US, the number of faculty members holding a baccalaureate degree (36%) was only slightly higher than those holding a master's degree (32.5%).<sup>5</sup> Only 4.1% held

doctorate degrees and 8.6% held associate degrees, while 17.9% of the faculty members were dentists.<sup>5</sup> However, CODA Standard 3.7 specifies that full-time DH faculty members must hold a baccalaureate degree or higher to teach, and most DH programs show a preference for educators with a master's degree or higher.<sup>24</sup> An increase in the number of baccalaureate-educated dental hygienists would in turn, increase the applicant pool of master's degree programs and subsequently increase the number of future educators needed to help fulfill the anticipated DH faculty shortage.<sup>24,25</sup>

In a recent report from the ADEA, high rates of faculty retirement are predicted in the coming five years, underscoring the need to prepare future educators.<sup>25</sup> With over 50% of the faculty workforce over 50 years of age, a DH faculty shortage is imminent, requiring a large pool of qualified future educators with the ability to easily transition from the baccalaureate to higher degrees.<sup>25</sup> Students in undergraduate baccalaureate-level programs should be encouraged to explore career paths beyond those of clinical DH. Baccalaureate degree DH programs are well positioned to support a growth mindset that includes academia and research.

### ***Comparisons to Nursing***

Advancing the dental hygiene professional education and practice through broader curriculum plans can be modeled after other health care professions such as nursing. For example, in a 2011 initiative, the Robert Wood Johnson Foundation and the Institute of Medicine provided an action-oriented blueprint for the future of nursing and recommended that a minimum of 80% of the associate-level registered nurses transition to a Bachelor of Science in Nursing (BSN) by 2020.<sup>26</sup> Nursing literature provides evidence in the differences between associate and BSN degree nurses in regards to the delivery of high quality and safe health care.<sup>26,27</sup> Nurses with higher degrees have been shown to demonstrate higher levels of competency in the delivery of safe, high-quality care.<sup>28,29</sup> Another study identified that BSN educated nurses reported significantly higher levels of preparation in research skills and evidence-based practice.<sup>29</sup> As of 2019, approximately one half of the new nurse graduates enter practice with an associate degree.<sup>27</sup> However state laws, such as one passed in New York, and policies requiring a baccalaureate degree within ten years of initial licensure, will increase the number of nurses holding a BSN in the workforce.<sup>27</sup>

Additionally, some health professions are replacing their baccalaureate degree with the masters and doctorate as the minimum requirement for entry into the profession.<sup>30</sup> There is research in support of doctoral dental hygiene programs to further potentiate dental hygienists as scholars and



scientists.<sup>31</sup> The baccalaureate-prepared dental hygienist will be poised to enter advanced professional degree programs with the requisite critical reasoning and decision-making skills. Similar to nursing, the new DH curriculum within entry-level baccalaureate programs reflects the changing roles of the dental hygienist, such as working independently and collaborating interprofessionally, as part of a coordinated health care team in non-dental settings.<sup>7</sup> As with other health professions, dental hygiene education at a higher level will provide more time for specialized areas of focus in public health, education, healthcare management, and research.<sup>4,7</sup>

### ***Educational Mobility***

In response to calls for a transformation in dental hygiene education, institutional leaders are advised to review, strengthen, or adopt policies that facilitate mobility from the associate degree to the Bachelor of Science in Dental Hygiene (BSDH).<sup>4</sup> Educational systems can be created to promote academic progression with multiple options for achieving the baccalaureate degree outside of the BSDH. Baccalaureate degree completion programs are an example of post-licensure programs that provide a pathway for the individual who already has a diploma or associate degree in dental hygiene. Another pathway is the option of dual admissions/enrollment programs. Students enrolled in an AS/AAS dental hygiene program within a community or technical college can simultaneously obtain a BSDH from an affiliate institution.<sup>32,33</sup> This innovative pathway allows a student to graduate with both degrees simultaneously or within a shortened period after completing the associate degree.

Re-imagining the entry-level dental hygiene degree as shifting from the associate to the baccalaureate level also necessitates recognizing the advantages of dental hygiene education within the community college and technical college settings. Community colleges often are near a hometown, offer low-cost yet high-quality education, and have democratic acceptance criteria/rates (often accompanied by strict academic achievement requirements after admission). Many health care professional programs have flourished within the community and technical college settings. They continue to provide opportunities to students through transfer and articulation agreements with state and private universities and distance-learning initiatives.<sup>35</sup> Some community colleges can now confer a baccalaureate degree, however, state legislative changes are required to allow for this process.<sup>34,35</sup>

### ***Global Support for the Baccalaureate Degree as Entry-Level***

Globally, there is evidence in support of the baccalaureate degree as the minimum entry-level.<sup>36,37</sup> A majority of European Union (EU) countries are moving away from the associate

degree (diploma) to the baccalaureate degree as entry-level.<sup>36</sup> Notably, the EU gradually has phased out the two-year diploma and requires a baccalaureate degree as an entry-level into the DH profession.<sup>36</sup> Also, within the EU, there is an increase in the number of dual degree programs for dental therapists and dental hygienists.<sup>36</sup> Since 2003, trends in the EU member states reflect an increased number of countries permitting autonomous practice by dental hygienists with or without a referral from dentists to better address the public's oral health needs.<sup>36</sup>

In contrast, the baccalaureate degree is still not the entry-level in North America. According to a recent study of dental hygiene students in Canada, 78% of the respondents "strongly support baccalaureate education" as the entry to practice.<sup>37</sup> The students' views reflect the need for advancing DH education in areas such as oral medicine, immunology, and microbiology, providing graduates with the skills and abilities to meet the complex oral health needs of the aging as well as underserved populations.<sup>37</sup> The findings in this survey are consistent with dental hygiene literature regarding reasons for the pursuit of a baccalaureate education that include expansion of one's knowledge base, increased personal satisfaction, improved employment opportunities, higher public perception, increased critical thinking abilities, smoother transition to graduate education, and superior economic potential.<sup>38,39</sup> Correspondingly, in a survey of ADHA members between 2016-2017, over half (65%) of the respondents had degrees beyond the associate level. Participants in the US were shown to value higher education as a necessary step in addressing the changing roles and responsibilities within the dental hygiene profession.<sup>40</sup>

### ***Dental Hygiene Educational Models and Content***

Shifting demographics along with corresponding oral diseases require educational considerations for future oral health care professionals and the services provided within the dental professions will increase to meet the needs of an aging population. Shifting demographics along with corresponding oral diseases require educational considerations for future oral health care professionals and the services provided within the dental professions to increase to meet the needs of an aging population. However, by 2035, it is projected that older adults will exceed the number of children in the population by approximately 1.5 million people.<sup>41</sup> The combination of the rise in the aging population along with their complex medical needs, will require health care providers with more advanced skills and education.

Correspondingly, chronic diseases are increasing within the younger population. Medical conditions such as diabetes, obesity, and asthma, are increasing, along with their accompanying

oral complications.<sup>42,43</sup> Another demographic shift within the US population is the increase in immigrants from non-European countries, creating greater oral health care needs in the population.<sup>44</sup> Data from the Migration Policy Institute in 2018 revealed that 44.8 million people in the United States were foreign-born, a number that has than quadrupled since 1965.<sup>45</sup> In light of the demographic shifts, DH faculty members are challenged to educate students to provide culturally responsive counseling and treatment. The increase in oral diseases may also suggest that traditional patient education strategies taught in DH schools may be insufficient at supporting behavior change, and may necessitate a greater focus on more effective tools such as motivational interviewing in the curriculum.<sup>46-47</sup>

Furthermore, approximately one in six children in the US live at or below the poverty level,<sup>49</sup> putting them at risk for asthma, obesity, malnutrition, abuse, malocclusion, and dental caries.<sup>48</sup> Medicaid enrolled approximately 37 million low-income children in 2017; however, access to and utilization of dental services have been continuing concerns.<sup>50,51</sup> Over twenty years ago, the US Surgeon General identified the failure to deliver services to impoverished children as a failure on the part of dentists and dental hygienists.<sup>52</sup> Following the Surgeon General's proclamation, "A National Call to Action to Promote Oral Health," called for changes in health professional education to eliminate these access to care issues.<sup>53</sup> Dental hygiene educational models must inspire a sense of social responsibility and the imperative for advocacy and care of vulnerable and underserved populations. These educational models need to help students develop a level of compassion and commitment to care for the members of these communities.<sup>54</sup>

Leaders within the dental education community suggest that dental education has not yet sufficiently adjusted to meet the oral health needs of the public.<sup>55,56</sup> Significant gaps in current dental curricula have been identified along with recommendations for change.<sup>55,56</sup> Service learning (SL) is a learning tool that helps students develop cultural awareness to address the underserved populations<sup>57,58</sup> and meets the recommendation that "clinical training will be more effective when training is delivered to the student in the same context in which he or she will practice."<sup>59</sup> Integrating SL into the dental curriculum has been shown to facilitate a deeper understanding of the relationship between health and disease and socio-political forces within a community.<sup>60</sup> Like any effective learning tool, SL takes time and careful coaching and requires more time within the dental hygiene curriculum for effectiveness. Baccalaureate DH education programs can be designed to provide more opportunities to integrate SL into the curriculum.

## **Recommendations**

A growing body of evidence indicates the baccalaureate degree education will provide greater opportunity to develop the societal expectations of a professional, that of competence, trust, and autonomy of decision-making in DH graduates.<sup>2-4,9,12-16,31,37-40</sup> As the roles and demand for dental hygienists increase within diverse health care settings, prospective employers will recognize the advantages of a more highly educated workforce, as reflected in nursing research.<sup>26,27</sup> During this period of transition in dental hygiene education and practice, it may be helpful to look to the nursing profession's experience with this issue. Nursing partnered with leading health care and professional organizations to provide evidence-based research and position statements in support of the baccalaureate degree as entry-level and its relevance to health care outcomes.<sup>26</sup> Existing nursing research can help the dental hygiene profession determine which components of the baccalaureate education work best for developing critical thinking and decision-making skills and ultimately lead to growth in clinical practice skills and leadership. Results from this educational transition in nursing can also provide guidance on whether a background in different academic fields, such as broader liberal arts and humanities education, along with science, create a more effective foundation for graduates.

## **Conclusions**

Baccalaureate dental hygiene programs are structured to manage the changing healthcare needs through courses in the liberal arts and advanced social and biological sciences. These programs offer professional dental hygiene coursework in a broader range of settings than can be addressed in associate degree programs. Dental hygiene baccalaureate programs provide formal coursework that emphasizes the acquisition of professional identity, leadership development, research and scholarship skills, and exposure to community and public health competencies. Ultimately, the advanced educational model will create oral health professionals who excel in dealing with the differences between individual patients and populations, social justice issues such as disparities in oral disease burden and access to care, and innovative workforce changes.

Changes are needed in dental hygiene education to meet the oral healthcare needs of the US population. To advance the dental hygiene profession, support is needed from government agencies and educational institutions, as well as individuals and members of the health professions committed to improving oral health. There is strong acceptance for the baccalaureate level of education to practice model for dental hygiene professional education from professional organizations such as the ADHA. Meeting the oral health

care needs of the public will require new roles for the dental hygienist and innovative models of oral health care that are achievable through the adoption of the baccalaureate degree as minimum preparation to enter the dental hygiene profession.

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# Critical Issues in Dental Hygiene Education

## Career Paths and Satisfaction of Dental Hygienists Holding Master's and Doctoral Degrees

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### Abstract

**Purpose:** There is an increased need for dental hygienists with advanced degrees to meet the demands of a complex health care system in addition to advancing the dental hygiene profession. The purpose of this study was to explore the career paths and satisfaction of dental hygienists with master's and doctoral degrees.

**Methods:** A qualitative descriptive phenomenological research design was used with a purposive sample of dental hygienists (n=20) who had master's and doctoral degrees. A virtual web-based videoconferencing platform was used to conduct focus groups and utilize a national sample. Focus groups were audio recorded and transcribed. Data was analyzed for themes manually and with qualitative analysis software.

**Results:** The results showed a wide range of career paths such as: administrator, lawyer, entrepreneur, dental therapist, dentist, nurse, educator, researcher, public speaker, consultant, editor, state oral health program coordinator, and marketing. The results also indicated that participants were satisfied and valued the pursuit of their advanced education. The six themes that emerged included: expanded opportunities; personal growth; professional growth; credibility; it's an investment; and just do it, don't overanalyze or second guess yourself.

**Conclusion:** Findings suggest satisfaction with advanced education as well as a wide variety of career paths. Participants also endorsed more dental hygienists being educated at the master's and doctoral level to advance the profession of dental hygiene.

**Keywords:** career paths, job satisfaction, postgraduate education, dental hygienists, dental hygiene profession

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### Introduction

The number of people entering the dental hygiene profession is growing at a rapid pace.<sup>1</sup> However, the majority of graduates (7,300 annually) are from associate and baccalaureate degree dental hygiene programs and are primarily prepared for entry-level clinical practice.<sup>1</sup> Although the number of dental hygienists for entry level practice is growing, there is also a growing need for dental hygienists who are academically prepared at the postgraduate level.<sup>2</sup> A shortage of master's and doctorally prepared dental hygienists has contributed to slow advancement of the profession in regard to increasing access to care; professional autonomy (including self-governance and self-regulation); and the breadth and depth of discipline-specific research.<sup>2-9</sup> This deficit has also left the profession with an unmet need for dental hygienists with graduate degrees for career paths in education, dental therapy (or mid-level oral health practitioner/advanced dental hygiene practitioner),

research, the public health sector, management, administration, and entrepreneurship.<sup>7-11</sup> Higher academically prepared dental hygienists are also better positioned to meet the demand for oral health care in an increasingly complex environment.<sup>2,4,6,10</sup>

One such way to meet the increased demand for oral health care is a mid-level oral health care provider or dental therapist. Although a master's degree is not required by the Commission on Dental Accreditation (CODA) standards for dental therapy education programs, mid-level provider models in some states (e.g. Minnesota and Massachusetts) are based on a dental hygiene foundation with further education at the master's level.<sup>12</sup> This mid-level oral health care provider model along with the existing direct access dental hygienists could help close the gap for access to oral health care in underserved populations.<sup>10</sup> The United States (US) Health Resource and Services Administration (HRSA)

supports education of advanced dental hygienists to increase access to care.<sup>11</sup> The existing dental hygiene workforce has the foundational educational infrastructure in place to pursue advanced education and ultimately serve in a variety of roles, including mid-level oral health care providers.<sup>10,11</sup>

Previous studies have shown that dental hygienists are interested in pursuing advanced education degrees.<sup>5,10,13-16</sup> However, finances, time management, and fear of engaging in scholarship/research are the top barriers preventing dental hygienists from pursuing graduate or doctoral education.<sup>13,17</sup> Conversely, the primary motivations for pursuing a graduate degree have been cited as increased career options, benefits, and salary.<sup>13,15</sup> Currently, there are no doctoral program in dental hygiene in the US. However, dental hygienists are pursuing doctoral degrees in other areas of study such as education, health science, public health, and organizational leadership.<sup>15</sup> Even though dental hygienists are pursuing doctoral education in other disciplines, this could also be detrimental to the development of the profession as the focus of research may not be directly related to oral health or dental hygiene theory development.<sup>9</sup>

Benefits of pursuing advanced degrees are not limited to personal growth; postgraduate study also benefits the growth of the dental hygiene discipline as well as access to oral health care for the public.<sup>6,8,13,18,19</sup> Nursing is several steps ahead of dental hygiene in terms of advancing their education to the doctoral level, self-regulation, and autonomy.<sup>20</sup> Unfortunately, these remain ongoing challenges for the dental hygiene profession. There is limited research on the career paths of dental hygienists who have pursued postgraduate education. The purpose of this study was to explore the career paths and satisfaction of dental hygienists with master's and doctoral degrees.

## Methods

A qualitative descriptive phenomenological design was used to explore career paths and satisfaction of dental hygienists who have master's or doctoral degrees. This particular design was chosen to better understand this topic from the lived experience of the participants.<sup>21-22</sup> In addition, this approach provides information about how meaning is experienced.<sup>22</sup> A phenomenological design requires the investigator to be aware of their own assumptions, beliefs, and bias to bracket them and be open and sensitive to the experience of the participants.<sup>21-22</sup>

A non-probability purposive sample of (n=20) dental hygienists who held a master's and/or doctoral degree agreed to participate. Focus groups were used for data collection. Focus groups allow for the interaction of a group of participants

with common characteristics or interests to engage around a topic. What emerges from a focus group is discussion of perspectives or experiences of the participants that captures the viewpoints of the majority of the group.<sup>23</sup> Given the focus groups were held virtually, best practices for this approach were followed in planning the procedure.<sup>24-26</sup>

The MCPHS University's Institutional Review Board (IRB) approved the study with the status "exempt" and assigned it protocol number IRB091919B.

## Participants

The inclusion criteria were dental hygienists who have graduated from a master's or doctoral degree program and graduated from an accredited entry-level dental hygiene program; dental hygienists with entry-level degrees were excluded from the study. Participants were recruited via dental hygiene forums on social media (Facebook and LinkedIn). Additionally, snowball sampling allowed participants to assist in recruitment of others who met the inclusion criteria.

## Instruments

A short demographic survey was developed to gather descriptive information. The demographic survey inquired about age; gender; race; number of dependents while completing the advanced degree; current occupation; type of entry-level dental hygiene degree held and year of graduation; type of advanced degree held and discipline; and number of years in clinical practice prior to deciding to pursue advanced education.

The focus group interview questions were semi-structured and explored the career paths and satisfaction of the study participants. Questions were developed based on similar nursing literature and were pilot tested with a small group (n=3) of dental hygiene graduate students. The questions included:

1. What motivated you to pursue a master's or doctoral degree?
2. Tell me how you feel your advanced education has increased opportunities and how it has impacted you personally and professionally.
3. Tell me about other avenues you would like to pursue or expand upon either related to your current career path or possibly a new direction?
4. Was pursuing a master's or doctoral degree worth it to you and why?
5. How do you feel your advanced degree has helped you contribute to advancing the profession of dental hygiene?

6. What words of wisdom would you offer to a dental hygienist thinking of pursuing a master's or doctoral degree?

Minor word edits to improve clarity were suggested by the pilot testers. In addition to the focus group questions, a pilot session of the entire focus group procedure was conducted prior to recruitment of participants.

## Procedure

Following IRB approval, the invitation to participate was posted on the social media sites. Interested parties received an email containing information about the study as well as an informed consent form for review. Focus groups were scheduled for participants based on availability. The focus group sessions took place through an online video conferencing platform (Zoom; San Jose, CA, USA). This platform was chosen because of its ease of use, cost-effectiveness, features, and convenience. In addition, the virtual setting increased access to a national sample of participants and synchronous communication is less complex allowing participants to see and hear each other more easily.<sup>15,16</sup> Participants logged in from their personal computers or cell phones and followed the link to the focus group session. Participants who preferred to remain anonymous, directions to change the username were provided.

A total of five focus groups were conducted with the number of participants ranging from three to six. Each session began with a review of informed consent and ground rules for the focus group. The principal investigator (PI) led each session by reviewing instructions, following the interview guide with the semi-structured questions with prompts as needed, and encouraging each participant to respond to each question fully. The interview guide ensured each participant was asked the same questions and the PI guided participants back to the question when necessary. Responses were kept to approximately two minutes to allow each participant time to respond. Each focus group session lasted 40-60 minutes.

The focus groups sessions were recorded, and the audio recordings allowed for facilitation of accurate transcription. Upon completion of each focus group session, the audio recording was uploaded for professional transcription. The PI also listened to the audio recordings and confirmed accuracy of all transcripts verbatim. To aid in trustworthiness (validity) of the data, member checking was conducted with two participants from different focus groups who reviewed their transcript for accuracy.

## Analysis

Two investigators independently analyzed the data, one coded data manually and one used qualitative data analysis software (MaxQDA; Berlin, DE). The qualitative design and research process was guided by Creswell.<sup>27</sup> The data was read to identify tones, meaning units, themes, and ideas. The data showing recurring themes, tones, and ideas were grouped together and labeled. The coding process was used to generate a description of the data, and coding was used for recurring themes found in the data. The narratives and quotations from the participants illustrated the themes and strengthened the findings. The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist is a 32-item checklist that aids in accurate reporting of a qualitative study and the investigators addressed each item.<sup>28</sup> Validity (trustworthiness) included continuing recruitment until data saturation was reached, through member checking, the use of two investigators to independently code data to identify themes, and by using thick, rich descriptions from the participants to illustrate findings.<sup>27</sup>

## Results

The participants (n=20) were all female, predominately White, and from 13 states, representing most regions in the US (Table I). Seventeen participants held master's degrees (n=17) and three held doctoral degrees (n=3). Most participants had graduated from an entry-level program with an associate degree, and most continued on to complete their advanced education within five years from the time of graduation. After completing advanced education, the participants reported pursuing the following career paths: administrator, provost, lawyer, entrepreneur, leadership/executive coach, dental therapist, dentist, nurse, educator, public speaker, consultant, editor-in-chief, state oral health program coordinator, and director of operations for a Dental Support Organization (DSO). Participant career pathways are shown in Table II.

## Themes

Six major themes emerged from the data: *expanded opportunities, personal growth, professional growth, credibility, it's an investment, and just do it, don't overanalyze it or second guess yourself*. Regarding the theme of *expanded opportunities*, examples of statements included the following: "It opened doors for me...that I would have never gotten had I not earned my masters;" "I could kind of pick and choose which way I wanted to go;" "as a clinical hygienist it's really hard to wrap your head around just how powerful the degree is and how far it can really take you;" and "every time I went back to school and added more letters after my name, my pay went up!"



**Table I. Participant demographics (n=20)**

	n	(%)
<b>Age</b>		
25-34	3	(15)
35-44	5	(25)
45-54	2	(10)
55-64	6	(30)
65-74	4	(20)
<b>Race</b>		
Asian/Asian American	1	(5)
Black/African America	1	(5)
Hispanic/Latino	1	(5)
White	17	(85)
<b>Gender</b>		
Female	20	(100)
<b>US Regions</b>		
West (Montana)	1	(5)
Midwest (Michigan, Minnesota, Illinois)	6	(30)
South (District of Columbia, Florida, North Carolina, Oklahoma, Texas, Virginia)	8	(40)
Northeast (Massachusetts, New Jersey)	5	(25)
<b>Dependents while pursuing advanced degree</b>		
None	11	(55)
1	2	(10)
2	5	(25)
3	2	(10)
<b>Entry-Level Degree</b>		
Associate of Science	12	(60)
Bachelor of Science	8	(40)
<b>Year entry-level degree completed</b>		
1971-1980	4	(20)
1981-1990	3	(15)
1991-2000	7	(35)
2001-2010	4	(20)
2011-2020	2	(10)
<b>Number of years in practice prior to advanced degree</b>		
0-5	9	(45)
6-10	3	(15)
11-15	2	(10)
16-20	3	(15)
21-25	2	(10)
26-30	1	(5)

**Table II. Career paths and degrees (n=20)**

Employment Setting	Degree Type	n	%
Business Owner	MSDH focus on management	1	5
Consultant	M.S. Health Administration	1	5
Corporate	MBA	4	20
Corporate	M.S. Adult Education		
Corporate	MSDH (emphasis on Public Health)		
Corporate	MBA		
Corporate, education, private practice	M.S. Health Services Administration	1	5
Education	MBA	4	20
Education	MSDH		
Education	M.S. Education		
Education administration	MPH, JD (Juris Doctor)		
Education/business owner	MSDH education/public health dual concentration	1	5
Entrepreneur, educator, private practice	MSDH	1	5
Entrepreneur	PhD Organizational Leadership	1	5
Nurse, Doctoral Nursing Student	M.S. in Nursing, Clinical Nurse Specialist	1	5
Private Practice (dentist)	D.M.D.	3	15
Private Practice (dental therapy)	M.S. Advanced Dental Therapy		
Private Practice (dental hygiene)	MSDH		
Public Health (state oral health director)	MSDH	1	5
Speaker, writer, editor, researcher	MPH	1	5

Many participants remarked they felt pursuing a post graduate degree increased their *professional growth*. The following quotes illustrate this theme: “I feel that getting our degrees is so much bigger than just ourselves. It’s really advancing our profession as a whole;” “If I got my MPH I

could save the world in a different way;” “I wanted to be a dental therapist;” “I’m publishing research that’s contributing to the body of knowledge in our profession;” “I had the opportunity to collaborate and revise a chapter in Esther Wilkins’ textbook;” “I try to educate dentists [at continuing education presentations] when I’m lecturing to them about the value of their hygienists;” and “I was on the dental therapy board for Minnesota and that gave us a lot of opportunity to give testimonies for dental therapy.”

Additionally, many of the participants felt they experienced tremendous *personal growth*. Some quotes that illustrate the personal growth theme included: “It made me look at things differently in terms of community health and the same with the law degree;” “It’s been very helpful in my role as an administrator because trust me I have to make decisions;” “I was able to challenge myself. You know if you don’t have a challenge you don’t grow;” “What I came to understand was that some of the things that I was told like about myself in a negative way were actually my strengths;” and “It’s just given me a confidence that when I do speak up, that I have every right to speak up.”

Credibility was another common theme among the participants. Those who felt their education gave them credibility made comments such as these: “You definitely get looked at from a different perspective when you do have those terminal degrees;” “It does give me more credibility is what it does;” “The JD [juris doctor] really helped at least put me a little bit on par with a bunch of DDSs’ and helped me move up the administrative chain;” “Politically I’ve been able to testify for dental therapy;” “The respect you get from yourself and other people, it’s worth it;” “Having the dual hygiene dental degree as a lecturer is nice because I have credibility with hygienists and I have credibility with dentists;” and “When you’re in front of a group of professionals or students you’ve got the credentials that match what you’re trying to teach them.”

Another theme that emerged around the value of advanced education was it’s an investment and the dimensions ranged from the impact on pay (salary) to education being an investment in yourself. Examples included: “Every time I went back to school and added more letters after my name, my pay went up;” “Absolutely master’s and PhD both hands down. It says a lot about you and us in this group and who we are and our dedication to our profession and its sustainability really;” “It’s an investment in yourself but it’s it’s still an investment;” and “100% worth it. Education is one thing in this world that nobody can take away from you and it’s an investment in yourself and it grows you as a person.” One participant reported the graduate degree provided opportunities, but she felt unable to pursue them due to a possible reduction in pay upon entry into a new position that would not provide a return on her investment.

The final theme just do it, don’t overanalyze or second guess yourself focused on encouraging colleagues to pursue advanced education. Some quotes that reflect the theme included: “It is a time commitment, and the time is going to pass either way;” “Go in there expecting to be challenged and know that you’re going to come out far ahead if you put everything you can into it;” “Don’t be afraid ever;” “Just do it. Don’t overanalyze it. Don’t second guess yourself. Just go for it;” “I would say that all hygienists, if they ever expect to do anything other than clinical hygiene, they need more education;” “it has to be an area of interest, and not that you’re running away from something, that you’re more running to something;” “don’t compare yourself to the other hygienists. We are all on different paths, take it one step at a time;” and “I was exactly like you. I am just further down this path, and you just take it one step at a time and when opportunity knocks, no matter how fearful you are, if you feel it in your gut, this is a great opportunity. Embrace it.” Representative quotes and themes are shown in Table III.

## Discussion

Previous research has suggested career options associated with pursuing graduate studies were limited to education, public health, and research.<sup>18</sup> In addition; research conducted with dental hygienists identified a barrier to pursuing graduate education was a lack of knowledge about potential career prospects.<sup>17</sup> The purpose of this study was to explore the career paths and satisfaction levels of dental hygienists who pursued master’s and doctoral degrees.

Some of the findings of this study regarding the impetus for pursuing advanced education were consistent with Carpenter et al<sup>15</sup> in regard to a lack of satisfaction with clinical dental hygiene. Many participants reported experiencing burnout from the demands of clinical practice with limited opportunities for growth. Others reported feeling disenchanted with private practice and working for a dentist. The participants had a passion for dental hygiene but desired more respect and flexible ways to utilize their skill set. As a result of taking the step to advance their education, participants in this study shared a wide range of career opportunities and choices. Career paths in academia ranged from educator to provost; paths in the clinical setting ranged from dental therapist, nurse and dentist; self-employed career paths included public speaking and consultant; corporate career paths included director of operations, editor-in-chief, and marketing; and public health positions included state oral health program director. For many of the participants, their career path coincided with the type of degree program chosen. Other participants leveraged their degree for different types of careers. Results from this

**Table III. Illustrative quotes for themes**

Theme	Illustrative Quotes
<i>Increased Opportunities</i>	<p>“It’s helped me to be refined, be stronger as an educator”</p> <p>“I would have never been hired without that degree”</p> <p>“I will say that there is definitely no shortage of opportunity when it comes to having more education, more multiple degrees”</p> <p>“I’ve enjoyed working for an organization that is interested in my growth as a person”</p> <p>“you’re invited to a different kind of table because you’re qualified you have your terminal degree”</p> <p>“I could give myself a little bit more of a backbone when I was applying for jobs.”</p>
<i>Professional Growth</i>	<p>“I hope to inspire my students to be the movers and shakers”</p> <p>“It’s kind of ‘us versus them’ mentality (with dentists). And I am hoping that, that I can help break down those barriers”</p> <p>“Every single time we’re choosing to get a bachelor’s degree or a master’s degree in dental hygiene, we’re elevating our profession more”</p>
<i>Personal Growth</i>	<p>“It’s impacted me personally in the sense that it was an evolution, and so I allowed my interest to kind of drive me to where I was going”</p> <p>“I definitely got more confident than I ever have had before”</p> <p>“It was just fulfilling”</p> <p>“It was a great sense of self-satisfaction and an esteem”</p> <p>“I don’t think I felt like I had the confidence to go after things the way I did once I had a broader degree”</p> <p>“I think it does give you that background to help you be more professional and aware of what’s going on and what your roles can be”</p>
<i>Credibility</i>	<p>“I have been pursued by several entities wanting me to participate on boards to give opinions”</p> <p>“It empowered me to realize I was more knowledgeable than I thought I was. I became more vocal in meetings. I had an opinion that I could put fact behind”</p> <p>“I know what I’m talking about and all these initials after my name prove it”</p> <p>“I think what we need are more educated people with doctoral and master’s degrees to keep gaining that traction”</p> <p>“My peers, were expecting my opinion more”</p>
<i>It’s an investment</i>	<p>“It was worth it. I’m on a speaker’s circuit of sorts and I bring the effects of oral biofilm on systemic health to a lot of nurses, they benefit from my knowledge”</p> <p>“The challenge of the education was great, both mentally and physically”</p> <p>“I have three children and it showed them how to work hard to achieve something”</p> <p>“It was an excellent program. It was all online. And I couldn’t believe I made it through, I survived”</p> <p>“Best decision ever”</p>
<i>Just do it, don’t overanalyze or second guess yourself</i>	<p>“I will say that there is definitely no shortage of opportunity when it comes to having more education”</p> <p>“you’re never too old to go back”</p> <p>“I say go for it. I think it’s a long life if you’re doing something every single day that you don’t love.”</p> <p>“It was definitely worth it and I wouldn’t change what I did”</p> <p>“You don’t have it all figured out to start”</p> <p>“If your goal is to get out of being ‘trapped in the OP’ you’re going to fall flat on your face. You have to have a passion for whatever it is you’re pursuing”</p>

study add to the body of knowledge regarding potential career options for dental hygienists who are uncertain about the opportunities graduate education will afford them.<sup>18</sup>

Both personal and professional growth were significant themes among the focus group participants. Participants felt better able to bring about change by impacting access to care for those who are unserved or underserved, advocating for oral health care policy change, assume leadership roles, mentor, and empower other dental hygienists to advance their education, increase visibility of the profession, and contribute to the body of knowledge for the profession. One very representative quote to encompass this theme was “getting our degrees is so much more, bigger...than just ourselves. It’s really about advancing our profession as a whole.” Findings from this study are consistent with previous research suggesting the need for advanced education to expand the dental hygiene knowledge base and provide a workforce with enhanced educational qualifications to serve as education, administrators, and more.<sup>2,4,6-8</sup> If more dental hygienists pursued advanced education, it would elevate the profession, possibly leading to self-regulation. Parallel professions to dental hygiene, such as nursing have been successful in expanding graduate education opportunities as a component of facilitating their advancement.<sup>19,20</sup> In addition, nursing has made great strides with professional autonomy and self-regulation and can offer insights to dental hygiene on pathways to achieving these goals.<sup>19,20,29</sup>

However, one aspect of advancing the profession remains with the development of a doctoral degree program in dental hygiene in the US. While dental hygienists interested in pursuing doctoral degrees have increased, the doctoral degrees are in other disciplines outside of dental hygiene.<sup>15</sup> The value of developing a doctoral degree in dental hygiene includes a more in-depth development of theory and research specific to dental hygiene and oral health.<sup>2,8</sup> The doctoral degree in dental hygiene remains elusive despite attempts by educational institutions and the American Dental Hygienists’ Association to make this a reality.

Another finding shared by participants in this study was the personal growth and confidence related to advancing their education. Lack of confidence is a roadblock to the advancement of the entire profession and suggests that advanced degrees may help overcome this issue.<sup>9,13</sup> By advancing their education, participants expressed they learned more about themselves, felt more ready to assume leadership, and were less afraid of tackling the unknown such as new jobs, unfamiliar tasks, etc.

Credibility related to having their ‘voice’, opinion, and expertise respected by other professionals in a variety of settings was a major theme expressed by the participants. This becomes more essential as many health professions have elevated their entry-level degrees to master’s and doctoral degrees; the dental hygiene profession will need credibility amongst other health care professionals for interprofessional collaboration.<sup>4,6,9</sup> Professional recognition, similar to the theme of credibility, was also reported in previous research studies.<sup>18</sup>

Findings revealed feeling pursuing an advanced degree provided a good return on investment primarily due to the immediate and increased opportunities available to them. Participants felt their time and financial commitment was worth it, with one participant remarked on financial rewards “each time I went back to school and added letters after my name.” Furthermore, by increasing the number of dental hygienists with advanced degrees it can potentially impact the educator shortage as well as increase the likelihood of creating a doctoral program for the profession.<sup>7,8</sup>

Participants offered encouragement with the theme *just do it; don’t overanalyze or second guess yourself* to other dental hygienists to pursue advanced degrees to expand their career paths. The findings of Carpenter et al. suggested that encouragement was a key factor in influencing individuals to advance their education.<sup>15</sup> Mentoring, defined as transmitting advice, support, and expertise to a less experienced individual to enhance professional development, is an essential component in advancing any profession to develop future leaders.<sup>30</sup> With increased numbers of postgraduate educated dental hygienists, there will be greater opportunities to mentor others towards profession advancement.

Further research is needed to explore the process used by similar health professions in advancing their education, scholarship, self-regulation, and professional autonomy.<sup>19,20,29,31</sup> As noted in the recommendations from the *Advancing Dental Education in the 21st Century: Phase 2 Report*, it will be important to explore ways to create career ladders in graduate education to prepare graduates for the changing health care environment.<sup>32</sup>

This study had limitations. The sample size was small and homogenous. A more diverse sample (e.g. gender and race/ethnicity) may have offered alternative perspectives. In addition, the western region of the US was minimally represented. A limitation of the focus group approach, whether virtual or face-to-face, is being with a group of participants and socially engaging which could result in someone not feeling comfortable about sharing their true thoughts on a topic. To minimize this, the participants had the option of

using a pseudonym as the username and joining with audio only. An interesting observation was the camaraderie between focus group participants with one participant referring to the focus group as a 'sisterhood'. This suggests participants felt comfortable with engaging and sharing their perspective. The PI was a master's student at the time of the study, which may have resulted in bias. However, participant quotes were used to report to minimize interpretation and possible bias.

## Conclusion

This study explored the career paths and satisfaction of dental hygienists who have pursued master's and doctoral degrees. The findings suggested completion of advanced education provided access to many opportunities which led to personal growth along with professional credibility. In addition, participants felt their advanced education also supported the further development of the profession and encouraged other dental hygienists to continue to their education.

The results add to the literature about potential career paths and could inspire other dental hygienists to pursue graduate or doctoral studies.

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# Critical Issues in Dental Hygiene Education

## Exploration of the Scholarship of Doctoral Prepared Dental Hygienists

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### Abstract

**Purpose:** The purpose of this study was to explore the scholarship of doctoral prepared dental hygienists as it relates to advancing the dental hygiene discipline.

**Methods:** A qualitative descriptive research design was used to determine patterns regarding dental hygienists' experiences with their doctoral education and resulting scholarly activities. Purposive and network sampling were used to identify potential participants. Interviews were audio recorded and transcribed. Data generated from the interviews were analyzed simultaneously with data collection. Open coding and axial coding were used to analyze data in a continuous comparative method to determine themes. Validity was insured through triangulation, member checks, and respondent validation.

**Results:** Ten participants were interviewed, and data analysis revealed several themes for each research question. Themes that influenced the decision to enroll in the program included *personal*, *professional*, *influencers*, and *situational*. Experiences the PhD program provided were *scholarship socialization*, *program requirements*, and *PhD program faculty*. Relative to career advancement, themes included *credibility* and *career opportunities*. Scholarship activities contributing to the dental hygiene discipline revealed two themes: *scholarly activities* and *dental hygiene is an evolving discipline*.

**Conclusions:** Although each participant's journey to a doctoral degree was unique, there were similar themes for motivation to obtain this advanced degree in addition to the preparation for engagement in scholarly activities and career advancement. While many participants had not pursued building theoretical or conceptual models, most agreed on their importance and the concept that dental hygiene is a developing discipline.

**Keywords:** dental hygiene, doctoral education, dental hygiene education, scholarship, scholarly activities, dental hygiene discipline, career advancement

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### Introduction

Dental hygiene education began in 1906 when Alfred C. Fones, a dentist who valued prevention, trained his assistant to scale and polish teeth.<sup>1</sup> By 1913, Dr. Fones had established a nine-month program in his carriage house to educate these new oral health professionals, named dental hygienists.<sup>1</sup> After graduating three classes from the carriage house, dental hygienists began to receive their education through institutions of higher education. By 1916 formal programs were established at Hunter College, Rochester Dental Dispensary, and the Forsyth School of Dental Hygiene.<sup>1</sup> Over the next 40 years, dental hygiene education expanded from university settings to community colleges. The American Dental Association (ADA) Council on Dental

Education worked to establish curriculum and standards for all dental hygiene programs and it was decided that after 1947 all accredited programs would have a two-year minimum duration.<sup>2</sup> Later, the Truman administration supported this concept with the Report on Higher Education for American Democracy. This report endorsed community colleges as a cost-effective means to complete the first two years of college and receive occupational training to meet the needs of the workforce following World War II.<sup>3</sup>

Currently, the entry-level for dental hygiene remains at a two-year professional curriculum, with 329 entry-level programs in the United States.<sup>4</sup> The majority of the entry-level programs award an associate degree, however there are

70 various types of baccalaureate degree programs in dental hygiene with an additional 57 programs offering baccalaureate degree completion options.<sup>4</sup> The first master's degree program in dental hygiene was established at Columbia University in 1953 with the goal of preparing future dental hygiene educators and program administrators.<sup>2</sup> According to data from the American Dental Hygienists' Association (ADHA), there are currently 14 master degree programs with a dental hygiene major, Master of Science degree in Dental Hygiene (MSDH), and six programs granting related disciplines such as health sciences and allied health. Presently, the MSDH degree is the terminal advanced degree in dental hygiene.<sup>6</sup>

Despite the number of doctoral programs for health professions including nursing, physical therapy, pharmacology, and audiology professional programs, no doctoral program for dental hygiene exists in the United States (US). A number of health professions, such as physical therapy, are moving toward a doctorate as the entry-level degree. While doctoral education has been considered an essential factor in leadership, scholarship, research, policy and education in dental hygiene,<sup>7</sup> currently dental hygienists must pursue doctoral degrees outside of the dental hygiene discipline.<sup>8</sup> As a result, these scholars focus their research towards the discipline of their doctorate rather than within the dental hygiene discipline.<sup>9</sup>

Doctoral preparation of dental hygienists is essential for building the dental hygiene knowledge base and, ultimately, for advancing the profession.<sup>10</sup> In the 2005 report, *Dental Hygiene: Focus on Advancing the Profession* published by the ADHA, a primary aim was to create a doctoral degree program in dental hygiene. Recommendations included developing curricular models for professional and academic doctoral programs in dental hygiene; conducting educators' workshops at professional meetings to promote the development of dental hygiene doctoral programs; and publishing curricular models for doctoral programs.<sup>10</sup> While there are still no doctoral programs in dental hygiene in the US, advancing education in dental hygiene remains vital to the ADHA's vision to incorporate dental hygienists into the healthcare delivery system as primary healthcare providers and expand access to care.<sup>11</sup>

Scholarship in the dental hygiene discipline is underdeveloped as compared to other disciplines because research is limited and not framed within the context of theoretical models or conceptual frameworks.<sup>12</sup> These frameworks are vital to the establishment of a scientific body of knowledge unique to dental hygiene rather than theories that are borrowed from other disciplines.<sup>13</sup> Presently, there are seven theoretical models that support the dental hygiene discipline<sup>14-21</sup> with little to no research establishing validity for these models.<sup>22-26</sup>

Dental hygienists with doctoral degrees are needed to support the dental hygiene discipline. Specifically, a doctoral curriculum prepares graduates to participate in research. Conducting original research through the application of scientific methods results in scholarly activities to grow the knowledge base. Although there are doctoral prepared dental hygienists, it is unknown whether they have previously or are currently engaging in scholarly activities, and whether these experiences have impacted the dental hygiene discipline. The purpose of this qualitative study was to explore the scholarship of doctoral prepared dental hygienists as it relates to advancing the dental hygiene discipline.

## Methods

This study received approval from the Idaho State University Institutional Review Board (IRB-FY2019-272). A qualitative descriptive research design was used to determine patterns or themes regarding dental hygienists' experiences with their doctoral education and resulting scholarly activities.

The following research questions guided the study: 1) What factors influence the decision of dental hygienists to enroll in a doctoral program? 2) What experiences in the doctoral program prepared individuals to engage in scholarship? 3) How has a doctorate degree helped dental hygienists advance in their careers? 4) How have their scholarship activities contributed to advancing the dental hygiene discipline?

Purposive sampling identified potential participants who were knowledgeable about the phenomena of interest.<sup>27</sup> Network sampling was also used to identify additional participants. Inclusion criteria involved dental hygienists who had earned a doctorate degree and participated in scholarly activities. The required scholarly activities included the completion of at least three peer reviewed publications, including the dissertation and a minimum of two research studies conducted or grants written during and after the award of the doctorate degree. Exclusion criteria eliminated dental hygienists who did not have a doctorate degree or had not participated in scholarly activities. A screening questionnaire was administered to identify dental hygienists who met the inclusion criteria. Additionally, the information collected assisted researchers in selecting participants with diverse disciplines from which the degrees were received: education, community health and science.

An interview guide was created with open-ended and probing questions to gain more in-depth responses.<sup>28</sup> Two research team members evaluated the questions to ensure the reliability and the consistency of data collection during the semi-structured interview sessions. A copy of the interview



guide was sent to the participants prior to the interview to help prepare their responses. To establish the validity of data collection, one bracketing interview was conducted prior to the interviewing of subjects. Bracketing is a method used to decrease the potential effects of preconceptions of the interviewer and increase the researcher's clarity with participants' experiences.<sup>29</sup> Following the bracketing interview, one pilot interview was conducted with a dental hygienist who met the inclusion criteria for the study to evaluate the ability of the interview questions to gather relevant data and address any improvements needed in the research design.

A written consent form was sent to potential participants and verbal consent was obtained. Interviews were conducted by the primary investigator (PI) through an audio-recorded phone conversation (WS-300M Digital Recorder Voice Recorder; Olympus, Tokyo, JP). Word-for-word transcription of the audio-recording was completed by a professional transcriptionist. Pseudonyms were utilized during the interview and on the transcript to maintain confidentiality and anonymity. The PI listened to the audio-recorded interview to verify if the transcripts were correct.

Data generated from the interviews were analyzed simultaneously with data collection. This method allowed each previous interview to guide the next, as themes and/or categories become apparent. Open coding was used, in which data were divided into manageable words or phrases that were relevant to the research questions. During the next phase of coding, open codes were combined to form larger segments of data called categories or themes; referred to as axial coding. The goal of axial coding is for the themes to emerge and provide the PI direction and assist in answering the research questions.<sup>28</sup> During the data analysis process, the PI went back and forth between axial coding and open coding in a continuous comparative method to compare data and determine similarities and differences.<sup>28</sup>

Internal validity was insured through triangulation.<sup>28</sup> Member checks or respondent validation were also used to ensure validity.<sup>28</sup> The tentative findings were sent to each participant to review and provide feedback on the data analysis. Participants were encouraged to inform the PI of clarifications needing to be made to the findings.

## Results

Demographic data were analyzed for frequencies and are presented in Table I. Ten dental hygienists with doctorate degrees participated in the study. The majority of participants were between the ages of 51 and 60, female, and possessed a doctorate from an education, community health, or science discipline. Most participants were employed in a university setting and a majority of participants' dissertation topics were dental hygiene related. The following results present the themes answering the four research questions.

**Table I. Demographics (n=10)**

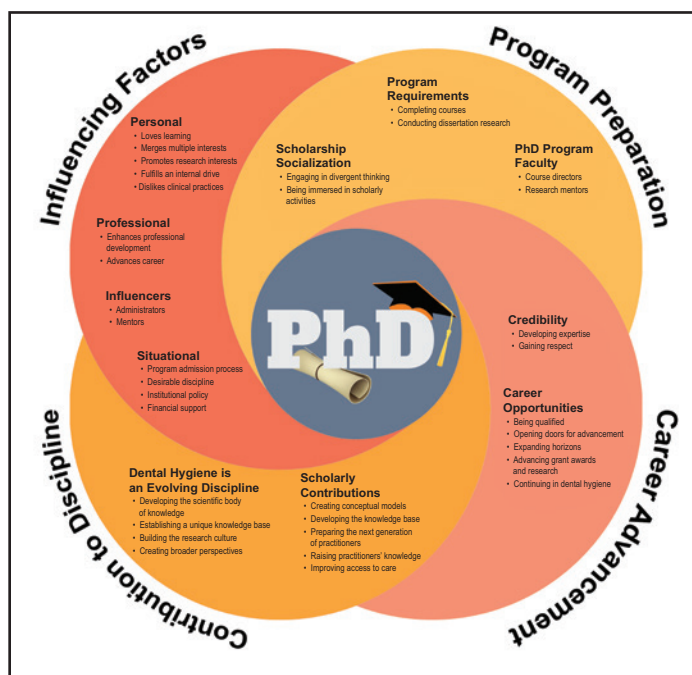
	n	(%)
<b>Age Range</b>		
41-50	1	(10)
51-60	5	(50)
61-70	1	(10)
71-80	3	(30)
<b>Gender</b>		
Male	1	(10)
Female	9	(90)
<b>Entry-level degree</b>		
Certificate	3	(30)
Diploma	3	(30)
Associate	3	(30)
Bachelor	1	(10)
<b>Year of entry level degree</b>		
1966-1970	3	(30)
1971-1980	1	(10)
1981-1990	3	(30)
1991-2000	3	(30)
<b>Type of master's degree</b>		
Dental Hygiene	4	(40)
Education	2	(20)
Science	4	(40)
<b>Year of master's degree</b>		
1961-1970	1	(10)
1971-1980	2	(20)
1981-1990	1	(10)
1991-2000	2	(20)
2001-2010	4	(40)
<b>Doctorate degree discipline</b>		
Education	4	(40)
Community Health	2	(20)
Science	4	(40)
<b>Year of doctorate degree</b>		
1976-1985	1	(10)
1986-1995	1	(10)
1996-2005	1	(10)
2006-2015	7	(70)
<b>Dissertation topic</b>		
Dental hygiene related	8	(80)
Oral biology	1	(10)
Physiology focus	1	(10)
<b>Employment setting</b>		
University setting	8	(80)
Retired educators	2	(20)

## Influencing Factor Themes

Four themes emerged related to factors influencing the participants' decisions to pursue a doctorate degree: *Personal*, *Professional*, *Influencers* and *Situational* (Figure 1). Personal interests reflected sub-themes: loves learning, merges multiple interests, promotes research interests, fulfills an internal drive, and dislikes clinical practices. As Ivy stated, "I was more interested in education but more specifically the intersection between education, anthropology and sociology." Another participant discussed her science interest:

"I chose oral biology, that was a conscious decision. I liked biology, but I liked the fact that I have spent two years in dental hygiene where I knew about teeth. And I thought this program would be ideal from the standpoint of merging my two interests." (Jean)

Figure 1. Personal, Professional, Influencers and Situational



Professional factors included the sub-themes: enhances professional development and advances career. Judy and Alex revealed their perspectives on professional development. Judy noted "I knew that I wanted to be able to do more than continue to be just in the technical college system where I had been for 11 years." While Alex indicated, "If you don't continue to be intellectually challenged in the work that you're doing, you burn out and, and you get bored and you start looking for something else." Career advancement was represented another participant who stated:

I wanted to move up the ladder, at the university where I was, and I needed the Doctoral degree. I knew that having a Doctoral degree was a prerequisite to get into an administrative position." (AJ)

Influencers who were administrators and mentors who had encouraged participants to pursue their doctoral degree were another professional factor. An example was described by Lucy, "the director of [the bachelor completion] program was very visionary, and she was the one who planted that seed." The last factor identified was situational. Four related sub-themes emerged: *program admission process*, *desirable discipline*, *institutional policy*, and *financial support*. Elizabeth reported, "one of the deciding factors [of taking the new employment position] actually was that there was a PhD program available in the university that had offered me the position." Others reflected the financial benefits available to them including, "There also was a tuition reimbursement, a type of scholarship," (Ivy) and "A faculty benefit was that we could take two, three-hour courses at no charge." (Joni)

## Preparation to Engage in Scholarship Themes

Three themes related to preparation to engage in scholarship were identified, *Scholarship Socialization*, *Program Requirements*, and *PhD Program Faculty* (Figure 1). Scholarship Socialization was organized into two sub-themes including engaging in divergent thinking and being immersed in scholarly activities. This theme was epitomized by Jean who said, "Socialization takes time. I had five years of being ingrained with scholarship." Other key quotes include:

"A critical part of the PhD program is learning how to write, learning how to analyze, develop scholarship and thinking in a very critical scholarly way." (Ivy)

"[The PhD program] taught me to be a lot more skeptical about what you see out there in the literature, to be able to more thoroughly assess studies that are published and, to be able to just make better decisions." (Elizabeth)

"Looking at certain problems or challenges from a different perspective, that's what the PhD has done for me. I now see things in different shades of gray, I can see and I understand from different perspectives...a doctoral degree makes you find other ways of looking at things and it may not be within the box; it may be a little bit unconventional." (AJ)

Analysis of the theme, *Program Requirements*, revealed two sub-themes, including *completing courses* and *conducting dissertation research*. Representative quotes reflecting this theme included:

"The PhD program required us to take not only quantitative research but qualitative research." (Judy)

"My program taught me more about statistics, study design, and overall project management." (Alex)

"I had a range of research courses, theory courses, and practice-based courses. I was pleasantly surprised how much

my doctoral program helped me develop the skills for my scholarship.” (Ivy).

“I don’t think you can really do substantial research without a PhD because you just don’t have the experience in research.” (Marie)

The final theme of this section relates to *PhD Program Faculty*. Sub-themes identified included course directors and research mentors as noted by Karen and Lucy.

“My PhD, I didn’t have many courses at all. The mentorship I got from my supervisor was where I learned a lot, not so much from the actual content of the course, but the supervisor and the mentor and the instructor that’s involved in coursework.” (Karen)

“One of my committee members was a very strong feminist and helped me develop my feminist approach to my research. I also had an advisor who was very pivotal, as far as me developing as a scholar because of what he required of me in developing my research proposal.” (Lucy)

**Career Advancement**

Two themes were identified related to career advancements *Credibility* and *Career Opportunities* (Figure 1). Credibility was analyzed as two sub-themes including *developing expertise* and *gaining respect*. Key quotes reflecting these sub-themes are represented by two of the participants.

“[The PhD] gave me credibility because no matter how smart and talented dental hygienists may be you’re on a very different playing field. It gives me a very strong credibility with dentists and with other scientists who recognize my degree as comparable, if not harder.” (Alex)

“You need dental hygienists at that table and you need them to be respected and listened to. The different tables that are making decisions creating policy in health care, creating research agendas or making decisions about where the dental hygiene discipline goes. Even if they’re sitting at the table without a PhD then they might be there, but they might not be respected and listened to.” (Lucy)

Multiple sub-themes were identified related to Career Opportunities: *being qualified*, *opening doors for advancement*, *expanding horizons*, *advancing grant awards and research*, and *continuing in dental hygiene* were identified as significant to the participants. Key quotes representing these sub-themes are shown in Table II.

**Contributions to Advancing the Discipline**

Two themes emerged from the interviews related to how scholarship activities contributed to advancing the dental hygiene discipline, *Dental Hygiene is an Evolving Discipline* and *Scholarly Contributions*. Four sub-themes were identified

**Table II. Key quotes: Career Opportunities**

<p><b><i>Being qualified</i></b></p> <p>“I would not have my position that I have today. I wouldn’t have got the promotions that I have gotten without the PhD.” (Ivy)</p> <p>“I have tenure at a major university and there’s no way I would be hired in the faculty I am without a doctorate.” (Marie)</p>
<p><b><i>Opening door for professional advancement</i></b></p> <p>“A PhD is essential. I would have not advanced in my career without it.” (Ivy)</p> <p>“Every degree is another window of opportunity.” (AJ)</p> <p>“Having a PhD is a key, a magic little key. A [PhD] advances you in real tangible ways and also in less tangible ways as far as, just having a PhD as a label that you attached to your name, where people make assumptions about your abilities and your knowledge and what you can offer that you don’t have when you have a masters. Its specialty unlocks a lot of doors.” (Lucy)</p>
<p><b><i>Expanding horizons</i></b></p> <p>“My PhD discipline is a broader and different lens than just dental hygiene. And that widening of my lens and widening of perception allowed me to leapfrog into other areas.” (Judy)</p>
<p><b><i>Advancing grant awards and research</i></b></p> <p>“We’ve done research with other universities and had major funding and that would not have come through without having a doctorate.” (Marie)</p>
<p><b><i>Continuing in dental hygiene</i></b></p> <p>“I really wanted to stay involved in the profession. Dental hygiene has been my passion since I was 19 years old. So, I feel like I still have a lot to contribute.” (Elizabeth)</p>

relative to the evolving discipline: *developing the scientific body of knowledge*, *establishing a unique knowledge base*, *building the research culture*, and *creating broader perspectives*. Regarding building a body of knowledge, one participant stated,

“My question would be can we overlap our body of knowledge with other bodies of knowledge or to be a true body of knowledge, Is it just ours? It has to be better defined through consensus and research. Then you have to provide the outlets through masters and PhDs to build and grow it. And that’s when we’ll truly have a dental hygiene discipline. Cause right now we’re a pseudo discipline.” (Lucy)

On building a research culture, another commented,

“We need to really establish a PhD as our end discipline, to become a true discipline. You really have to have an end point. And that’s the doctoral degree. We need to somehow

try to encourage more dental hygienists to pursue doctoral education to build a critical mass of doctoral prepared hygienists.” (Elizabeth)

In terms of creating broader perspectives, Alex observed, “I don’t think the scientific literature and theoretical base is unique because in dental hygiene education we beat everybody into submission. We teach everybody with the same textbooks, with the same philosophies, the same models. Everybody looks the same, they act the same, they think the same. Creative thinking or deviation from the norm is not encouraged. All you have to do is look at characteristics of the profession and that’s the only evidence you need to support that. If you have degrees in outside disciplines, you can bring novel and interesting things back to dental hygiene that nobody’s had exposure to before. Our current educational system has us stuck and it’s reflective in our literature too.” (Alex)

Additional quotes substantiating the theme of contri-butions to advancing the dental hygiene discipline are shown in Table III.

Six sub-themes were associated with the theme, *Scholarly Contributions* including creating *conceptual frameworks*, *developing the knowledge base*, *preparing the next generation of practitioners*, *preparing the next generation of researchers*, *raising practitioners’ knowledge*, and *improving access to care*. Key quotes illustrating these sub-themes are shown in Table IV.

## Discussion

This qualitative study was the first to explore the scholarship activities of dental hygienists with doctoral degrees relative to advancing the discipline. The findings provided new evidence that dissertation topics in the study population were related to dental

**Table III. Key quotes: Dental hygiene is an evolving discipline**

<p><b><i>Developing the scientific body of knowledge</i></b></p> <p>“The dental hygiene, scientific body of knowledge could be improved by being broader based. That was the purpose of the dental hygiene research agenda. The majority of research that comes in is all about the minute and very narrowly focused about a certain disease or about a technique instead of being more about public health or interprofessional work.” (Judy)</p> <p>“For a very long time we depended on organized dentistry, medicine, and on other disciplines. We’ve borrowed very heavily from nursing. We’re still borrowing heavily for nursing, but it’s all interprofessional at this point.” (Joni)</p>
<p><b><i>Establishing a unique knowledge base</i></b></p> <p>“I think [dental hygiene’s knowledge base] is unique because a lot of what we do focuses on prevention.” (Mary)</p> <p>“Dental hygiene has a much more holistic and prevention and health promotion focus. And I think that does make us somewhat unique.” (Karen)</p> <p>“The other very unique part that we need to look at is prevention and care rather than cure or repair.” (Ivy)</p> <p>“We have to really start creating the data to show the outcomes of what dental hygienists delivered, models of care produce, how does the care that we deliver change patient outcomes, how does it affect the cost of care. We have basic fundamental questions about what we do and how it drives patient health that are unanswered. We think that we know the answer because it’s anecdotal, it’s what we observe, but we don’t have good numbers to show that.” (Alex)</p> <p>“The first step [in developing the dental hygiene body of knowledge] is making sure we have a definition and that definition is current and also visionary. Then making sure that education supports it and if you don’t have higher education in dental hygiene, then you can’t grow it. So the argument is always that if you don’t have PhDs and masters trained dental hygienists, you don’t have anyone developing that body of knowledge.” (Lucy)</p>
<p><b><i>Building a research culture</i></b></p> <p>“If we are able to establish a doctoral degree that could be one of our pathways on creating more theoretical or conceptual models for the profession.” (AJ)</p> <p>“We see sort of a ‘dumbing down’ of our profession where our graduate programs aren’t encouraging original research. If you don’t have original research you can’t grow a unique body of knowledge. So we’re stuck a little bit and we need to be doing creating more theoretical frameworks. But more importantly, we can’t just create them. We have to test them to see if they actually work.” (Alex)</p> <p>“We need to have more people who are knowledgeable about doing qualitative research and maybe mixed methods studies because that’s how you’re going to get some of the more social science types of theoretical information into dental hygiene and, applicable to dental hygiene. I think those are the kinds of studies we need more of because that’s how we’re going to improve our understanding of other paradigms.” (Elizabeth)</p> <p>“If we graduated more doctoral level hygienists to push the boundaries of the profession that could help advance us.” (AJ)</p>
<p><b><i>Creating broader perspectives</i></b></p> <p>“The dental hygiene scientific body of knowledge could be improved by being broader based. That was the purpose of the dental hygiene research agenda... Individuals we see in our profession are looking at wanting to make positive changes for the future. Those are all really good things, but the actual construction of it and making it happen, that’s a whole different layer of challenge.” (Judy)</p> <p>“I see more responsibilities coming to dental hygiene, to dental therapy, to dental assisting, and less responsibilities for the clinical services to the dentist. I see the dentist is more of an administrator or even a ring master.” (Joni)</p>

**Table IV. Key quotes: Scholarly contributions**

<p><b><i>Creating conceptual models</i></b></p> <p>“I value and understand how important conceptual models are. I support and really encourage and think that we need a lot of fine minds and active energy and scholars in dental hygiene to develop more theoretical or conceptual models.” (Ivy)</p>
<p><b><i>Developing the knowledge base</i></b></p> <p>“One of the reasons why we want a PhD is to have a better knowledge base and to produce new knowledge.” (Jean)</p> <p>“My scholarship and involvement has been able to help forward those things for the profession and looking at things through a broader lens instead of a narrower one. Help us advance the profession by having less boundaries with supervision and knowing that we’re just as clinically capable.” (Judy)</p> <p>“I’m still publishing..... And I will continue to do research and publish as long as I can because I love it.” (Elizabeth)</p>
<p><b><i>Preparing the next generation of practitioners</i></b></p> <p>“Understanding why people need a bachelor degree minimum, and even within our profession, I think that’s super, very important.” (Marie)</p> <p>“I wish more young dental hygienists could understand how advancing their education will help them to become master clinicians.” (Alex)</p>
<p><b><i>Preparing the next generation of researchers</i></b></p> <p>“The people who are directing and educating the dental hygiene master’s program should have a doctorate. You have to live research, you have to do more than one project. That’s why there needs to be more hygienists with PhDs to teach the master’s people. The joy of scholarship is producing other scholars for dental hygiene. I have advanced the dental hygiene discipline through my publications with students.” (Jean)</p> <p>“Few graduate programs in dental hygiene are left where students do original search. They used to all do original research but they don’t anymore. We have a tremendous responsibility, those of us who work in research to try to actively create the next generations of people who are going to take over the kind of roles that, you know, I’m in because it’s slim pickings right now to be honest with you and it’s a bit scary.” (Alex)</p>
<p><b><i>Raising the practitioners’ knowledge</i></b></p> <p>“The professional development courses or the clinical education courses that I present keep them current. The theories have changed over time and I want the evidence to be sound. Sometimes we practice the way we were taught and as clinicians we need to make sure we change with the times. We need to accept information and integrate it into clinical practice.” (AJ)</p> <p>“I’m very passionate about hygienists becoming more advanced clinicians. So I hope that some of my scholarly endeavors will eventually translate into raising that bar for that.” (Alex)</p>
<p><b><i>Improving Access to Care</i></b></p> <p>“My scholarship is a contribution to be able to first contribute to the community so that our community members can get the education and access to care that they need. Every dental student and faculty knows how competent and strong dental hygienists are in community settings because we are here and we’re doing the work.” (Ivy)</p> <p>“One of the things that I do, even though a lot of people look at access to care and marginalized and vulnerable populations, I focused specifically on prison population now, which was easy moving from institutionalized elders to institutionalized adults, For the most part it’s the institutionalization and the culture change models that are in place, or the organizational culture. That’s where my contribution is, not only from being a dental hygienist but from just a dental perspective, I work with an interprofessional team here and I’m the only dental professional involved.” (Karen)</p>

hygiene, rather than other disciplines. Although each participants’ journey was unique, interesting, themes emerged from the data.

Multiple factors influenced participants’ decision to pursue doctorate degrees. Previous research supports personal and professional factors previously identified such as increasing knowledge, gaining respect, gaining a deeper understanding of oral diseases, and merging of multiple interests.<sup>30</sup> However, the participants in the previous study also included individuals with dental degrees and a range of doctoral degrees.<sup>30</sup> In another study by Tumath and Walsh on the perceptions regarding dental hygiene doctoral programs from students in a master’s degree program, interests in earning a doctorate included career advancement (becoming a better teacher and/or researcher), and increased salary.<sup>8</sup> Regarding influencers, Carpenter et al. identified similar Influencers to the participants in this study, including educators, dental professionals, researchers and family members.<sup>30</sup> These influencers provide encouragement and support for individuals as they consider and pursue doctoral education.

Doctoral education provides a socialization experience through immersion in scholarly activities and divergent ways of thinking; practices that are not usually a part of the undergraduate or master’s degree education experience. Weidman, et al. attributed socialization as processes for gaining knowledge, values and skills that are vital for entry into a career, requiring an advanced level of comprehension and attributes.<sup>31</sup> Socialization within the context of a doctoral program requires individuals to internalize the values, roles, and attitudes that are accepted as part of the culture of scholars and to commit to portraying “the persona of the scholar.”<sup>32</sup> Cunningham-Williams et al. described a conceptual model of socialization of doctoral students consisting of four

major components: research focused interdisciplinary curriculum, individualized mentoring, leadership development, and formal and informal supports, leading to academic and careers with a research concentration.<sup>33</sup> Doctoral coursework in a selected minor area, (e.g., anthropology, economics, physiology) can provide additional experiences to expand one's perspectives through developing a broad understanding of another discipline.<sup>30</sup> Coursework completed in other disciplines increases the individual's ability to engage in divergent thinking, the method or process of exploring creative ideas for problem solving. With divergent thinking, ideas are generated spontaneously in a non-linear manner. Participants in this study noted that more divergent thinking is needed within the dental hygiene profession, a skill that can be acquired when exposed to doctoral coursework.

In considering doctoral education for dental hygiene, Ortega and Walsh analyzed doctoral education in nursing and proposed two types of doctoral degrees for dental hygiene; one for professional practice and another as a PhD.<sup>34</sup> Gurenlian et al., outlined curricula for the two dental hygiene doctoral programs.<sup>32</sup> While the professional practice doctorate would be focused on clinical practice, the proposed PhD program would educate and prepare researchers and academicians for advancing the discipline's scientific knowledge base.<sup>35</sup> Researchers educated within the discipline would be socialized to engage in quantitative and qualitative investigations leading to the development and testing of theoretical and conceptual models as well as establishing priorities for future research.<sup>35</sup>

While participants in this study had not earned a doctorate in dental hygiene, they indicated that obtaining a doctoral degree contributed to their professional advantages. Participants noted that credibility was established by earning a doctorate which led to a recognition of a developed expertise and brought respect. Davis et al. reported similar findings credibility and respect in their study of dental hygiene educators. Additionally, Davis et al. found that a majority of dental hygiene educators in their study agreed that the greatest need for establishing doctoral programs in dental hygiene was for the ability to relate equitably with doctoral graduates of other health disciplines.<sup>36</sup> Participants in the current study perceived that career opportunities increased, and salary compensation options became available due to their advanced degree. Likewise, Davis et al. found similar agreement; dental hygiene educator participants were motivated to pursue a doctoral degree to become better researchers, educators, and program administrators.<sup>36</sup>

Advancing the dental hygiene discipline through increasing the scientific knowledge base is an important consideration;

however, many of the participants lacked experience in contributing to the development or testing of theoretical models or conceptual frameworks. Cobban et al. examined whether dental hygiene practice would benefit from pursuit of development as a discipline.<sup>12</sup> While dental hygiene has developed some characteristics of a discipline, research production by dental hygienists had been limited and often not situated within theoretical or conceptual frameworks,<sup>12</sup> thus supporting the need for further development in this area.

A research infrastructure is needed to promote research and advance the scientific basis for dental hygiene practice.<sup>37</sup> An key component of an infrastructure is the presence of professionals who are educated in research, particularly those who are prepared through doctoral education in dental hygiene.<sup>37</sup> Participants in this study suggested that the dental hygiene research infrastructure was weak, and expressed concern that graduate students no longer experience significant study in research design or thesis. Unfortunately, this observation impacts the interest in research, which participants may have previously developed during their master's degree education. Another challenge to a research infrastructure was the need for broader consensus on defining the unique body of knowledge for dental hygiene. However, doctoral programs offer experiences in both quantitative and qualitative research which help to foster the development of conceptual models and theoretical frameworks. To date, there are only seven theoretical frameworks for the dental hygiene profession with limited testing of these constructs.<sup>14-21, 22-26</sup>

Transitioning dental hygiene to the level of recognition as a research-based discipline, requires the building of research capacity. The foundation is fostering a strong research culture among practitioners, academicians and researchers that begins during the entry-level curriculum and continues through graduate and doctoral education. A research culture has been defined as "an organization constructing an environment that enables and supports creative work to generate new knowledge and that provides researchers with opportunities to interact and grow."<sup>38</sup> Research needs to be integrated into all aspects of education, to create a critical mass of practitioners who use science-based evidence to guide patient care, and researchers to create new knowledge.

This study has several limitations. Although purposive sampling is widely used in qualitative research, this sampling method limits the generalization of the results. However, the intent purposive sampling is to provide in-depth insights about the study questions.<sup>39</sup> Participants were recruited through professional networking, with many of the participants in educational settings, recommending potential participants who were also in education. Unfortunately, potential participants working outside of education did not volunteer to participate.

Also, this study did not include dental hygienists with all types of doctoral degrees and participants were located only in the US and Canada.

Further research is indicated to support the development of an understanding of doctoral education in dental hygiene and the development of the discipline. Each theme addressed within this qualitative study could be examined in greater detail using maximum variation with dental hygienists who have different types of doctoral degrees allowing for additional expression and experiences to emerge. A new Delphi study could be conducted allowing for examination and consensus pertaining to dental hygiene's research infrastructure. Lastly, a study examining the current levels of dental hygiene research being conducted and determining how the current research relates to existing conceptual models and theoretical frameworks. A perspective is needed on the contributions dental hygiene researchers are making to the discipline and the existing gaps in the literature to chart a course that makes significant contributions to the advancement of the profession.

## Conclusion

The participants of this study provided valuable insight regarding their experiences in doctoral programs and scholarship activities. Although each participant's journey to a doctorate degree was unique, there were similar themes for motivation to obtain this advanced degree as well as the preparation for engagement in scholarly activities and for career advancement. While many participants lacked personal experience in building theoretical or conceptual models, most agreed on the importance of these models and that the dental hygiene discipline is continuing to evolve and develop.

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