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- Dental and Dental Hygiene Student Perceptions of Interprofessional Education
- Educational Preparedness to Provide Care for Older Adults in Alternative Practice Settings: Perceptions of dental hygiene practitioners
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- Fluoride-related YouTube videos: A cross-sectional study of video contents by upload sources

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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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Thank You!

Rebecca Wilder, RDH, BS, MS
Editor-in-Chief, *Journal of Dental Hygiene*



I am extremely appreciative for everyone who plays a role in supporting the *Journal of Dental Hygiene* through their submissions of timely manuscripts to the members of our Editorial Review Board who freely give their time and expertise with their thorough reviews of the research submissions. In addition, we also have many individuals who are not formally on our Editorial Review Board, who generously contribute their experience when needed. This editorial is dedicated to all of who give their ongoing support of our peer-reviewed, scholarly Journal.

Providing a comprehensive review of a manuscript takes a great deal of time to provide thoughtful, constructive feedback to the authors. Our Editorial Review Board members come to us with their own areas of expertise and commitment to the dental hygiene profession. While most of our Editorial Review Board members are dental hygienists, we also have members who are dentists, hold doctorates in other fields or are dental hygienists with additional degrees including nursing, public health, nutrition, physical therapy, and other allied health professions.

I would like to personally thank Sue Bessner and Tyler Dempsey from the Professional Development and Membership Engagement Division of the American Dental Hygienists' Association as well as ADHA's Chief Executive Officer, Ann Battrell, and Chief Operating Officer, Bob Moore, who are so supportive of the *Journal of Dental Hygiene* and what it represents to the advancement of the profession. Finally, I want to personally thank Cathy Draper, RDH, MS who serves as our managing editor. She works tirelessly with the reviewers, authors and the editor through all stages of the production of the *JDH!*

The 2018 *Journal of Dental Hygiene* Editorial Review Board is listed on the following page along with our guest reviewers. Thank you again for your time, knowledge and commitment to the growth and advancement of the dental hygiene profession. All of us here at the *Journal of Dental Hygiene* look forward to working with each of you to continually improve **OUR** Journal!

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Dental and Dental Hygiene Student Perceptions of Interprofessional Education

Michelle R. McGregor, RDH, MEd; Sharon K. Lanning, DDS; Kelly S. Lockeman, PhD

Abstract

Purpose: Commission on Dental Accreditation standards for dental and dental hygiene programs include interprofessional education (IPE) experiences within the curriculum; an initial step in the acquisition and application of IPE is for students to perceive it as relevant. The purpose of this study is to identify dental and dental hygiene students' attitudes regarding IPE following the completion of a novel interprofessional course involving health professional students from six different degree programs.

Methods: Faculty members from the Schools of Allied Health Professions, Dentistry, Nursing, and Pharmacy designed a one-hour, required course focusing on collaborative practice, roles and responsibilities, teamwork, and communication. Students from six different professional programs were divided into interprofessional teams for the thirteen session IPE course. Upon completion of the course, all participants (n=487), were invited to complete an online course evaluation survey utilizing the Student Perceptions of Interprofessional Clinical Education (SPICE-R2) instrument. A retrospective pre-test-post-test approach was used to assess attitudinal change.

Results: A total of 300 students from the six health care professions (n=300) completed the SPICE-R2 pre- and post-test surveys for a response rate of 62%. In general, students reported significantly more positive perceptions about IPE after completion ($M = 39.7$, $SD = 7.57$) than they did prior to the course ($M = 36.6$, $SD = 7.13$), $t(299) = -9.24$, $p < .001$; and the effect size was moderate (Cohen's $d = .535$). One-way analysis of variance revealed a significant main effect for student program on change in scores on the total SPICE-R2 scale. Although post-tests did not reveal differences between specific programs, dental hygiene students exhibited the greatest attitudinal change, while dental students demonstrated the lowest.

Conclusions: Sample sizes from the six healthcare programs varied and serve as a limitation for this study. Findings suggest that dental hygiene students may perceive greater benefit from IPE because they see themselves as collaborative practitioners, while dental students may self-identify as leaders of the oral healthcare team. Further research is warranted to examine students' perceptions of IPE to determine the potential impact and success of these curricular activities.

Keywords: interprofessional education, health education, collaborative practice, professional attitudes

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Introduction

Access to all aspects of healthcare in the United States (U.S.) is disproportionate based on factors such as race, ethnicity, socioeconomic status, and location.¹ The Institute of Medicine (IOM) has drawn attention to a variety of factors that contribute to poor patient care outcomes and has made recommendations for fundamental changes in the U.S. healthcare system that include both interprofessional education (IPE) and interprofessional practice. Recently, the IOM proposed a conceptual framework for IPE focusing on the value of interprofessional learning across the continuum, from pre-licensure education to graduate education, and ultimately into

continuing education.²⁻⁵ In response, health science programs, spurred by changes in accreditation standards, have initiated a variety of IPE programs.¹⁰⁻¹⁴ These IPE programs aim to develop "collaboration ready" practitioners able to communicate clinical findings, coordinate patient care, and connect patients to health resources in the communities in which they live.¹¹⁻¹⁴ The Commission on Dental Education (CODA)¹⁵⁻¹⁶ expects institutions to provide opportunities for learners to engage with other health professional students and develop collaborative interprofessional skills. Specifically, CODA standards 1-9 and 2-19 for dental programs¹⁵ and standards 2-13d and 2-15 for dental hygiene programs¹⁶ emphasize professional roles,

communication and coordination of patient care within a diverse healthcare team.

A wide variety of IPE initiatives in dental education have been reported in the literature.¹⁰ Within dental hygiene education, interprofessional interactions have been most frequently associated with volunteer activities (68%), basic sciences courses (65%), communication training (63%) and behavioral science courses (59%) according to a national survey conducted in 2015.¹⁷ A second study reported that small group exercises (80%), service-learning projects (75%) and case-based discussions (59%) were among the most common methods for integration of IPE. Standardized patient experiences and shared clinical activities are other ways in which dental hygiene and dental programs expose their students to other health professional students.¹⁸

While a variety of IPE experiences have been implemented throughout healthcare education, substantial challenges remain in implementing IPE and assessing of the impact of these experiences amongst oral healthcare trainees as they move through various stages of professional development.¹⁹ Faculty at Virginia Commonwealth University (VCU) developed a large scale, interactive, required course with the objective of enhancing the entry level health professional students' foundational knowledge, attitudes, and skills needed to attain interprofessional competency. The purpose of this study was to examine learners' attitudes about IPE prior to and following participation in an IPE course; specifically, the differences between pre-doctoral dental and dental hygiene students.

Methods

This study was granted exempt status by the VCU Institutional Review Board (protocol number HM14278).

Course Description

A core group of faculty members (planning committee), consisting of a faculty member from each of the six professional programs participating in the course plus two faculty from VCU's Center of Interprofessional Education and Collaborative Practice met to develop a required, one-hour, thirteen-session, pass-fail course. Collectively, the planning committee had broad experience in IPE, clinical practice, teaching, curriculum development and assessment and were guided by the IOM's conceptual framework for integrating IPE across the learning continuum.² The course originated as a non-

academic three-hour activity in academic years 2012-13 through 2014-15. Sessions were added in the second year as content and cases were developed. The inaugural offering of the thirteen-session required course was in fall 2015. Based on student evaluations and faculty feedback, the course was enhanced for fall of 2016, and served as the basis for this study.

Students from the Schools of Allied Health Professions, Dentistry, Nursing, and Pharmacy were enrolled in the course. All students were considered "beginning level," meaning they had not begun or had just started clinical training. Enrollment by the six professions represented in the course can be found in Table I.

Table I. Interprofessional Course: Learning Objectives

Upon completion of the course, students will be able to:	IPEC Competency Domain ¹⁶
Define interprofessional education and interprofessional collaborative care Identify trends in healthcare that are driving interprofessional practice Describe the potential impact of interprofessional collaborative care	Interprofessional Teamwork and Team-based Practice
Know the roles & responsibilities of their own profession Know the roles & responsibilities of other professions Describe how professionals collaborate within certain contexts/settings of healthcare	Roles and Responsibilities
Define models of team formation and effective teamwork Demonstrate teamwork behaviors and skills for effective team communication Assess effectiveness of teamwork	Teams and Teamwork; Interprofessional Communication

Course content and activities targeted three domains of the Core Competencies for Interprofessional Collaborative Practice:²⁰⁻²¹ Roles and Responsibilities, Teams and Teamwork, and Interprofessional Communication. The overall learning outcomes of the course were for students to: characterize interprofessional collaborative care; recognize the training, licensure, and typical practice of health professions; and develop effective team-based skills for interprofessional collaboration. Specific learning objectives can be found in Table I.

Students were assembled into 88 interprofessional teams, consisting of five to six students per team, for the learning activities over the duration of the course. Teams were randomly assigned

to include students from each of the health professions, with eleven teams per classroom. While representatives from physical therapy, occupational therapy and dental hygiene were not on every team due to smaller class sizes, all professions were represented in each classroom. The majority of sessions were held in classrooms designed for group work and included stations consisting of oblong tables for collaboration, dual monitors to project materials from the instructor and individual students, and a microphone system for large group discussions.

Initial learning activities prompted students to explore their own profession's scope of practice and roles towards collaborative care. Students then came together to inform other professions of their training and typical scope of practice. Students were prompted to explore similarities and differences in their roles and responsibilities and acknowledge how overlap may be beneficial as well as cumbersome in the care of patients. Students then focused on a model for effective collaboration, which included phases of planning, action, and reflection. The model was based on the theoretical process of reflective practice and team skill development and included communication processes, conflict resolution and group decision making.²² Team assignments followed and students approached the planning phase by creating goals, gaining group consensus, and clearly outlining roles and responsibilities. During the action phase of the assignment, students were encouraged to assist teammates and monitor progress. The reflection phase provided opportunity to review performance of all team members and make adjustments for future work. Assignments consisted of a written case study, a simulated patient encounter, and a capstone project that required student teams to create a brief video essay depicting the nature of interprofessional collaborative care and its benefits to patients within a specific context or healthcare setting.

Final grades in the pass/fail course were determined by a combination of activities completed individually or as an interprofessional team. Assessments included three knowledge-based multiple-choice quizzes (30%), three individual learning activities (10%), six team-based learning activities (20%), and a team-based capstone project (40%).

A total of 20 faculty members from the six participating health science programs taught the course. Faculty were either recruited based on their involvement in other university IPE initiatives, or appointed by their program's leadership. The number of faculty representing each program was proportional to the number of students enrolled in their respective programs. Faculty from two different professions were paired to work

together over the duration of the course based on their experience with IPE and availability for the thirteen sessions. Faculty pairs were randomly assigned to the classrooms where they provided instruction, facilitated the learning activities, and assessed the capstone project. Faculty were provided with teaching materials and facilitator notes developed by the core planning committee. Faculty met weekly for a thirty-minute, pre-session huddle to review materials, discuss course management issues, and clarify assessment expectations. A debrief thread was emailed to faculty at the conclusion of each session, thus providing timely feedback to guide course enhancements.

Study Design

A non-experimental, comparative design with a retrospective pre-test-post-test²³ measure to assess change in student attitudes, was used for the study. Attendance was taken at weekly class sessions throughout the semester as one measure of student participation. Data were collected for the purpose of annual program evaluation, and secondary data analyses were conducted to answer the focused study questions. An online course evaluation survey with the additional attitudinal measure was distributed to all enrolled students at the end of the semester via email using Qualtrics (Provo, UT). Each student received a unique URL for the survey and their responses were linked to embedded demographic data identifying their specific academic program. The survey was open for two weeks, and students were sent up to three reminders to complete the course evaluation.

The revised Student Perceptions of Interprofessional Clinical Education instrument version 2 (SPICE-R2), developed to assess students' attitudes and perceptions of the appropriateness and benefits of IPE and interprofessional practice without a focus on any one profession,²⁴ was used to measure attitudes. This 10-item survey captures student perceptions about three areas of IPE. Each item is rated on a 5-point Likert scale and summed to arrive at subscale scores and an overall score. The first subscale measures attitudes about Interprofessional Teamwork and Team-based Practice and includes four items, such as "Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team," with scores ranging from 4 to 20. The second subscale measures attitudes about Roles and Responsibilities for Collaborative Practice and includes three items such as "I understand the roles of other health professionals within an interprofessional team," with scores ranging from 3 to 15. The final subscale, consisting of three items, measures attitudes about Patient Outcomes from Collaborative Practice. Items include statements such

as “Patient/client satisfaction is improved when care is delivered by an interprofessional team,” and scores range from 3 to 15. Students were asked to think back and reflect on their perceptions at the beginning of the semester (prior to the course) and rate their level of agreement with each statement and then to rate their level of agreement at the current point in time (at the end of the course).

The SPICE tool was originally designed for use with learners during the clinical stage of their training.²⁵ A retrospective pre-test was used rather than the traditional prospective pre-test because these participants were early learners, with little or no experience with clinical care. Enthusiasm for their new professions and lack of understanding about the complexity of interprofessional care may cause students to inaccurately assess their perceptions on a traditional pre-test. The retrospective pre-test-post-test design provided students with an opportunity to reflect on the items as related to the constructs covered in the course, minimizing potential response shift bias and yielding a more accurate and reliable measure of change. The SPICE-R2 measurements appeared first in the survey, so students responded to those items before moving to the next screen, with questions pertaining to satisfaction with various aspects of the course.

Analyses

To determine attitudinal change, mean post-test scores were compared with retrospective pre-test scores on the total scale and for each subscale using paired samples t-tests. Differences in change associated with specific student disciplines were calculated by determining a change score for each respondent as the difference between the post-test score and the retrospective pre-test score on the total scale and for each subscale. Scores were compared using a one-way analysis of variance (ANOVA). Individual attendance (number of sessions attended) for all enrolled students was also examined using one-way ANOVA to determine any variances by individual disciplines.

Results

Of the total number of students enrolled in the mandatory IPE course (n=487), three-hundred students from the six professional programs (n=300) completed the survey for a response rate of 62%. Response rates by professional program are displayed in Table II. Responses from dental hygiene students (n=16) and dental students (n=46) comprised 21% of the total sample. In general, the majority of respondents from all six programs reported significantly more positive perceptions about interprofessional education upon completion of the course ($M = 39.7, SD = 7.57$) than prior to the course ($M = 36.6, SD = 7.13$), $t(299) = -9.24, p < .001$. The change in perception about IPE had a moderate effect size (Cohen’s $d = .535$). Among the three subscales of the measure, change was greatest in student attitudes about Roles and Responsibilities for Collaborative Practice, $t(299) = -13.30, p < .001$, Cohen’s $d = .771$. This category had the lowest mean pre-test score. The smallest change was in the subscale related to Interprofessional Teamwork and Team-based Practice, $t(299) = -3.08, p = .002$, Cohen’s $d = .179$. This category had the highest mean score at pre-test. Attitudes about patient outcomes showed moderate change, $t(299) = -7.51, p < .001$, Cohen’s $d = .434$). Means, standard deviations, and results of comparisons between retrospective pre-test and post-test scores are shown in Table III for the overall group and each professional program.

The one-way analysis of variance revealed a significant main effect for student program in regards to change in scores on the total SPICE-R2 scale and on the Roles and Responsibilities for Collaborative Practice subscale

Table II. Enrollment and Response Rate by Program

Program: <i>Degree Sought</i>	Enrolled Students	Percent of Total Course Enrollment	Number Completing Survey	Response Rate
Dental Hygiene <i>Bachelor of Science in Dental Hygiene</i>	22	5%	16	73%
Dentistry <i>Doctor of Dental Surgery</i>	97	20%	47	48%
Nursing <i>Bachelor of Science in Nursing</i>	146	30%	92	63%
Occupational Therapy <i>Doctor of Occupational Therapy</i>	42	9%	30	71%
Pharmacy <i>Doctor of Pharmacy</i>	125	26%	78	62%
Physical Therapy <i>Doctor of Physical Therapy</i>	55	11%	37	67%
All	487	100%	300	62%

Table III. Summary Statistics and Paired *t*-test Results for Comparisons Overall and by Program

	<i>n</i>	Retrospective Pretest		Posttest		Absolute Change		<i>t</i>	<i>p</i>
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>		
Overall Scale (Score Range: 10-50)									
Dental Hygiene	16	32.63	10.01	38.63	8.37	6.00	7.46	-3.22	0.006
Dentistry	47	33.66	7.86	35.85	9.95	2.19	7.82	-1.92	0.061
Nursing	92	36.49	6.47	38.60	7.69	2.11	4.67	-4.33	<.001
Occupational Therapy	30	36.80	5.29	40.90	5.34	4.10	4.89	-4.59	<.001
Pharmacy	78	37.81	6.66	41.92	5.78	4.12	5.68	-6.40	<.001
Physical Therapy	37	39.95	6.68	42.24	5.88	2.30	4.48	-3.12	0.004
All	300	36.64	7.13	39.71	7.57	3.07	5.76	-9.24	<.001
Subscale 1: Interprofessional Teamwork and Team-based Practice (Score Range: 4-20)									
Dental Hygiene	16	14.00	4.55	15.81	3.39	1.81	3.35	-2.16	0.047
Dentistry	47	13.70	3.54	14.17	4.36	0.47	2.89	-1.11	0.272
Nursing	92	14.39	3.57	14.55	4.02	0.16	2.23	-0.70	0.484
Occupational Therapy	30	16.67	2.02	17.20	2.73	0.53	2.87	-1.02	0.318
Pharmacy	78	16.12	2.92	16.88	2.81	0.77	2.76	-2.46	0.016
Physical Therapy	37	16.78	2.94	16.76	2.68	-0.03	2.36	0.07	0.945
All	300	15.23	3.44	15.70	3.68	0.47	2.64	-3.08	0.002
Subscale 2: Roles/responsibilities for Collaborative Practice (Score Range: 3-15)									
Dental Hygiene	16	8.19	3.21	11.00	2.99	2.81	3.25	-3.46	0.004
Dentistry	47	9.57	2.89	10.64	3.21	1.06	2.84	-2.57	0.014
Nursing	92	10.27	2.40	11.78	2.39	1.51	2.26	-6.42	<.001
Occupational Therapy	30	8.27	2.56	10.83	2.35	2.57	1.77	-7.92	<.001
Pharmacy	78	9.87	2.69	12.05	2.01	2.18	2.20	-8.76	<.001
Physical Therapy	37	10.30	3.00	12.16	2.15	1.86	2.19	-5.18	<.001
All	300	9.75	2.76	11.58	2.50	1.83	2.39	-13.30	<.001
Subscale 3: Patient Outcomes from Collaborative Practice (Score Range: 3-15)									
Dental Hygiene	16	10.44	3.65	11.81	2.76	1.38	1.89	-2.91	0.011
Dentistry	47	10.38	2.52	11.04	3.08	0.66	2.43	-1.86	0.069
Nursing	92	11.83	2.38	12.26	2.39	0.43	1.53	-2.73	0.008
Occupational Therapy	30	11.87	2.19	12.87	1.66	1.00	1.51	-3.63	0.001
Pharmacy	78	11.82	2.21	12.99	1.96	1.17	1.82	-5.66	<.001
Physical Therapy	37	12.86	2.04	13.32	1.93	0.46	1.19	-2.34	0.025
All	300	11.66	2.48	12.43	2.41	0.77	1.78	-7.51	<.001

(Table IV). Though the overall variance attributed to the effect of the IPE course was statistically significant, post-hoc tests did not reveal individual program scores significantly different from each other. Figure 1 illustrates the absolute change for the total scale and for each subscale overall, as well as each individual program.

There was also a significant main effect for specific professional programs in regards to attendance [$F(5, 345) = 5.139, p = .000$]. Dental hygiene students had the highest attendance rate, a mean of 12.00 sessions attended out of 13 total ($SD = 0.65$), while dental students had the lowest average attendance rate ($M = 11.06, SD = 0.92$). The average number of sessions attended by students in the other four disciplines were similar and fell between the two oral health professions: nursing ($M = 11.53, SD = 0.79$), occupational therapy ($M = 11.68, SD = 0.65$), pharmacy ($M = 11.65, SD = 0.61$), and physical therapy ($M = 11.57, SD = 0.95$).

Table IV. One-Way ANOVA for Effect of Program on Change for Overall Scale and Subscales

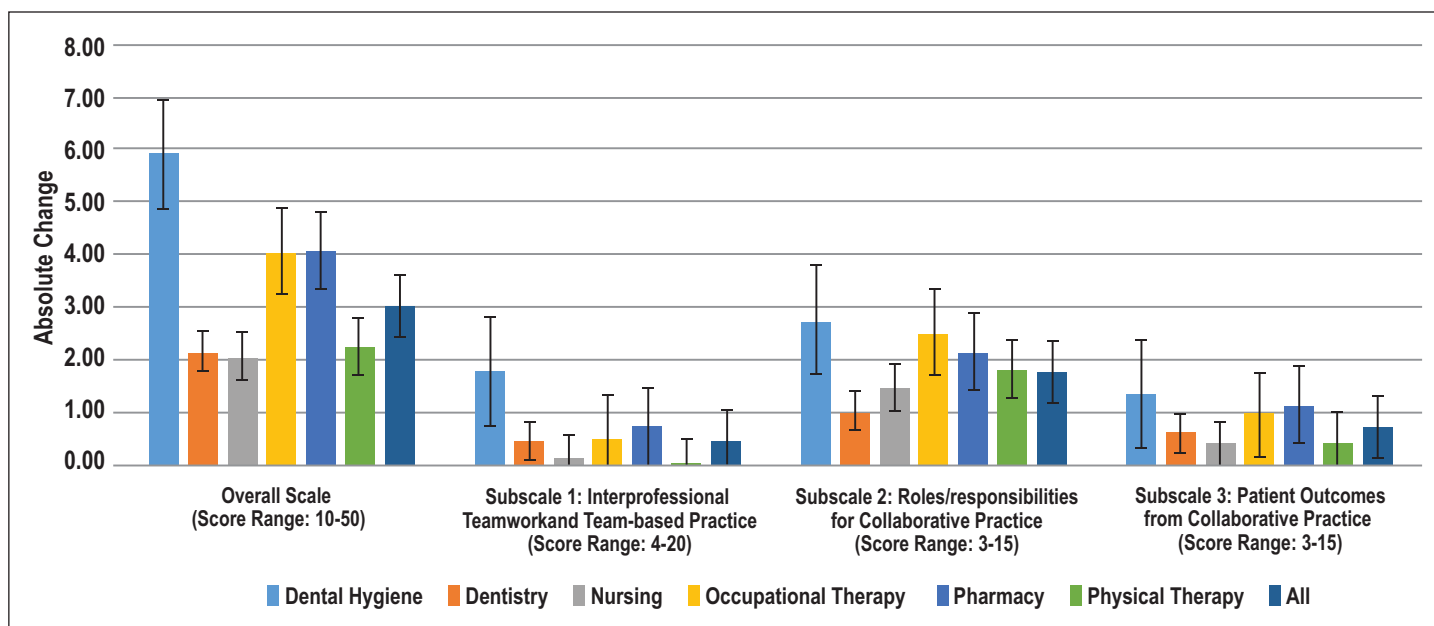
	Source	df	SS	MS	F	p
Overall Scale	Between-group	5	397.81	79.56	2.45	0.034*
	Within-group	294	9530.58	32.42		
	Total	299	9928.39			
Subscale 1	Between-group	5	53.75	10.75	1.56	0.172
	Within-group	294	2028.98	6.90		
	Total	299	2082.73			
Subscale 2	Between-group	5	78.25	15.65	2.83	0.016*
	Within-group	294	1627.41	5.54		
	Total	299	1705.67			
Subscale 3	Between-group	5	34.20	6.84	2.21	0.053
	Within-group	294	908.93	3.09		
	Total	299	943.13			

*Post-hoc tests did not reveal individual program scores that were significantly different than other programs.

Discussion

Improved health outcomes can be expected through interprofessional practice when patients have greater access to care, enhanced coordination of care, and better connections to health resources in their communities.^{10,17} Dentistry is part of the primary healthcare system and both dentists and dental hygienists must be able to successfully communicate with other primary care providers. Chronic health conditions, such as diabetes, have oral health related consequences; and oral health conditions also impact systemic health. Dental hygienists and dentists are uniquely positioned as valuable members of the healthcare team to promote oral, as

Figure 1. Absolute change in SPICE-R2 scores from retrospective pretest to posttest by program and overall



well as, overall health and well-being.²⁶ IPE is an integral first step towards developing future practitioners who understand their own role as well as the roles of other healthcare professionals within collaborative care.

CODA standards relating to interprofessional competency are relatively new and it is important to share learning objectives and educational methodologies to determine best practices in IPE for oral health professionals. Learners who appreciate the relevance of the topic being taught may be more likely to engage with the material and, in the case of IPE, better represent their respective professions while interacting with other health professional students. This study was conducted to help inform IPE curricular development by the highlighting students' perceptions and experiences of a large-scale IPE course and at an urban university.

In discussing the study findings, limitations related to its design should be considered. The use of a convenience sample at a single site may limit generalizability of the findings. Because instructors in the course had varying levels of experience with IPE and with teaching, the classroom experience for students varied depending on which instructional team they were assigned. This could have impacted responses to the attitudinal measure. The overall response rate to the attitudinal survey was relatively high at 62%, but the possibility of non-response bias must also be considered since response rates varied by student discipline. Dentistry students in particular had a response rate of only 48%, which was substantially lower than the overall rate, while the response rate of dental hygiene students was slightly higher (73%).

Despite these potential limitations, the findings demonstrate that students overall reported having significantly more positive perceptions about interprofessional education after completing the course than they did before the course. While post-hoc tests found no detectable evidence that one program was significantly lower or higher than others, there was significant variation, and a visual examination of the SPICE-R2 change scores displayed in Figure 1, reveals patterns that differ by program. While dental hygiene students seem to have experienced greater change in attitudes than other groups, dental students appear to have been among the groups with the lowest measurable change. The paired samples *t*-tests for dentistry students show significant change only on the Roles and Responsibilities for Collaborative Practice subscale. Small sample sizes, particularly dental hygiene ($n = 16$), limit any definitive conclusions, but the evidence seems to indicate that there are potential differences that merit further study.

Dental students may enter their training with the perception that their practice will be largely independent of

other members of healthcare professionals; thus they perceive themselves to be leaders for the oral healthcare team. By contrast, dental hygiene students may enter their profession with the perception that it is fundamentally dependent on other members of the healthcare team. Institutions may be admitting students to dental hygiene programs who are more naturally drawn towards collaboration, a characteristic which is further supported within their curriculum. Dental hygiene education conditions students to identify themselves as collaborative practitioners, and the content of this course reinforces that aspect of their identity. It gives them concrete concepts to ground their training. Greater emphasis may need to be placed on admitting dental students demonstrating a propensity towards collaboration and insight about the collaborative nature of healthcare. It has been reported the multiple mini interviews and Big Five personality inventories are tools that can identify inherent personality traits such as agreeableness and team work abilities amongst dental school applicants.²⁷⁻²⁸ Utilization of such tools along with early IPE activities that explore healthcare teams and hone students' collaborative skills could have a significant impact on how future dentists see their role within healthcare.²⁷⁻²⁸ Educational preparation in the unique skills of a profession is a necessity; however, ongoing training in silos is counterproductive to teamwork. IPE can benefit early learners in discovering their professional identities as a healthcare worker and member of a multidisciplinary team.²⁹

It may be that dental hygiene education has a stronger emphasis on being a member of the oral healthcare team since most state practice acts require a dental hygienist to work under some type of supervision while dentists practice independently. Dental education may be inadvertently focused on the dentist as leader of the oral healthcare team. Furthermore, since few of the 333 dental hygiene programs in the United States are affiliated with dental schools,³⁰ the isolated training environment for dentists may perpetuate a traditional perception that their role is mono-professional. Previous research has revealed differences in attitudes between other healthcare practitioner groups in the continuing education setting.³¹ Nurses, similar to dental hygienists, were found to experience more sustainable attitude and behavior change after IPE when compared to physicians, suggesting that health professionals who are trained to be leaders of the team, such as physicians and dentists, may not view themselves collaborating in the same manner as health professionals whose roles traditionally involve supervision.

All students were held to the same attendance policy; points were deducted from the final grade if absent more than

three times. Among the six health care profession groups, dental hygiene students attended the most class sessions. Dental hygiene students may have had higher attendance rates because they identified with the basic tenant of collaborative practice or they may have recognized its relevance to their future practice with increased exposure to course content. However, differences in academic workload, program culture and schedules may also have influenced student attendance amongst the various programs. Additionally, the cohort of dental hygiene students was younger in age as compared to the other participant groups and had less experience in higher education experiences. Even the nursing student cohorts, also seeking a baccalaureate degree, primarily came from an accelerated program, had already earned at least a four-year college degree. The younger dental hygiene students may be more readily accepting of concepts new to them as supported by Anderson and Thorpe who reported that younger, undergraduate health science students achieved higher learning outcomes and were more positive about their learning than their older counterparts.³²

Further investigation is needed to determine the ways pre-existing attitudes and biases influence the development of team-based skills amongst healthcare workers and the specific types of early IPE experiences needed to demonstrate relevance to students regardless of the specific profession. Oral healthcare professionals are expected to interact with the public health system to improve access to care and implement preventive oral care services.³³ A longitudinal study by Curran et al demonstrated that the maximum impact of IPE can be achieved when health and human service professional students are exposed to IPE both early and frequently during the course of their studies.³⁴ The overarching premise of VCU IPE course was based on the principle that all students are healthcare professionals first and practitioners of a specific discipline second. Yet, establishing the relevance of IPE and collaborative practice for students entering the dental profession may vary for students depending on their particular profession, based on differences in current and developing practice models, licensure, and reimbursement protocols. Having a better understanding of how to promote collaborative practice amongst the various professions could prove to be beneficial and inform curricular development for health science students and those seeking a career in healthcare.

Conclusion

A large-scale, required IPE course for early learners was created to align with the IOM report recommendations and core competencies for interprofessional collaborative practice.

Health professional students from six disciplines including dentistry and dental hygiene reported having significantly more positive perceptions about IPE upon completion of the course as compared to those identified prior to the course. Dental hygiene students demonstrated the greatest change in attitudes towards IPE as compared to the five other student groups; dental students' attitudes were among the lowest in measurable change. Results from this study highlight the need for educators to carefully consider student attitude towards the importance of IPE and explore ways to cultivate an interprofessional identity among dental and dental hygiene students.

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Educational Preparedness to Provide Care for Older Adults in Alternative Practice Settings: Perceptions of dental hygiene practitioners

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Abstract

Purpose: Research indicates that geriatric education continues to be inadequate across the health professions and graduates are unprepared to care for the increasing numbers of older adults. The purpose of this study was to explore dental hygiene practitioners' perspectives regarding whether their dental hygiene education prepared them to treat older adults in community and institutional settings.

Methods: A qualitative phenomenological study design was utilized to conduct in-depth interviews with a purposive sample of dental hygienists currently providing care for older adult patients in alternative practice settings.

Results: Fifteen dental hygienists from across the U.S. working with older patients in alternative settings, met the inclusion criteria (n=15). Common themes related to dental hygiene practice emerged from the qualitative data included: adapting patient care to alternative settings; emotional toll on the practitioner; physical challenges; outcome goals for treatment; need for hands-on clinical experience in alternative settings as dental hygiene students; and working as part of an interprofessional team.

Conclusion: Participants generally agreed that they were not prepared to care for dependent older adults in alternative settings as part of their dental hygiene education. Clinical experiences working with older adults in alternative settings, as part of the dental hygiene clinical curriculum, are needed to prepare graduates to care for this growing population.

Keywords: dental hygiene education, geriatric dentistry, gerontology curriculum, nursing home residents, alternative practice settings

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Introduction

The older adult population in the United States (U.S.) is expected to double to 83.7 million by 2050,¹ and the oldest-old (those age 85 and older) is projected to increase from 6 million to 14.6 million by 2040.¹ Increased educational levels of the older adult population has been shown to play a role in overall well-being and equates with above-average health.^{1,2} A key indicator of well-being is improved oral health, resulting in an average of only 1 in 5 older adults losing all their teeth.^{2,3} However, for dentate older adults, issues with access to dental care, place this group at risk for untreated oral disease, which can lead to adverse health outcomes.⁴

Health challenges related to decreased mortality and increased age include chronic disease conditions with the majority of older adults reporting a minimum of one chronic condition

with coronary artery disease, arthritis, and diabetes the most commonly reported.¹ In addition to chronic disease, physical limitations resulting in some type of disability including issues with hearing, vision, cognition, self-care, or ambulation impact 35% of individuals over age 65.¹ About a third of community dwelling older adults report difficulty performing one or more of the Activities of Daily Living (ADLs).¹ In comparison, 95% of older adults living in institutionalized settings report difficulty with one or more of the ADLs.¹

These health indicators, along with the expansive growth in this population, will have widespread effects on the healthcare system.⁵ Gerontological practitioners are needed for this rapidly aging population,⁶ however, students from across the health care disciplines frequently rank this area of practice at the bottom of their future professional life.⁶

Health Professions Geriatric Curriculum

Bardach et al conducted a review of geriatric education in health professions including medicine, nursing, pharmacy, dentistry, physician assistant studies, physical therapy, and communication disorders and found that geriatric education continues to be inadequate across the professions and graduates are not prepared to care for anticipated numbers of older adults.⁷ Common barriers cited to including geriatric content across health professions include time in an already overloaded curriculum, limited faculty with expertise in geriatrics, and lack of quality clinical externship sites.⁷

The Commission on Dental Accreditation Standards (CODA) for Predoctoral Dental Education Programs does not contain a standard that is specific to the care of the geriatric or older adult.⁸ However, the standard that broadly addresses this population states: “Graduates must be competent in providing oral health care within the scope of general dentistry to patients in all stages of life,” allows for dental schools to determine how caring for the older adult will be addressed.⁸ An outcome of having such a broad standard may be that dental graduates feel unprepared to care for older adults. Data from the American Dental Education Association (ADEA) showed a decrease in the number of dental graduates who felt well-prepared to care for older adults from 9% in 2002 to 0.2% in 2014,⁹⁻¹² despite 79% of graduates reporting the amount of content on geriatrics was considered to be appropriate.¹²

In comparison to other health professions, accreditation standards for dental hygiene programs address care of the geriatric patient in more specific terms. CODA standards state that “graduates must be competent in providing dental hygiene care for the child, adolescent, adult and geriatric patient.”⁸ However, geriatric patient competency assessments are up to the individual institution. Care of older adult patients occurs primarily in on-site dental hygiene clinics, minimizing students’ exposure to the range of settings in which care for the dependent older adult may occur.

Evaluations of geriatric education in dental hygiene curricula have been reported infrequently in the literature. In 1988 Hutchinson found that the majority of programs spent an average of 5 hours on geriatric content in didactic courses.¹³ Ten years later, Tillis et al found the average didactic time devoted to geriatrics reported in a convenience sample of U.S. and Canadian dental hygiene programs had increased to 10 hours.¹⁴ In regards to a geriatric clinical component, Tillis et al found that only 54% of the programs reported a clinical component and only half of schools surveyed considered their geriatric curriculum to be adequate.¹⁴ Both investigators

recommend future research to evaluate the adequacy of geriatric education from the perspective of graduates.^{13, 14}

Preparedness to Work in Alternative Settings

Studies indicate more attention to geriatrics in the dental hygiene curriculum is needed to prepare graduates to provide preventive services to dependent older adults in both community and institutional settings.^{15, 16} The most common settings cited by Registered Dental Hygienists in Alternative Practice (RDHAP) in the state of California are residential/assisted-living facilities,¹⁷ highlighting the need to support geriatric practice as a career choice for dental hygiene graduates.

Dental hygiene education experiences have been shown to influence practitioners’ interest in providing care in long-term care facilities. Pickard et al studied dental hygienists in Kansas and found that approximately two-thirds of the respondents felt their dental hygiene education adequately prepared them to care for the older adult and over three-quarters of this group, felt this preparation would influence their decision to work in a LTC setting.¹⁶ Dickinson et al explored the readiness and willingness of dental hygienists in Texas to treat older adult patients in alternative practice settings.¹⁵ Of the survey respondents, 45% reported feeling prepared by their dental hygiene education to provide care to older adults while a little more than half felt somewhat prepared and 4% felt unprepared.¹⁵ Thirty-eight percent reported both a preparedness and a willingness to work in alternative settings such as nursing homes.¹⁵

These studies provide insight into how adequate preparation in dental hygiene programs can impact future career choices. The aim of this study was to explore practicing dental hygienists’ perspectives regarding how their dental hygiene education prepared them to treat older adult patients in alternative settings.

Methods

The study was granted exempt status by MCPHS University’s Institutional Review Board (protocol #IRB062016S). A qualitative, phenomenological study design was used to gather perspectives of a purposive, convenience sample of dental hygienists currently working with older adults in alternative settings (n=15). A qualitative approach using in-depth interviews was chosen given the lack of literature on the adequacy of geriatric education in general and specifically from the perspective of graduates which was suggested by Tillis et al in 1998.¹⁴

Inclusion criteria for the study was limited to dental hygienists working with the dependent older adult in an

alternative setting. Participants meeting inclusion criteria were a difficult population to access due to the limited number of dental hygienists working with this population in alternative settings, therefore, a snowball sampling method was also used.¹⁹ An informational flyer was sent to state components of the American Dental Hygienists' Association (ADHA) asking for assistance in recruitment. ADHA members in California holding RDHAP licenses were contacted via email; those expressing interest were sent the informational flyer. Social media was also used to recruit participants. Recruitment continued until saturation was reached.²⁰

Once identified, each potential participant was screened by telephone to determine if inclusion criteria were met and to confirm willingness and availability to participate. Qualified and willing participants gave informed consent. A demographic survey including years of practice, dental hygiene program and year of graduation, and experience working in alternative settings was distributed by email to each of the participants via a web-based survey tool.

Individual, in-depth interviews were scheduled and conducted in a web-based meeting forum supporting audio recording for later transcription. Interview questions were developed based on the literature and validated by oral health and gerontology content experts. Questions were pilot tested with a group of dental hygienists experienced in working with older adults. The interview consisted of a series of open-ended questions and lasted approximately 20 to 30 minutes (Table I). The interviews were transcribed verbatim by the investigator. Transcripts were organized according to each interview question and reviewed multiple times. An emergent approach capturing participants "voice" was used to develop

Table I. In-depth Interview Questions

1) What skills did you learn in your dental hygiene program when providing oral care for older adults in alternative settings?
2) While practicing dental hygiene in alternative settings, are you still implementing these skills with patient care that you learned in your dental hygiene program?
3) Did you experience challenges transitioning from providing oral health care for the older adult while in your dental hygiene program vs. providing oral health care in alternative settings? And if so, what were those challenges?
4) What would have helped ease the transition?
5) Based on your experiences, what additional skills should be included in the dental hygiene curriculum to better prepare graduates in providing care to older adults in alternative settings?

codes summarizing major themes.²¹ Codes were applied to the transcripts to cluster the data for each theme. A second investigator independently coded the data to ensure validity. Themes were then assigned phrases or 'names' to describe the meaning underlying each of the themes²¹ and sample quotes were provided to illustrate the dimensions of each theme. Member checking was used to establish accuracy; participants reviewed the results and provided feedback on whether they accurately represent their feelings, knowledge and attitudes.²²

Results

Fifteen dental hygienists from across the U.S. working with older patients in alternative settings, met the inclusion criteria (n=15). A little more than half (n=8), reported having over 20 years of clinical practice experience and over three quarters (n=12) reported practicing with older adults in alternative adult settings for less than 10 years. All of the participants (n=15) reported having worked in traditional clinical settings prior to practicing in alternative settings. The alternative practice settings included assisted living (46.7%) and nursing home/long-term care facilities (60%). The highest level of education reported was a master's degree. Participant demographics are shown in Table II.

Common themes related to dental hygiene practice emerged from the qualitative data included: adapting patient care to alternative settings; emotional toll on the practitioner; physical challenges; outcome goals for treatment; need for hands-on clinical experience in alternative settings as dental hygiene students; and need to work as part of an interprofessional team.

Theme 1. Adapting the Dental Hygiene Care to an Alternative Setting

Most of the participants reported their hygiene programs "did not train for alternative settings" although they reported having treated older adult patients in dental hygiene clinics as students. Many felt that the "actual skills learned in dental hygiene school are used with any patient regardless of practice setting." These skills included instrumentation, communication, thorough review of health histories, patient education, and adapting care for an individual's abilities. Participants felt a lack of focus regarding the specific changes and adaptation of these skills for treating elderly patients in alternative settings. They felt the majority of what they learned was "not from hygiene school, but from working with this population in alternative settings" One participant stated that "I was a little nervous before I went to do this [work in an alternative setting], it was definitely a whole different beast, a lot of new challenges came up."

Table II. Participant Descriptive Statistics (n=15)

	Frequency	Percent (%)
Highest dental hygiene degree		
Associates	2	13.3%
Bachelors	9	60.0%
Masters	2	13.3%
Missing	2	13.3%
Dental Hygiene experience (years)		
1-5	0	0.0%
6-10	1	7.7%
11-15	4	26.7%
16-19	0	0.0%
20+	8	53.3%
Missing	2	13.3%
Adult practice in alternate setting (years)		
0-3	5	33.3%
4-5	4	26.7%
6-9	3	20.0%
10+	1	7.7%
Missing	2	13.3%
Dental setting experience type*		
General Dentistry	13	100%
Pediatric Dentistry	2	13.3%
Periodontal Dentistry	2	13.3%
Other	5	33.3%
Missing	2	13.3%
Alternative practice setting type*		
Assisted Living	7	46.7%
Nursing Home / Long-Term Care Facility	9	60.0%
Hospital Setting	1	7.7%
Other	8	53.3%
Missing	2	13.33%

* Respondents may work in more than one type of setting; totals do not equal 100%.

Older adults in alternative settings have special needs and are typically medically complex. One participant stated that “we never really discussed what it takes when you are in a nursing home.” Several of the participants expressed that the “biggest difference is the experience of handling the patients.” “It’s a totally different kind of dental hygiene.” The participants felt that in a nursing home setting “you have to adapt very fast to the situation and work very fast” and dental hygiene school does not prepare you for this. They also felt it was challenging to “drop traditional training” and to “look

at each older adult patient with individualized special needs as unique, and tailor treatment to those needs and abilities.” One participant summed up the need for highly developed critical thinking and problem-solving skills by suggesting the clinician must “use critical thinking skills and think out-of-the-box as far as what is going on, what else is happening, and what is causing the things that are happening.”

Theme 2. Emotional Toll of Caring for Dependent Older Adults

Many of the patients are no longer ambulatory and use a wheelchair in addition to cognitive, physical, sensory, motor skills, and hearing impairments. Several participants stated that they were not prepared for the “emotional and physical toll” of working with this population and felt their dental hygiene education did not prepare them for what they would find outside of traditional clinical settings. Some participants said, “it’s very sad in the nursing homes”. One participant stated, “I don’t remember anyone saying, when you leave your first patient, and you are driving home, you may cry all the way.” Another participant said, “whether it’s disabilities of other kinds or the older adult population, you are treating a patient who is quite vulnerable and is in quite a vulnerable state of their lives.” “You have to be comfortable” working in this environment. Several participants think it “takes a certain personality to actually go out and do this, it’s not for everybody.”

Theme 3. Physical Toll of Alternative Settings

Another challenge stated by participants was the physical toll of working with older adult patients in alternative settings. There is a lack of “ergonomically proper set up” in the various facilities. One of the main challenges identified was working with mobile equipment and adapting to less than ideal work spaces. One participant summed up this challenge, “It would be nice if they had a little room, in all these facilities, where you could take the patient, transfer them, work on them, and take them back to their room. But nope, we are standing on our heads trying to scale #15 (FDI #27) that’s got a 10mm pocket. I have to contort and get down on my hands and knees when we are at somebody’s bedside or in little apartment. It’s hard, it’s hard work.”

Theme 4. Need to Adjust Outcome Goals for Treatment

In dental hygiene school or in a traditional clinical setting, practitioners are used to “patients wanting to repair their mouths towards health.” Treatment goals are different in a nursing home. Families of the patients being treated “feel [the patient] is nearing the end of their life and of all of the problems that [the patient] has, fixing their last six teeth are not a priority.” Many participants felt unprepared for this

shift and did not know how to adjust to this mindset. They expressed that as students and practitioners the “overall goal is to get to health, perfect health” but in these alternative settings, perfect oral health “is not the goal for the patient nor their families.” They also stated that “we are very much point A to point B to point C educated.” Participants found when working with individuals in alternative settings you may have to adjust expectations and be satisfied with “just knowing you are achieving a good level of progress.” Many participants expressed issues related to this new way of thinking.

Theme 5. Need for Hands-On Clinical Experience in Alternative Settings

When asked, what would have helped ease the transition into treating older patients in alternative settings, the overwhelming response was experience and exposure. One participant stated “the way people would learn about the elderly is to have a rotation and experience, because it’s kind of like show-and-tell. Nothing book-wise is ideal to learn the situation, the motivations, and what the teeth look like. It’s just so different.” A common theme was that “for some people it is out of their comfort zone” and many felt it was because students are never exposed to what they will see, hear, and smell in alternative settings. One participant spoke of an experience she had with students who were shadowing her. The patient being treated had dentures with bridges of calculus and the students had never been exposed to such heavy deposits. Not only did students feel overwhelmed, but they were unprepared as to how to approach cleaning the appliance. Another participant with experience as a dental hygiene clinical instructor for over ten years stated, “when you are in dental hygiene school, you see what is in front of you. So, if you have not had a patient with a partial or a denture, or isn’t elderly, your experience is limited.” The majority of the participants recommended increased exposure and experience in the form of clinical rotation in alternative settings.

Theme 6. Need to Work as Part of an Interprofessional Team

Participants exposed numerous aspects of working in alternative settings not encountered previously in school or traditional practice settings. In an alternative setting you must “form a relationship with the care staff, and create an integrated approach between medical professionals and dental professionals.” One participant summarized the differences by stating, “You have to have an understanding how nursing homes are run, not just the care staff, but the administrative staff, because it is completely different from dental offices. The most challenging part of the job is getting the facilities to see the importance of oral care and making it a priority. You

must know both sides of the pendulum. Everybody’s priorities are different and they may look at oral hygiene care as one more thing they need to do. If you know the inner workings of how a facility works, then you can come up with solutions. That’s the kind of integral approach you need.”

Discussion

Research has shown a variety of concerns including complex health histories, the overwhelming nature of patient management, interaction challenges, and the emotional burden of providing care that have been cited by medical and allied health professions in regards to caring for the older adult.²³⁻²⁷ Results of this study reflect similar concerns.

One participant stated a lack of preparation regarding what it takes both physically and mentally in regards to caring for older patients in nursing home settings. “Not only is it different ergonomically, it also requires a different state of mind when treating this patient. Many of these dependent older adults are approaching the end of their life, and family members want to limit treatment. They may not be interested in restoring the oral cavity back to health.” Many participants said that although they understood the wishes of the family, it was difficult to change the mindset that the goal was “getting the patient back to total health.” Studies have shown a common theme of frustration and disappointment among medical professionals regarding lack of help they could offer the older adult patient.^{25, 28} Several participants felt, at first, that it was difficult to accept that they were treating the patient to the best of their abilities based on the limitations but that they were in fact actually providing a service to the patient.

Benefits of a curriculum in gerontology along with clinical learning experiences working with older adults have been observed in previous studies.^{24, 29} A study conducted by Yoon et al found that while dental hygiene students possessed the “functional skills and knowledge” needed to perform oral health procedures, they lacked the confidence to modify this knowledge and skills to the older adult population in alternative settings.³⁰ Further results showed that exposure to this population helped the students to recognize and understand why oral health care may not be a priority in the alternative setting.³⁰ There was overwhelming agreement among the study participants that exposure and experience caring for dependent and medically complex patients in alternative settings should be part of the dental hygiene clinical curriculum. Results from this study were supported by the previous research conducted by Yoon et al and Wallace et al^{30,31} This work reinforces the need for exposure and experience in providing care to the older adult population in alternative settings within the dental hygiene curriculum.^{30,31}

Wallace et al concluded that students who receive a realistic introduction to the environments encountered in alternative settings such as nursing homes or long-term-care facilities are better prepared and more confident in their abilities.³⁴

The need to work as part of an interprofessional team was also a common theme among the participants. Communication and collaboration between administrative staff and medical personnel of the facility and dental hygienists was integral in forming interpersonal relationships. Many participants felt improved communication and increased collaboration would improve the oral health of the patient and help to promote the importance of oral healthcare. It would also help dental hygienists understand the “the other side of the coin” when it comes to the responsibilities and time restraints of other professionals who also care for these patients. The dental hygienists felt that better knowledge of nursing homes operations and an improved understanding of the scope of challenges faced by management and administration would prepare them to advocate regarding the role oral health plays in the overall health and well-being of the patient. Dental hygiene students having clinical experiences in alternative settings such as nursing homes, will provide them with an introduction to the interprofessional collaboration skills needed for future practice.³² One example of interprofessional collaboration in nursing home settings is the care (or case) conferences which often includes a nurse, occupational therapist, physical therapist, dietitian, and primary care provider along with family members. The purpose of the care conference is to discuss the resident’s (or patient’s) current status and goals for care.³³ Dental professionals historically have not been present at these meetings, however research suggests they would be welcomed as part of the interprofessional team to assist with oral health, as it applies to the older adult’s well-being.³⁴

Findings of this study are limited due to the small sample size and lack of a control group; all participants were currently working with older adults in an alternative setting. Participants also relied on “self-report” of their dental hygiene education experiences, including didactic content as well as clinical encounters.

Conclusion

This study assessed the experiences of practicing dental hygienists working with the older adult population in alternative settings to determine whether the gerontology education received in dental hygiene school adequately prepared them to treat this population. While most participants felt they received the basic skill set needed to treat any patient as part of their dental hygiene education, the majority felt

that they were unprepared for the emotional and physical toll this type of work takes on the practitioner. Participants overwhelmingly agreed that exposure and experience in caring for older adults in alternative settings is needed as part of the clinical component of the dental hygiene curriculum.

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Access to Preventive Oral Health Services for Homebound Populations: A pilot program

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Abstract

Purpose: Certified Public Health Dental Hygienists (CPHDH) perform traditional dental hygiene scope of practice duties, along with caries stabilization (interim therapeutic restorations) through collaborative agreements with a dentist, in the state of New Hampshire. The purpose of this pilot study was to assess the oral health status, dental needs, including referral and utilization, and satisfaction of care received by homebound individuals in their place of residence when provided by a CPHDH.

Methods: A purposive sample of homebound individuals participated in a mixed methods study that included quantitative data from an intake survey, a retrospective chart review, and qualitative in-depth interviews.

Results: Study participants (n=15) had an average of 22.4 natural teeth; 44% of participants had not seen a dentist for two or more years. Forty-three percent of participants required a referral to a dentist due to dental needs beyond the scope of the CPHDH. Themes from the interviews included: difficulty in accessing a traditional dental care delivery model despite a high value placed on oral health and a high need for dental care. In general, participants expressed satisfaction with care received by the CPHDH.

Conclusion: Participants reported a positive experience and satisfaction with care received from a CPHDH suggesting that this is a viable approach to provide preventive oral health services and caries stabilization to populations with complex access to care challenges.

Keywords: homebound patients, vulnerable populations, access to care, direct access dental hygienist, caries stabilization, silver diamine fluoride, interim therapeutic restorations

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Introduction

Homebound populations are comprised of non-institutionalized, dependent or semi-dependent individuals, who due to physical, psychiatric and/or social determinants, have restricted ability to leave their place of residence.¹ According to the Centers for Disease Control, about one in every five Americans have some type of disability, making them more disposed to becoming homebound.¹⁻² Disabilities are estimated to impact 13% of the population of the United States (U.S.) increasing to 35% in those 65 years of age or older.² As new technology and medicine continue to improve life expectancy, the risk of becoming homebound or institutionalized increases.²⁻³

The elderly population (65 years of age and older) in the U.S is estimated to rise to 98 million individuals by 2060,

far surpassing any other age group in the population.³⁻⁶ The percentage of the very old (85 years and older) is also expected to triple, drastically increasing risk of dependency and becoming homebound,³⁻⁶ along with the complexity of medical conditions.^{4-5,7-13} Research has also shown that homebound populations experience multiple chronic health conditions including diabetes, obesity, hypertension, coronary heart disease, and congestive heart failure.^{4-5,7-13}

In addition to chronic disease co-morbidities, there are also substantial unmet dental needs among homebound populations.¹⁴⁻²⁰ While restorative needs and periodontal treatment needs are high, a large proportion of homebound individuals have not even seen a dentist in two or more years.¹⁴⁻²⁰ The consequences of disregarding the unmet oral health needs of the homebound population is magnified by

the oral-systemic health connection.²¹ Additionally, the U.S. Surgeon General's report on oral health highlights that those with low-incomes, physical disabilities, or illness are at high risk for poor oral health, with homebound populations at highest risk of all.²²

Evidence of poor oral health and its effects on systemic health is extensive; however, gaps in the literature exist pertaining to the oral health status and dental needs of homebound populations.²² Prevention and advancement in dentistry have made it more common for an individual to retain their natural teeth longer,²³ however, oral disease becomes more likely once an individual is no longer able to access dental care, resulting in needless suffering, health complications, and diminished quality of life.²² More research is needed to identify the dental needs, barriers, and possible solutions, especially given the rapid growth of this high risk population.

Complex barriers have contributed to inadequate access to dental care for many low-income, physically disabled, and other high risk individuals in the U.S.²¹ Barriers to dental care include lack of dental insurance, including Medicaid programs; economic barriers; low health literacy; and inability to access dental offices due to travel or physical ailments.²⁴ The current oral health model in the U.S. does not support the ability to meet the needs of the homebound population.²¹ Expanding the role of the dental hygienist or creating a midlevel dental provider would likely provide benefits to improve access to dental care, such as but not limited to: lowering costs, improving access to care for those at a high risk of poor oral health, and providing education and improving the overall quality of life.²⁴

Alternative approaches to preventive dental care through the expanded scope of practice of the dental hygienist or a midlevel dental provider have been shown to have positive outcomes.²⁴ Non-traditional dental models of delivery of care using Advanced Skills Hygienist and Dental Assistant (ASH-DA) teams, Dental Health Aide Therapists (DHAT) and Registered Dental Hygienist in Alternative Practice (RDHAP) have been demonstrated to have high rates of satisfaction, acceptable quality of care, and appropriate safety of treatment.²⁵⁻³³ In the state of New Hampshire, legislation creating the Certified Public Health Dental Hygienist (CPHDH) was passed in 2015 to add another direct access model. CPHDHs are able to work in non-traditional settings such as schools, hospitals, or other institutions, in addition to caring for those who are homebound through a collaborative agreement with a dentist. The CPHDH scope of practice includes traditional services provided by a dental hygienist in addition to allowing the CPHDH to perform caries

stabilization with interim therapeutic restorations (ITR) upon completion of an approved course.

The purpose of this pilot study was to assess the oral health status, dental needs, including referral and utilization, and satisfaction of care received by homebound individuals in their place of residence when provided by a CPHDH.

Methods

Massachusetts College of Pharmacy and Health Sciences University's Institutional Review Board (IRB) granted this study "exempt" status in accordance with 45 CFR 46.101(B) (2). A mixed-methods study design was used including an intake survey, retrospective chart review and qualitative data consisting of in-depth interviews.

The Oral Healthcare at Home (OHH) pilot project was conducted by Crotched Mountain Community Care (CMCC) of New Hampshire beginning in August 2015, to help meet the oral health needs of a community of low income, Medicaid-eligible adults, many of whom were considered homebound.³⁶ The aim of OHH was to utilize and evaluate a model of accessing preventive dental care delivered by a Certified Public Health Dental Hygienist (CPHDH). The CPHDH served a total of 27 clients in two counties during the period of the pilot project.

A purposive sample of individuals who had received dental care through OHH was used. Inclusion criteria included: Medicare defined homebound status, the ability to communicate with the interviewer or a translator, and the ability to participate in the pilot project for three months. Exclusion criteria included: inability/ unwillingness to provide consent, or inability to remain in the program for three months. Potential participants were likely to have Medicaid and/or Medicare without dental benefits; therefore, they were unable to seek regular dental care except for emergency treatment.

Recruitment was initiated by CMCC case managers who selected the homebound clients with the highest needs for oral health services; potential participants included those who were medically compromised or limited from seeking dental care due to access challenges. Interested participants provided informed consent to allow review and use of de-identified data from the intake survey and dental charts, along with agreement to participate in an interview at the end of the project.

Intake survey

An intake survey was completed by each participant prior to or during the first appointment with the CPHDH. The survey included demographic information, number of medications taken, physical barriers, medical diagnosis, living

situation (alone or with spouse or family members), ability to communicate, emergency room visits related to dental pain, dental pain, number of teeth present, last dental visit, any current dental or oral pain. Retrospective review of intake surveys was completed by the primary investigator (PI) following the final interview sessions in order to avoid bias.

Retrospective Chart Review

Data related to the oral health status of each participant prior to and at the end of the program was gathered by the PI through a retrospective chart review. Chart data included the initial and follow-up oral assessments; decayed missing and filled teeth (DMFT) at baseline and program completion; treatment provided including interim therapeutic restorations (ITR); silver diamine fluoride (SDF) and fluoride varnish application; prophylaxis/non-surgical periodontal therapy; number of CPHDH visits; dentist referrals and rationale; and any treatment completed by a dentist.

In-depth interviews

In-depth interviews were used to gain personal perspective on experiences related to access to dental services and satisfaction with care by the CPHDH. Interviews were completed by the PI in the absence of the CPHDH, to eliminate possible coercion or feeling the need to provide a socially acceptable response.

The investigators developed a set of interview questions based on the purpose of the evaluation; questions were pilot-tested for clarity and relevance by two individuals who were homebound. Revisions were made based on feedback provided by the pilot testers and included the following:

- Please tell me about how you got dental care, including dental cleanings, before participating in the OHH program? Please tell me about your oral health before beginning this program?
- Please tell me as much as you can about the experience of the Oral Healthcare at Home program and working with the dental provider.
- Please tell me how you felt about the care you have received from the dental provider in this program (CPHDH)? Do you want to continue receiving dental care in your home from the dental provider (CPHDH)? Tell me about the treatment that was done and tell me about how you feel about your oral health now?

Interviews were primarily conducted in the participant's residence and took place face-to face, except in cases where participants preferred to be interviewed by phone. Permission was gained prior to audio recording of interviews. Upon

completion of the session, the PI asked for permission for subsequent contact for clarification, verification, and further questions if needed. Each interview was transcribed immediately following the session and a summary of the word-processed transcript was offered to the interviewee for review as part of the peer debriefing process to aid in accuracy and validity of the qualitative data.³⁵

Data Analysis

A coding dictionary was developed for the intake survey and the initial and follow-up assessment chart review data. Coding consisted of classifying categorical data in a numeric format, i.e. presence of full dentures was no=0 and yes=1, to allow descriptive analysis. Statistics were organized into tables showing frequencies to describe the characteristics of the study population. Due to the small sample size, the mean and mode were reported only for ordinal items such as age, number of medications, years since last dental visit, number of teeth present, and number of missing teeth.

A thematic analysis of the in-depth interview transcripts was conducted by the PI to identify common themes related to the purpose of this program evaluation.³⁷ Each transcript was evaluated and reviewed several times to find common themes and words/ideas, creating codes. Themes emerged from the codes and gave insight to common perceptions of the homebound population. These codes and themes were offered to the participants for review as part of the peer debriefing process. A second external auditor independently conducted a thematic analysis to enhance accuracy and validity of the findings.³⁵

Results

Of the 27 OHH pilot project CMCC clients, a total of 15 homebound individuals consented to participate in the program evaluation (n=15). Participants ranged in age from 32 years to 85 years; the mean age was 59.87 years. A majority (73%) of participants suffered from co-morbidities and reported taking an average of 11.4 medications, demonstrating a medically complex population. Common medical findings were diabetes (38%), multiple sclerosis (25%), and gastroesophageal reflux disease (25%). Participants reported an average of 2.5 years since their last dental visit and 69% reported an existing dental concern. Demographic characteristics of the participants are displayed in Table I.

Data from the initial oral assessment showed the mean number of teeth present in the study population was 22, over two-thirds were at high risk for dental caries, nearly one-third reported pain while chewing and one participant had a fistula present. The mean and mode for coronal and root caries was skewed due to the small number of participants having the

Table I. Intake Demographic Survey Descriptive Statistics (n=15)

	Frequency	Percent (%)
Gender		
Male	4	26.7
Female	11	73.3
Living Situation		
Alone	5	33.3
Spouse/Family	9	60
Residential Care/Assisted Living	1	6.7
Client able to communicate need?		
Yes	12	80
No	3	20
If No, caregiver available?		
Yes	3	100
No	0	0
Cognitive ability to understand evaluation procedure		
Yes	15	100
No	0	0
Are there physical barriers to evaluation?		
Yes	10	66.7
No	5	33.3
Do you smoke?		
Yes	1	6.7
No	14	93.3
Have there been any emergency room visits due to dental or mouth pain?		
Yes	2	13.3
No	13	86.7

majority of the caries. Comprehensive periodontal assessments were difficult to complete due to the constraints of the home environment. Descriptive statistics from the initial oral health assessment are shown in Table II.

The CPHDH provided program participants access to care through the provision of 46 home visits with high rates of completion for oral prophylaxis and fluoride treatments. Over half the participants (n=8) had silver diamine fluoride (SDF) placed to prevent or arrest caries; three of these participants were receiving palliative care only. Thirty-six interim therapeutic restorations (ITR) placed during the evaluation period; problems with ITRs (47%) occurred primarily in the client with rampant caries due to difficulties in caries stabilization prior to referral to the dentist. Results may also have been skewed due to the newness of the procedure at the beginning of the pilot program. Early ITR challenges may have been

Table II. Initial Oral Health Assessment Descriptive Statistics (n=15)

	Frequency	Percent (%)
Presence of Partial Prosthesis		
Yes	3	20.0%
No	12	80.0%
If Yes, Upper, Lower, or Both?		
Upper	1	33.3%
Lower	2	66.7%
Both	0	0.0%
Presence of Full Denture		
Yes	0	0.0%
No	15	100.0%
Presence of Abscesses/Fistula		
Yes	1	6.7%
No	14	93.3%
Any pain while chewing		
Yes	5	31.3%
No	11	68.8%
Caries Risk		
Low	2	13.3%
Moderate	3	20.0%
High	10	66.7%
Recession		
Low	0	0.0%
Moderate	3	20.0%
Severe	3	20.0%
Unable to assess	9	60.0%
History or Active Periodontal Disease		
No	0	0.0%
Yes	4	26.7%
Unknown	11	73.3%
Degree of Periodontitis (if applicable)		
Low	0	0.0%
Moderate	4	26.7%
Severe	1	6.7%
Unable to tolerate examination	10	66.7%
History or Presence of Oral Cancer		
No	15	100.0%
Yes	0	0.0%
Continuous Measures	Mean	SD
Number of Teeth Present	22.2	6.8

related to material choice, technique, and retention. Oral infections that could not be treated by the CPHDH, occurred in 43% of all home visits. CMCC Case Managers made the referrals for individuals needing additional restorative care and ensured that the clients' dental needs were met. The number of decayed teeth at the follow-up assessment decreased from the DMFT score from the initial assessment. Patient care data is summarized in Table III.

Qualitative Findings

The most prevalent themes identified from the interview data included: lack of dental care, oral health status, resources (costs and transportation), experiences with the program, satisfaction of care from the CPHDH and access (convenience, comfort).

Table III. Initial and Follow-Up Assessment Dental Status and Treatment Provided by CPHDH (n=15)

Client	Dental Home	Years Since Dental Visit	Initial DMFT*	Follow-up Assessment DMFT	# Visits During Evaluation Period	ITR**	SDF***	Prophy/SRP	# Fluoride Varnish	Referral to DDS	Reasons for Referral	Treatment Completed by DDS
#1	No	3+	0-11-15	0-12-14	4	0	0	4	4	Yes	Perio abscess	Extraction #3
#2	No	2 (palliative care only)	26-5-0	3-8-19 (ITR's)	9	20 (13 repairs)	1	5	5	Yes	Rampant caries, retained roots and abscesses	Extractions #21, 22, 15
#3	Yes	2	0-1-2	0-1-2	4	0	0	4	4	No		
#4	Yes	2	2-0-0	0-0-0	4	2	0	4	4	No		
#5	No	4	3-11-9	0-11-10	8 (URPD repair and OHI visits)	1	2	4	4	No		
#6	No	Unknown	1-0-0	0-0-0	3	1	0	2	2	No		
#7	Yes	1	3-8-9 (Root Caries)	0-8-11 (2 Implants)	5	0	3	5	5	Yes	Loose bridge	Implant, fixed bridge repair
#8	No	Unknown	7-9-0	4-9-3	4	4 (1 repair)	0	3	3	Yes	Caries	Restorations
#9	No	1	0-21-5	0-21-5	4	0	0	4	4	No		
#10	Yes	1 (palliative care only)	5-8-8	2-9-9	6	2	4	5	4	Yes	Abscess, caries and periodontal disease	Extract #20, exam, x-rays and tx plan
#11	Yes	1 (palliative care only)	3-16-10	1-16-10	5	2 (1 repair)	3	5	4	Yes	Loose fixed bridge, lost crown, caries and periodontal disease	Exam, x-rays and tx plan
#12	No	Unknown	3-18-7	0-18-7	7	2	3	5	5	No		
#13	No	2	1-7-7	0-7-7	6	1	1	5	5	No		
#14	No	Unknown	1-16-4	0-16-4	3	1	1	2	2	No		
#15	No	Unknown	0-21-2	0-21-2	6	0	0	4	3	Yes	Soft tissue pain, exam, x-rays	Exam, x-rays - no treatment

* Decayed, Missing, and Filled Teeth ** Interim Therapeutic Restoration ***Silver Diamine Fluoride

Theme 1. Lack of dental care

The majority of participants reported not having any dental care for two or more years. Examples of the participant's claims are the following:

"I did not get any dental care before this program. I haven't seen a dentist in several years."

"Basically, there wasn't any dental care."

"It was 10 years ago that I saw a dentist and I haven't had a chance to go."

"No, I did not have dental care before, it had been years."

Theme 2. Oral Health Status

The majority of participants stated that they were content with their oral health status while about one-third reported feeling bad about their oral health prior to beginning the program. Examples of how the participants felt about their oral health include the following:

"I was not happy with my oral health – I was desperate for a cleaning and I was kind of stuck. I couldn't find anyone to help me and I just wanted to find someone for a cleaning and there wasn't all this funding for these programs."

"All teeth were painful and I hadn't gotten a cleaning so they were very dirty. I was looking at other people with nice white teeth and I got upset because I had dark teeth."

"She was very unhappy with her mouth. She tried not to open her mouth and tried not to show her teeth when talking with other people. Her teeth were black and small and her gums bled a lot." (Interpreter's translation)

Theme 3. Resources

Similarities were seen among resources (costs and transportation) being a major barrier to accessing dental care. Money was discussed in every interview with some examples included in the following:

"I ran out of money and just found it too difficult so I stopped going there but at the time I was going I had really bad oral health because I didn't have any dental insurance and didn't have any money so I was in bad shape."

"I had almost no dental care because dental insurance did not cover."

"I'm on Medicaid and dentist didn't take Medicaid and I was not able to get much of anything."

"Going here was inconvenient and hard because I always had to find a ride. I'm in a wheelchair and don't drive so it was difficult to get there for me and very inconvenient."

"It was difficult to get into the office even with the wheelchair but it is impossible to get in there now. She has to be transported by ambulance due to her current condition." (Husband translating interview)

Theme 4. Positive experiences

All participants reported positive experiences with the OHH program as shown in the following responses:

"My experience with the program has been great. It's very convenient and so easy."

"I am so happy she is very professional and patient and she changed my mouth health and I am so happy with this. It is very good because it makes me afraid to go out but this is done in the home so it makes me more comfortable."

"I find it helpful that someone is able to come to my home and provide care for me here. The best part of the program is that she is competent and thorough and she makes house calls and I just like the fact that I don't need to find transportation."

"I love it I just love it because I'm in a more comfortable spot than a dental office, I definitely want to keep getting care because I'm more at ease- more comfortable."

"She is so thankful to God and America about this program and she hopes it can help other people too. She is a mom from 11 kids and nobody takes care of moms but here they take care of us older people and that's good I'm so thankful." (Interpreter's translation)

Theme 5. Satisfaction of care from the CPHDH

All participants expressed satisfaction with the convenience, comfort, access and care received by the CPHDH as expressed by the following responses:

"Oh, I'm thrilled to death and I am very satisfied with the care and I definitely want it to continue the care, it is so much easier for me considering all the transportation I have line up and I can't walk far so I have to have a wheelchair."

"I was satisfied with the care that I've received, she comes and does cleanings and it's much easier for us to get cleanings at home."

"If I was a teacher, I would give her an A+ I am very satisfied with my care and I would like to continue to receive care in my home."

Discussion

The majority of the participants (73%) had a number of co-morbidities including diabetes, MS, obesity, hypertension and other chronic diseases commonly identified in the literature,¹³ making this an especially vulnerable population. According to the U.S. Surgeon General's report on oral health, those with physical disability or illness restricting their access to dental care, may also experience a negative impact to their overall health.²²

Women comprised over half of the study's homebound population (68%), which is consistent with the literature.^{7-13, 38-39} The mean age of participants was 59.87 years of age, with an age range of 32 to 85 years of age. Gaps in the literature are evident concerning the demographics of the homebound population; much of the current focus of research is on elderly homebound populations and does not include the individuals who are homebound due to disabilities.¹³ The CMCC services a unique population of homebound individuals providing an expanded picture of the diverse age range within this population beyond the elderly.

A collaborative, interprofessional approach to care resulted in regards to the ability of the program participants to access and utilize dental care. The CPHDH made from 3 to 9 home visits per participant during the evaluation period and provided regular oral evaluations and preventive care in addition to silver diamine fluoride treatments⁴⁰ and placement of ITRs⁴¹ for caries stabilization for those receiving palliative care only or until a dental visit could be arranged. Over 46% of the participants who received dental referrals were able to obtain needed dental care. Findings from the intake DMFT scores indicate fewer DMFT at the follow-up assessment at the pilot program conclusion, suggesting the value of the CPHDH services in providing access to care in preventing and stabilizing oral disease in a medically complex homebound population.

Major themes emerging from the in-depth interviews showed 100% satisfaction with dental care received through the CPHDH and the overall experience with the program was positive. Similar studies have shown a high degree of acceptance and satisfaction with dental care received through non-traditional methods.²⁵⁻³³ While most participants stated that they were content with their current state of oral health prior to the start of the program, they also recognized the lack of dental care options available to them. Participants also demonstrated an interest in receiving dental care at home, indicating that they valued oral health. Disparities in accessing and receiving dental care within this study population are similar to those found within the literature.^{11-12,15-16} Cost of

care and transportation were the major barriers identified by the study population, including one participant who had to be transported by ambulance for any care outside the home, supporting the need for more affordable, accessible dental care through advancement of direct access dental hygienists with an expanded scope of practice along with the creation of midlevel provider models.²⁶⁻³¹

The many challenges faced by homebound individuals in trying to obtain dental care in the traditional delivery model, requires further qualitative research so dental professionals and policy makers are better informed regarding the factors impacting access to care. Policy changes in adult Medicaid to expand beyond palliative care for adults are needed in order to sustain alternative approaches to oral health care such as the OHH in New Hampshire. Other types of home health care assistance are covered by Medicare and Medicaid for homebound populations; oral health needs to be added to these services. Growth in the disabled population will provide opportunities to create diverse ways of obtaining oral health care.²³

Limitations of this study include the small sample size with non-random, purposive selection, which may have led to bias or skewed results. This grant-supported program was free of charge for participants, which could have skewed their overall satisfaction rating. Other limitations include the qualitative research study design which can limit the generalization and possible misinterpretation of the findings. To minimize this limitation, peer debriefing and the use of an external auditor were used. Future research should be conducted with a larger, randomly selected sample to fully understand the multifaceted characteristics of the homebound population and to explore the impact of the various types of direct access dental hygiene and mid-level providers on health outcomes. Teledentistry is another area where research could enhance understanding of how to increase access to quality oral health care in a more cost-effective manner.

Conclusion

The purpose of OHH pilot program was to meet the preventive and therapeutic oral health needs of a homebound population through the use of a direct access dental hygienist, CPHDH, with expanded functions in caries stabilization. Program participants ranging in age from 32 to 85 years of age, with dental needs including caries, pain, infection and lack of access to care, received preventive and therapeutic care in their residences from a CPHDH; nearly 50% of the participants were referred to a dentist and were able to receive the necessary dental care. All of the pilot program participants reported a positive experience and satisfaction with care received from a

CPHDH, suggesting that this is a viable approach to provide preventive oral health services and caries stabilization to populations with complex access to care challenges.

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Comparison of the Efficacy of Calculus Detection Between Ultrasonic Inserts and an Explorer

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Abstract

Purpose: The purpose of this study was to evaluate the efficacy of calculus detection between a thin and curved ultrasonic inserts (UI) as compared to the Old Dominion University (ODU) 11/12 explorer.

Methods: Three clinical dental hygiene faculty members were recruited to participate as calibrated raters for the presence of calculus in a group of 60 patient volunteers. Inclusion criteria were: adults aged >18 in good health, and no history of a professional prophylaxis within the past six months. Raters used an ODU 11/12 explorer, thin and curved UIs to evaluate 4 surfaces on Ramfjord index teeth for the presence of subgingival calculus. Data were analyzed for intra- and interrater reliability, sensitivity, and specificity.

Results: Interrater reliability for calculus detection with an ODU 11/12 explorer and a thin UI was demonstrated with an Intraclass Coefficient (ICC) of .782, confidence interval (CI) 95%. An ICC of .714, CI 95% was demonstrated with the ODU 11/12 explorer and curved UIs. Intra-rater reliability was shown with mean Kappa averages in the full agreement range (Kappa=.726, n=2,160, $p<0.01$) for use of the ODU 11/12 explorer versus the thin UI as well as versus curved UIs (Kappa=.680, n=2160, $p<0.01$). Sensitivity was 75%, specificity 97%, PPV 81%, and NPV 94% when the thin UI was used and sensitivity measured 65%, specificity 98%, PPV 81%, and NPV 95% when curved UIs were used.

Conclusion: Calculus detection was comparable when using the ODU 11/12 explorer, a thin UI and curved UIs on patients with limited amounts of calculus among the three clinicians. Efforts may be focused on developing tactile sensitivity for calculus detection in addition to calculus removal when using thin and curved ultrasonic instruments. Future studies should investigate calculus evaluation utilizing a variety of ultrasonic insert designs, varying amounts of calculus, and levels of clinical experience.

Keywords: periodontal therapy, ultrasonic instrumentation, ultrasonic insert design, calculus detection, dental hygienists

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Introduction

The primary goal of periodontal therapy is to remove biofilm and calculus deposits to promote a healthy periodontium. Non-surgical periodontal therapy, involving the removal of readily detectable calculus, helps to achieve and maintain the health of the adjacent periodontal tissues.¹⁻⁴ Removal of bacteria-harboring calculus and contaminated cementum reduces the levels of subgingival plaque and promotes the healing process.¹ Although the complete removal of calculus may not always be achievable, periodic re-evaluation of the periodontal tissues for signs of inflammation, aids in the detection of residual calculus. The Old Dominion (ODU) 11/12 explorer is one of several standard instruments used for calculus detection in preventive and active periodontal therapy

and for clinical licensure examinations. Evidence supporting the sensitivity and specificity of the ODU 11/12 explorer is limited,^{5,6} however, it serves as part of an armamentarium of instruments utilized subgingivally to thoroughly detect and remove calcified deposits. Since the visualization of the subgingival environment is limited without assisted technology, tactile sensitivity acquired through a variety of instruments is essential for the evaluation of the presence of hard deposits on the tooth structure.

Technologies are being developed to complement the use of an explorer for the accurate detection of subgingival calculus including endoscopy, auto-fluorescence, spectro-optical technology, lasers, and ultrasonic-based devices.⁷ Endoscopy utilizes optical fibers and a light source to enter a periodontal

pocket and magnify the environment from 24-48 times onto a monitor allowing the clinician to work in real-time while instrumenting the root surface.⁷ While the use of a dental endoscope requires a lengthy learning curve, necessitates extra treatment time, and requires investing in expensive equipment,^{8,9} endoscopy has been shown to enhance calculus detection, particularly with regards to residual deposits.^{10,11}

The DIAGNOdent™ (KaVo; Biberach, Germany) consists of an indium gallium arsenide (InGaAs) diode and utilizes auto-fluorescence technology by emitting light with a wavelength of 655nm onto the tooth structure primarily for the purpose of caries detection.¹² Auto-fluorescence technology can also be used for calculus detection, however few studies have evaluated the clinical effectiveness of this device for this purpose.^{12,13} The DetecTar™ (Dentsply Professional, York, PA) is a light-emitting diode utilizing spectro-optical technology delivered through an optical fiber attached to a cordless handpiece. Designed exclusively for calculus detection, not its removal, this device requires additional study to determine its efficacy in clinical situations.¹³ Lasers, specifically the KEY3 laser, combine the technology of the InGaAs diode for calculus detection and a Erbium-doped yttrium aluminum garnet (Er:YAG) for calculus removal. Major limitations to the widespread use of this laser include its high cost and restricted use for dental hygienists due to state dental board regulations. Powered scaling or ultrasonic instrumentation is commonly used for the effective and efficient removal of biofilm and calculus.^{12,14} However, the Perioscan (Sirona; Bensheim, Germany) is a piezoelectric ultrasonic instrument specifically developed for the dual purpose of calculus detection and removal.¹⁵ Current evidence is limited to in vitro studies, more in vivo studies are needed to determine the clinical efficacy of this technology.¹³

A variety of ultrasonic instrument designs exist for the purpose of biofilm and calculus removal during periodontal therapy. The Thinsert® (Dentsply Sirona; York, PA, USA) ultrasonic insert (UI) has a thin tip design with a similar thickness to the ODU 11/12 explorer. This design allows for improved periodontal access and more effective subgingival adaptation. Right and left curved UIs are utilized during periodontal therapy for improved access to difficult areas such as furca, concavities, and depressions.^{16,17} The combination of straight and curved UIs in site-specific areas throughout the dentition has been demonstrated to improve the outcomes of non-surgical periodontal therapy.¹⁸ During periodontal therapy, practitioners typically alternate between using an explorer for calculus detection and a variety of hand and ultrasonic instruments for calculus removal. This alternating process is repeated until the clinical endpoint has been achieved.

Considering that periodontal therapy appointments are often completed within fixed time intervals, efficiency of the periodontal therapy session is critical. One approach to improve efficiency is to use the same instrument for several functions. Since the diameter of the thin UI is similar to the ODU 11/12 explorer, it may serve the dual purpose of calculus detection as well as removal. Curved UIs have similarities to the ODU 11/12 explorer and may also be effective in calculus detection. The purpose of this study was to examine the effectiveness of calculus detection between a thin UI, curved UIs as compared to the ODU 11/12 explorer in experienced clinicians.

Methods

This study received approval from the Biomedical Institutional Review Board (2016H0273 and 2017H0275) of the Ohio State University (OSU). Three faculty members from the OSU Division of Dental Hygiene with clinical teaching assignments along with current employment in a private practice or the non-profit setting at the OSU Dental Faculty Practice, volunteered to participate in the study. Faculty participants consisted of two full-time members (≥ 0.75 FTE) and one part-time member (< 0.75 FTE) and possessed a range of clinical dental hygiene experience from less than five years, ten to fifteen years, and over twenty years. Each faculty participant was randomly assigned a participant number.

Patient participants were recruited from the community by posting no-cost advertisements on an external website, internal monitors within the OSU School of Dentistry, and the OSU Study Search website. Patient participants were initially screened for availability during the dates of data collection and based on the eligibility criteria. Eligible participants were adults aged 18 and over with good general health and no history of a professional prophylaxis within the past six months. Exclusion criteria were individuals with uncontrolled systemic disorders and a history of professional prophylaxis within the past 6 months. All participants were provided with the rationale and design of the study. Eligible participants were randomly assigned a participant number, completed and signed informed consent, medical history, and Health Information Portability Accounting Act (HIPAA) forms prior to the start of the study.

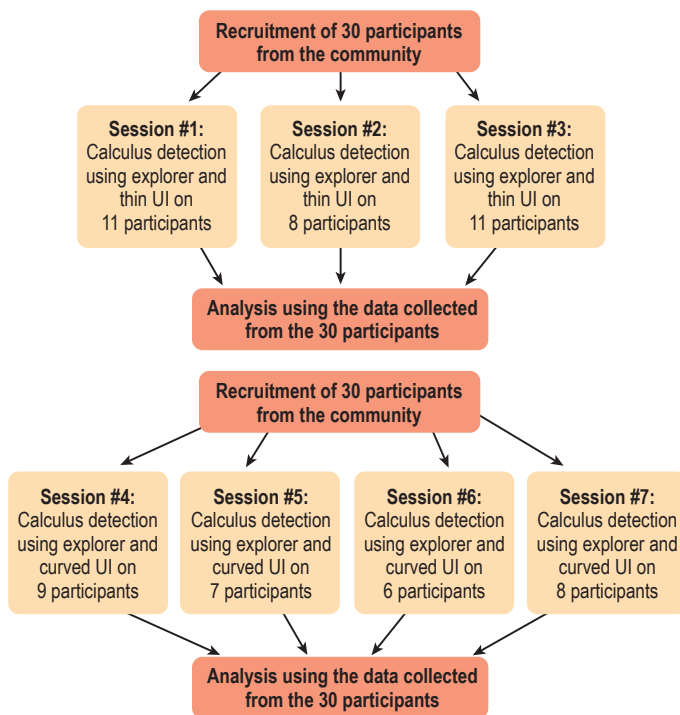
An ODU 11/12 explorer, thin and curved UIs, disconnected from the ultrasonic unit, were used for this study. Presence or absence of readily detectable calculus was recorded on a standardized, color-coded calculus detection chart; each faculty participant used the same colored forms each assessment. Ramfjord index teeth (teeth numbers 3, 9, 12, 19, 25, and 28) and on four possible surfaces per tooth

(mesial, buccal, distal, and lingual)¹⁹ were used to evaluate for the presence of calculus.

Faculty participants/raters underwent calibration training using three typodonts with differing surfaces of simulated calculus (Practicon Inc; Greenville, NC, USA) one week prior to the start of the study. The participants first used the ODU11/12 explorer to detect for calculus; evaluations were recorded on the standardized calculus detection chart. After a minimum of three days, participants detected for calculus using the thin UI and recorded their evaluations on the standardized calculus detection chart. All participants were found to be in the full agreement range for intra- and interrater reliability.

Data collection occurred over seven separate sessions held after normal clinic hours in the OSU Student Dental Clinics. The first three sessions compared calculus detection between the explorer and thin UI. During the final four sessions, calculus detection was compared using the explorer and curved UIs. Study session and participant flow is shown in Figure 1.

Figure 1. Study Sessions and Participant Flow



During each session, participants evaluated each patient for calculus using a random order and a randomly chosen instrument until all patient participants were evaluated for calculus. Each calculus detection chart was color coded per faculty rater. After each chart was completed, each chart was submitted into an individual patient folder to secure each

faculty rater's evaluations from the other raters. In subsequent sessions the faculty rater evaluated each patient for calculus using a random order with the remaining instrument. The availability of six to eleven patients per session minimized the faculty rater's memory retention of the patients between the first and second rounds and also minimized fatigue, which could have altered the tactile sensitivity if all the instruments were used in a single session.

Data analysis

All statistical analysis was conducted using SPSS Version 25 (IBM, Chicago, IL, USA). The first aim of the study was to measure inter-rater reliability or the absolute agreement among more than two raters evaluating the same group of subjects. Two-way random-effects intraclass coefficient (ICC) values were determined using the faculty raters' evaluations using the ODU 11/12 explorer versus thin UI and the ODU 11/12 explorer versus curved UIs. Intraclass coefficient values less than 0.29 indicate poor reliability, between 0.30 and 0.49 suggests fair reliability, between 0.50 and 0.69 reveal moderate reliability, and values greater than 0.70 are indicative of strong reliability.^{20,21} The second aim was to measure intra-rater reliability by determining Cohen's Kappa coefficient values using each faculty participant's calculus detection evaluations when using the ODU 11/12 explorer versus the thin UI and the ODU 11/12 explorer versus the curved UIs. Kappa values range from zero (no agreement) to one (perfect agreement) with values in the range of 0.41 to 0.60 indicating moderate agreement, 0.61 to 0.80 considered in full agreement, and values greater than 0.81 indicating perfect agreement.²²⁻²⁴ The third aim was to determine whether the UI is a valid instrument for calculus detection. Sensitivity, specificity, positive predictive value (PPV), and negative predictive values (NPV) were calculated when using the thin UI and curved UIs versus the ODU 11/12 explorer to measure validity. A cross tabulation of all calculus evaluations was generated between the ODU 11/12 explorer (considered for the purposes of this study as the gold standard) versus the thin UI (test outcome) and the ODU 11/12 explorer (gold standard) versus the curved UIs (test outcome).²⁵ Sensitivity refers to detecting calculus when actually present, specificity refers to detecting the absence of calculus when actually absent, PPV refers to the calculus actually being present, and NPV refers to calculus actually being absent.²⁵

Results

A total of 60 eligible participants were recruited from the community to participate in this study comparing the effectiveness of calculus detection between the ODU 11/12

explorer versus thin and curved UIs as measured by three clinical faculty raters. Interrater reliability of calculus detection among the three faculty raters when using both the ODU 11/12 explorer and thin UI was shown to be an intraclass coefficient (ICC) of .782 with a confidence interval (CI) of .749 to .810 ($F(1439, 2878)=4.852, p<0.05$). When faculty raters used the ODU 11/12 explorer alone for calculus detection, the average ICC was .768 with a CI of .725 to .803 ($F(719, 1438)=4.577, p<0.05$). Using the thin UI alone, raters had a ICC of .790 with a CI of .750 to .820 ($F(719, 1438)=5.011, p<0.05$). In the sessions using the curved UIs, faculty raters using the ODU 11/12 explorer and curved UIs demonstrated an ICC of .714 with a CI of .684 to .741 ($F(1439, 2878)=3.579, p<0.05$) and the ICC while using the ODU 11/12 explorer alone was .737 with a CI of .701 to .769 ($F(719, 1438)=3.858, p<0.05$). Using only curved UI, the faculty rater ICC was .691 with a CI of .644 to .732 ($F(719, 1438)=3.357, p<0.05$). Interrater reliability results are shown in Table I.

Table I. Interrater Reliability of the Raters

	Intraclass Coefficient*	Lower Bound**	Upper Bound**	F-test	df1	df2	p-value
ODU 11/12 Explorer & Thin UI	0.782	0.749	0.810	4.852	1439	2878	<0.05
ODU 11/12 Explorer	0.768	0.725	0.803	4.577	719	1438	<0.05
Thin UI	0.790	0.750	0.820	5.011	719	1438	<0.05
ODU 11/12 Explorer & Curved UI	0.714	0.684	0.741	3.579	1439	2878	<0.05
ODU 11/12 Explorer	0.737	0.701	0.769	3.858	719	1438	<0.05
Curved UIs	0.691	0.644	0.732	3.357	719	1438	<0.05

*Intraclass coefficient: <0.5 poor reliability, 0.50-0.75 moderate reliability, 0.75-0.90 good reliability, >0.90 excellent reliability

**Confidence Interval: 95%

The second aim of the study was to determine the intrarater reliability of calculus detection when using the ODU 11/12 explorer versus a thin UI and versus curved UIs. The average Kappa value for all three raters was .726 when using the ODU 11/12 explorer versus the thin UI while the average Kappa value for the raters when using the ODU 11/12 explorer versus curved UIs was .680. Interrater reliability Kappa values are shown in Table II.

Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) when using the ODU 11/12 explorer versus a thin UI and versus curved UIs were measured in regards to the third study aim; validation of thin and curved UIs as instruments

for calculus detection. A total of 2,160 surfaces were evaluated for calculus using the explorer and the thin UI. Of those surfaces, 75% (n=322) were true positives, 96% (n=1,655) were true negatives, 4% (n=75) were false positives, and 25% (n=108) were false negatives. Sensitivity was 75%, specificity was 96%, PPV was 81% and NPV was 94% when comparing calculus detection using the thin UI (test outcome) to the ODU 11/12 explorer (gold standard). In evaluating curved UIs to the ODU 11/12 explorer, a total of 2,160 surfaces were evaluated for the presence of calculus. Sixty-five percent of those surfaces (n=141) were true positives, 98% (n=1,332) were true negatives, 3% (n=34) were false positives, and 35% (n=77) were false negatives. Sensitivity was 65%, specificity was 98%, PPV was 81% and NPV was 95% when comparing calculus detection using the curved UIs to the ODU 11/12 explorer (Table III).

Discussion

The purpose of this study was to evaluate the efficacy of calculus detection between thin and curved UIs, and the ODU 11/12 explorer. Intra- and interrater reliability was measured for the purposes of comparing calculus detection with UIs and an ODU 11/12 explorer. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of calculus detection were measured for the three types of instruments. Based on a generic χ^2 -test and 0.05 level of significance, a sample subject size of 30 was determined to have an effect size of 1.0 with greater than 90% power.

Table II. Intrarater reliability of the raters

Rater	Kappa Value* Thin UI/ ODU 11/12 explorer	Kappa Value* Curved UI/ ODU 11/12 explorer
All raters	0.726	0.680
Rater 1	0.776	0.766
Rater 2	0.715	0.622
Rater 3	0.641	0.615

*Kappa= 0.00 - 0.20 slight agreement; 0.21 - 0.40 fair agreement; 0.41- 0.60 moderate agreement; 0.61- 0.80 full agreement, > 0.81 perfect agreement

Table III. Comparison of calculus detection between ODU 11/12 explorer, thin and curved UIs

	Instrument	ODU 11/12 Explorer (gold standard)		PPV/NPV
		(+) calculus present	(-) calculus absent	
(+) calculus present	Thin UI	75% n=322 (true positive)	4% n=75 (false positive)	81% PPV TP/(TP+FP) n=397
	Curved UI	65% n=141 (true positive)	3% n=34 (false positive)	81% PPV TP/(TP+FP) n=175
(-) calculus absent	Thin UI	25% n=108 (false negative)	96% n=1655 (true negative)	94% NPV TN/(FN+TN) n=1763
	Curved UI	35% n=77 (false negative)	98% n=1332 (true negative)	95% NPV TN/(FN+TN) n=1409
Sensitivity/ Specificity	Thin UI	75% Sensitivity n=430	96% Specificity n=1730	
	Curved UI	65% Sensitivity n=430	98% Specificity n=1366	

However, since limited amounts of calculus were present and detected with the participants, results of the present study can only be generalized to patient populations with similar, limited amounts of calculus.

Study participants using the thin UI demonstrated a sensitivity of 75%, specificity of 96%, PPV of 81% and

NPV of 94% however when participants used curved UIs the sensitivity measured 65%, specificity 98%, PPV 81% and NPV 95% when considering the ODU 11/12 explorer as the gold standard for calculus detection. Both thin and curved UIs seemed more effective at detecting the absence of calculus versus the presence of calculus. Limited evidence over the past 10-30 years has revealed varying levels of sensitivity, specificity, and predictive values in the detection of calculus. Phippen and Feil, using manikins with artificial calculus, found a sensitivity 49%, specificity 88%, PPV 12%, and a NPV 51%.⁵ In an in vivo study with human participants, Sherman et al. revealed a low false positive (FP=11.8%) and high false negatives (FN=77.4%).⁶ However in the Sherman et al. study, the clinical evaluation of calculus after scaling and root planing was compared to the subsequent microscopic evaluation of the extracted teeth. With novel technology, Meissner et al. utilized a smart ultrasonic device for calculus detection and determined a sensitivity of 91%, specificity 82%, PPV 59%, and NPV 97%.¹⁵

Using the predetermined eligibility and inclusion criteria, recruiting participants with readily detectable calculus presented a challenge. However, previous studies revealed that between-rater agreement was greater when calculus was defined as readily detectable versus root roughness.^{6,26} Out of the 4,320 total surfaces evaluated in the present study, 648 surfaces (20%) were determined to have calculus using the ODU 11/12 explorer exclusively and 463 surfaces (15%) were determined to have calculus when using both the 11/12 explorer and either the thin UI or the curved UI (true positive).

Although the three faculty raters had varying levels of clinical experience, this did not seem to affect calculus detection. Both within-rater and between-rater agreement levels were in the full agreement range. Specifically, the levels of within-rater agreement when using both the ODU 11/12 explorer and thin UI was Kappa =.726 and the levels of within-rater agreement when using both the ODU 11/12 explorer and curved UI

was Kappa=.680. Previous research has shown that clinicians have a low ability to reproduce their evaluations with respect to calculus detection.^{5,6} Using manikins with simulated calculus, Phippen and Feil revealed low within-rater agreement (Kappa= .330).⁵ In a study using human subjects, Sherman et al. found similar low within-rater agreement levels regarding the presence of calculus both prior to (Kappa=.220 - .370)

and after scaling ($Kappa = .040 - .270$).⁶ In the current study, the levels of between-rater agreement were in the strong range within a narrow confidence interval with the ODU 11/12 explorer, the thin UI, curved UIs, all when used alone, as well as overall when using all instruments. This contrasts other studies which have demonstrated low levels of agreement between raters with regards to calculus detection.^{5,6} However, Santiago et al. showed higher between-rater agreement evaluating for readily detectable calculus, defined as a “jump or bump” of the explorer ($Kappa = .631$) versus the tactile perception of root roughness ($Kappa = .271$).²⁶

Anecdotally, after completing the first stage of the study utilizing the thin UI the raters commented on feeling limited by the straight design of the insert and challenges existed with adapting the thin UI along line angles. While the curved UIs allowed for improved adaptation of the instrument along the line angles, the tip width affected the perceived tactile sensations. Development of a novel UI design combining the shape of a curved UI with the diameter of the thin UI may lead to improvements during the process of calculus detection and removal.

Limitations of this study included the number of patient participants with readily detectable calculus deposits, potential rater recall of the calculus deposits on the patient participants’ teeth, and rater fatigue which may have affected tactile sensitivity. Future studies should investigate calculus evaluation utilizing other UI designs, measure the efficacy of UI calculus detection with varying amounts of calculus, and determine whether clinical experience, (dental hygiene students versus experienced clinicians), affects calculus detection using UIs.

Conclusion

Calculus detection was comparable when using the ODU 11/12 explorer, thin and curved UIs on patients with limited amounts of calculus. Efforts may be focused on developing tactile sensitivity when using both thin and curved UIs in the assessment, treatment, and maintenance of patients with sub-gingival calculus for increased efficiency in dental hygiene care. The development of a novel ultrasonic insert combining the shape of a curved UI with the diameter of thin UI may facilitate adaptation during the process calculus detection and subsequent removal. Future studies should investigate calculus evaluation utilizing novel ultrasonic insert designs, varying amounts of calculus, and varying levels of clinical experience.

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Experiences and Challenges of Clinical Dental Hygienists Transitioning into Teaching Roles

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Abstract

Purpose: The purpose of this pilot study was to examine the experiences of novice dental hygiene faculty when transitioning from private practice into clinical teaching roles.

Methods: A phenomenological qualitative study was performed using focus groups; data was collected from the responses provided from clinical faculty members during semi-structured interviews. Focus groups were comprised of three to four members. Participants were asked open-ended questions regarding their experiences, and to identify helpful strategies which assisted them as they entered the clinical teaching setting.

Results: Participants were both female (n=16) and male (n=1), ranging from 25 to 60+ years of age, with clinical teaching experience ranging from 1 to 5 years. Emergent themes, identified from an analysis performed on the participant's responses, revealed numerous strategies encountered by novice faculty as they entered clinical teaching roles. Strategies found to be helpful during the transition into clinical teaching included: shadowing experienced faculty, availability of resources such as textbooks and course materials for use as teaching aids, and orientation sessions held prior to the beginning of each semester. Few challenges were identified from the participants' responses, however, younger novice faculty members shared challenges in regards to being taken seriously by students due to their age. Older faculty members found relearning course content and terminology to be challenging.

Conclusion: Increased understanding of the unique experiences of novice clinical faculty, and identification of the successful strategies and challenges encountered by these individuals, may aid in developing effective approaches and programs for novice faculty as they enter clinical teaching roles.

Keywords: clinical education, novice faculty, adjunct clinical faculty, dental hygiene education, clinical teaching methodology

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Introduction

A national shortage of health care educators is increasing, and could potentially jeopardize future student enrollment in health profession programs due to insufficient numbers of instructors available to teach students.¹⁻⁷ Research investigating the shortage of health professions faculty has been conducted predominantly in the field of nursing education, with a lack of faculty attributed to retirement, and the competitive salaries offered to health care providers in clinical practice.¹⁻⁷ Fifty-six percent of nursing schools have reported open faculty positions, and dental hygiene programs are also reporting faculty shortages.⁸

Research in the field of dental hygiene regarding faculty shortages and retention, has been limited. However, a study by Carr et al. investigated factors leading to dental hygiene faculty shortages, and reported similar outcomes to those found in the nursing literature.⁸ Inadequate compensation offered to faculty, as compared to salaries earned in private practice, has been a chief factor in influencing faculty choosing to leave academia.⁸ Another factor impacting the dental hygiene faculty shortage, has been the limited number of qualified candidates.⁸ Fewer graduates possess the required baccalaureate or master's degree necessary to transition into a teaching role, with a large number of associate degree programs lacking the content, skills and knowledge necessary for entry into dental hygiene education.⁸

Behar-Horenstein et al. assessed faculty development needs in dental hygiene education in 2016.⁹ Study results revealed a lack of opportunities were offered for faculty to enhance their teaching skills and expand their educational methodology, both identified as significant factors contributing to the inability to retain faculty.⁹ Although previous research in dental hygiene education has identified factors contributing to faculty shortages and retention issues, experiences and challenges of novice dental hygiene faculty members, which could impact faculty retention, has not yet been examined.^{9,10}

Novice Clinical Faculty Challenges in Health Professions Education

Novice nursing faculty have reported dissatisfaction, frustration, and a sense of uncertainty due to unmet needs encountered as they entered their new teaching role.¹ Challenges identified by these novice faculty include: a lack of awareness regarding the demands of teaching, feeling unprepared as a result of having insufficient teaching resources when entering academia, low levels of confidence, and anxiety when teaching unfamiliar material to students.¹¹ Other challenges identified by novice nursing faculty have been the lack of training in the area of educational methodology, and feeling unprepared for their teaching role despite extensive clinical experience in their chosen field.¹¹

Novice faculty members in fields of nursing and occupational therapy have found teaching responsibilities combined with the demands of didactic work and the hours required to prep for each class, to surpass their expectations.^{11,12} In addition to the time required to prepare for classroom teaching extending beyond clinical teaching responsibilities, both nursing and occupational therapy faculty were overwhelmed by the expectation of conducting research in their respective fields, despite their recent transition into academia from clinical practice.^{11,12}

Another challenge identified by novice instructors in the nursing literature was the incivility they experienced from other instructors.¹³ The most common acts of incivility cited were senior instructors focusing on novice instructors' weaknesses, and belittling them as they tried to learn their new role and responsibilities.¹³ Novice nursing instructors reported experiencing humiliation, rejection, and territorial behavior on the part of senior faculty.¹³ Senior faculty also refused to assist new instructors creating an uncivil atmosphere and making it difficult for the novice faculty to ask questions about their teaching responsibilities.¹³ Novice nursing faculty members also reported that negative experiences impacted their self-confidence and undermined their ability to teach.¹³

Experiences with incivility among novice dental hygiene faculty has not been investigated, nor has it been studied extensively within health professions in general, with the exception of nursing.¹⁴ While limited research has been conducted in dental education regarding uncivil behavior amongst dental faculty, studies in dental education have focused on the perceptions of students regarding faculty interactions and the impact of faculty incivility on their learning experiences.¹⁴

Strategies Assisting Novice Clinical Faculty in the Health Professions

Research in both nursing and dental hygiene education has investigated various strategies to help guide novice faculty during their transition into academia.^{12,15,16} Mentorship from experienced faculty was found to be an effective strategy assisting in novice faculty's successful transition into teaching, while also contributing to their professional development.^{13,14} Another strategy, identified by novice dental hygiene clinical instructors, was the opportunity to receive professional development courses prior to employment.¹⁴ Although a background in teaching methodology was identified as being helpful, novice dental hygiene educators reported lacking the educational background in the didactic courses which would have helped them to prepare to teach the material.¹⁴ Paulis compared student and faculty perceptions regarding the role of preparation for clinical teaching. While both students and instructors identified training in teaching methods and communication as highly important, faculty identified student evaluation methods and grading were the most emphasized areas in their teaching preparation courses.¹⁰ The Paulis study provides insight into approaches which can assist novice faculty transition into a teaching role, however, the experiences and barriers encountered by novice dental hygiene faculty has not been investigated. The purpose of this pilot study was to gain further understanding of the challenges encountered by novice dental hygiene faculty and to consider their impact on the recruitment and retention of novice dental hygiene faculty members.

Methods

Massachusetts College of Pharmacy and Health Sciences University Institutional Review Board (IRB) granted this study "exempt" status in accordance with 45 CFR 46.101(B) (2) and was assigned protocol number IRB060616S. A phenomenological qualitative pilot study was designed using focus groups with semi-structured interviews and open-ended questions to explore novice dental hygiene faculty experiences when transitioning from clinical practice into academia. For

the purposes of this study, novice dental hygiene clinical instructors were defined as entry level faculty, with minimal experience or knowledge in clinical teaching. Inclusion criteria for study participants was having ≤ 5 years teaching experience. Faculty members with full time employment status, administrators, and adjunct faculty with >5 years of clinical teaching experience, were excluded from the study.

Participants were recruited from a single program, with two campuses, where students earn a Bachelor of Science in dental hygiene. Five focus groups were conducted between the two campuses, with 3-4 clinical faculty participants in each group. Participants were recruited using a convenience sampling technique, based on their availability to be on campus. Focus group members were grouped by availability which was determined by the day of the week that they taught; age or other demographic factors were not considered. All focus groups were led by the principal investigator (PI), who was a full-time faculty member in the dental hygiene program.

Informed consent and demographic data were collected from the participants via Qualtrics[®] (Provo, UT) survey software. Face-to-face and virtual focus groups used Zoom (San Jose, CA), a video conferencing tool which records and interviews multiple participants at one time, to collect responses from the novice faculty.

Demographic and qualitative interview questions were pilot-tested with novice faculty members (n=7) not participating in the study. Feedback from the faculty participants provided guidance regarding clarification of the interview questions, effectiveness of the semi-structured interview, and the data collection procedure. Novice faculty participants (n=17) were recruited through an email invitation and were given two weeks to provide online consent to participate in the study and provide demographic data. Each focus group lasted 40 to 45 minutes, and the face-to-face interviews (n=4) were conducted on the campus where the PI was employed. The virtual focus group (n=1) was conducted on the remote campus and was recorded using Zoom technology. The data recorded from both the virtual and the face-to-face focus groups were transcribed following the interview sessions.

A thematic analysis was used to analyze the transcribed data collected from the interview sessions. Participants' responses were reviewed multiple times with the potential patterns identified and highlighted in the transcribed data. Patterns appearing repeatedly in the transcribed data were used to identify the emerging themes.¹⁶ After analyzing the qualitative data collected from the participants (n=17), no new patterns or themes emerged, suggesting saturation had occurred.¹⁶

Results

Demographics

A total of (n=17) novice faculty members participated in the qualitative pilot study ranging in age from 20 to 30 years (n=6) to over 61 years of age (n=1). The vast majority identified as female (n=16) versus male (n=1) and the majority held a bachelor's degree (n=11) as their highest level of education. Years of experience as a dental hygienist ranged from one to three (n=3) to eleven or more (n=6). Demographic responses are shown in Table I.

Table I. Demographic Responses

Characteristics	n	%
Age		
20 to 30	6	35%
31 to 40	5	29%
41 to 50	1	6%
51 to 60	4	24%
61+	1	6%
Gender		
Male	1	6%
Female	16	94%
Transgender		
Highest level of education		
Associate degree	2	12%
Bachelor degree	11	65%
Master's degree	4	24%
Doctoral degree	0	0%
# years of experience as a Dental Hygienist		
1 to 3	3	18%
4 to 5	2	12%
6 to 7	2	12%
8 to 10	4	24%
11 to more	6	35%
# years of experience of teaching in Dental Hygiene		
1 to 3	9	53%
4 to 5	8	47%
6 to 7	0	0%
8 to 10	0	0%
11 to more		

Focus Group Responses

Responses to each of the open-ended questions provided insight into the experiences novice faculty encounter as they entered their new clinical teaching role (Table II). Participants reported age-related challenges, however, most responses reported positive experiences which had assisted them during their transition into academia. More experienced clinicians aged 40 years and older (36%) felt challenged by re-learning terminology and adapting to new technology during their transition to teaching. Younger, less experienced clinicians,

between the ages of 20 to 30 years (21%), felt students doubted their competence as instructors due to their age and lack of experience, and frequently viewed them as their peers.

A majority of the participants (53%) reported they had a seasoned instructor to assist them during the transition into their clinical instructor role. Although 47% of the participants had not been shadowed by an experienced instructor, participants did not share any negative comments about being on their own. Participants reported that their effective teaching strategies were often self-directed; a majority practiced with

Table II. Focus Group Questions and Selected Responses

<p>What experiences did you encounter transitioning into your role as a clinical instructor?</p>	<p>“I always had an instructor who I was able to shadow during my transition. I observed their flow and picked up what methods worked for me. This really helped me with the transition.”</p> <p>“I was lucky enough that I was taught by a seasoned instructor. I now feel I know better how to run the lab and present different concepts.”</p>
<p>What strategies helped you feel prepared for your new clinical teaching role?</p> <p>Provide examples of the strategies you developed and share if they were self-directed or provided from a mentor/colleague.</p> <p>If provided, what type of materials could have helped you be more prepared with your strategies?</p>	<p>“I would read the chapters in the textbook on the content or skill being taught a week ahead of time in order to feel prepared.”</p> <p>“The orientation meeting provided teaching methodology which guided me for the upcoming clinical role in the semester.”</p> <p>“Calibration meetings at the beginning of the semester helped me identify goals for the upcoming semester and helped me figure out what changes I needed to focus on.”</p> <p>“I reviewed all of the feedback the students received in their binders from the other instructors to identify what the students were working on.”</p> <p>“Videos of clinical skills would have helped me with all of the assessments we do.”</p> <p>“In calibration meetings adding hands on demonstration and a chance to ask questions would have been a great refresher for me.”</p>
<p>If any, what professional educational dental hygiene training did you receive during your transition into your clinical teaching role?</p>	<p>“I have taken some educational courses at other institutions that opened my mind to teaching...this helped me with the transition into the clinical teaching role.”</p>
<p>What training was most helpful pertaining to your teaching role and was this training informal or formal?</p>	<p>“I relied heavily on faculty orientation which oriented me on how things run in the program.”</p>
<p>What experiences encouraged your decision to become a dental hygiene clinical instructor?</p>	<p>“My clinical instructors were very informative and caring; when I observed this character with the instructors, it made me want to become a teacher.”</p> <p>“What made me go into teaching was a combination of things, the educational environment I had been in, the possibilities academia offers, and lifelong learning. Academia is just very inspirational.”</p>

student textbooks (57%) and other course materials found on the clinical course management software platform (41%).

Formal experiences offered through the dental hygiene program to assist novice faculty prepare for their teaching included: faculty orientation sessions (21%), clinical calibration meetings (21%) and feedback from experienced instructors (14%). Thirty-six percent of the participants reported that instructional videos and visual aids, such as hands on instrumentation demonstrations, would have aided them to prepare for their new roles.

Many of the novice faculty (42%) reported completing formal graduate courses which helped prepare them for their role as clinical educators. Other participants (42%) stated they relied on the formal training provided at annual faculty orientation meetings to help them understand the expectations for their teaching role. A majority of the participants (71%) reported the supportive and inspiring clinical instructors they had worked with, and the positive learning environment during their own dental hygiene school experiences, had encouraged them to become clinical educators.

Emerging Themes

Qualitative data collected from the participants' responses revealed four major themes: availability of course resources, orientation and monthly calibration meetings, shadowing and mentoring provided by experienced instructors, and age-related challenges encountered when entering a teaching role.

Theme 1. Availability of course resources

Participants repeatedly expressed the effectiveness of dental hygiene resources and their impact on their teaching experiences.

"I was definitely one to go home after clinic and re-read the chapters students were working on, and then would take notes. This helped to make teaching easier."

Theme 2. Orientation and calibration sessions

Faculty orientation and calibration sessions helped novice faculty understand the expectations in their role as clinical instructors.

"I think faculty orientations help us a lot; it gets our wheels spinning before the semester starts and gets us all on the same page."

"I think you learn a lot in our calibrations meetings...we all share common stories of what occurs with students during clinic sessions and this helped me to know what to do with students."

Theme 3. Shadowing and mentoring

Shadowing an experienced instructor, when first entering a clinical teaching role, was shown to assist novice faculty members during this transition period.

"I think shadowing is really helpful, I shadowed other instructors in clinic and I was always able to ask questions to see if I was doing things the right way."

"I observed the more experienced instructors to see what techniques might work for me and then adjusted this to my own methods."

Theme 4. Age-related challenges

Age-related challenges were identified by instructors as they transitioned into academia. For older instructors, the need to re-learn terminology and refresh their knowledge of dental hygiene content was identified as the greatest challenge.

"It was hard to put the material I was teaching students into the correct words for them, and I had to return to the textbook to learn it."

"I forget the specific terminology after being away from academia for 20 to 25 years; it required having to go back and review/relearn the material being assigned to students."

Younger instructors found challenges in being perceived as competent and establishing an appropriate relationship with students which would allow for effective learning.

"I think the biggest challenge was to learn not to become the student's friend. You have to find a balance of being an instructor and a nice person at the same time."

"I felt that being a younger instructor, students would question me about how long I have been teaching; I sensed they were questioning my competency."

Discussion

There is a gap in the literature identifying the challenges novice dental hygiene faculty members face during their transition into clinical teaching.^{12,14} Responses to the four open-ended questions and sub-questions (Table II) shared by the participants provided insight into the experiences of novice faculty when transitioning into their clinical teaching role. Use of resources such as textbooks, materials, and terminology to help prepare curriculum for the week was identified as being helpful for the novice faculty in this pilot study. These findings support those of Forbes et al. identifying a lack of materials and resources as obstacles for novice faculty transitioning into clinical teaching.¹

Formal experiences including orientation and calibration sessions and faculty feedback were viewed positively in this study, a finding that parallel the outcomes of Baker who found nursing faculty's attendance during orientation provided important guidance in their teaching roles.¹³ Similar findings were also identified by Tax et al. study on effective dental hygiene teaching models demonstrating the effectiveness of providing educational methodology to faculty entering clinical teaching roles.¹⁷ Another study by Mann et al. investigating novice nursing faculty's transition into academia, also supports this study's findings.¹⁸ Mann et al. identified mentorship, faculty orientations, and the opportunity to study clinical materials, enhanced novice nursing faculty's transition and improved their teaching skills.¹⁸ Findings from the Moystad et al. study of Norwegian dental educators also supports this pilot study outcomes.¹⁹ Moystad et al. found teaching competence, confidence and faculty development were enhanced through collaboration across a faculty of dental educators.¹⁹ The positive role of mentoring of novice dental hygiene educators by experienced faculty found in this pilot study, was also confirmed by the Cangelosi, Sawatzky et al., and Specht research outcomes, demonstrating that novice nursing faculty were assisted by the presence of faculty mentors.^{20,5,13}

Despite the identified parallels supported by previous research in regards to effective strategies for novice health professions faculty members, emerging themes identified in this pilot study were in contrast to research conducted primarily in nursing education.¹⁰⁻¹² Identified issues for novice clinical educators in nursing included: incivility from established faculty, lack of awareness of workload, and lack of support from the institutions where they taught.¹⁰⁻¹² Similar challenges were not identified by participants in this pilot study. However, the contrasting outcomes may be related to the limited dental hygiene educator population studied.

Limitations of this qualitative pilot study included the participants' self-evaluation of their experiences and potential recall bias. Participants may also have been reluctant to share their experiences in front of peers potentially influencing their responses. Another potential limitation was the PI who worked with some of the participants as a full-time faculty member which may have impacted the honesty of the responses. The small sample size (n=17), from a single dental hygiene program was also a limitation, preventing generalization of the findings.

Conclusion

This qualitative pilot study identified the challenges novice dental hygiene faculty members face during their transition from clinical practice to educator. Recognizing and

understanding the challenges of younger, less experienced faculty who believe students perceive them as a peer, or that they lack competence, is critical as they begin teaching. Older more experienced clinicians, often feel challenged by the need to re-learning terminology and adapt to new technology, should be provided with adequate resources and support from experienced faculty to successfully transition into clinical teaching roles. Future research, using a larger and more diverse sample size from multiple dental hygiene programs, is recommended to identify other challenges which may be experienced by novice dental hygiene faculty members.

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Fluoride-related YouTube videos: A cross-sectional study of video contents by upload sources

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Abstract

Purpose: The aim of this study was to describe characteristics of the most widely viewed fluoride-related videos on the video sharing website, YouTube, and to compare the content of videos uploaded from different sources.

Methods: Using a cross-sectional design, a total of 100 fluoride-related, English language videos were manually coded and statistically analyzed.

Results: A majority of videos were consumer-generated. Videos that were consumer-generated had the most views of any source (9,737,845 views; 69.32%). Compared to consumer-generated videos, videos uploaded by a professional source were 15.52 times as likely to mention fluoridated toothpaste (Odds ratio, OR=15.52, 95% CI, 1.92, 125.35), 5.04 times as likely to mention the need for training of health personnel (OR=5.04, 95% CI, 1.15, 22.02), 9.69 times as likely to mention the benefits of fluoride on teeth (OR=9.69; 95% CI, 2.01, 46.81), 3.52 times as likely to mention that too much fluoride is negative (OR=3.52, 95% CI, 1.06, 11.73), and 3.44 times as likely to mention the dangers of fluoride use in children 1-5 years old (OR=3.44, 95% CI, 1.05, 11.23).

Conclusion: Widely-viewed fluoride-related information on YouTube has an anti-fluoride sentiment, focusing more on the danger of fluoride rather than its benefits.

Keywords: fluoride, fluoridated toothpaste, caries prevention, social media, YouTube

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Introduction

Dental caries are common in the United States,¹ and affect all age groups.²⁻⁵ Fluoride, a mineral that naturally occurs in the environment, is often added to water supplies to address the high prevalence of dental caries.⁶ Fluoridation of drinking water was first introduced in 1945 as a clinical trial to help prevent and lessen the severity of tooth decay,^{6,7} and is considered a safe and cost-effective way to prevent dental disease in the population.^{8,9} Some individuals and groups argue against the fluoridation of water, however, claiming that government fluoridation of water violates one's right to consent, and cite detrimental side effects including increased risk of arthritis, hip fractures, and decreased intelligent quotient in children.¹⁰ Dental fluorosis, defined as changes in the enamel of the teeth, is another concern with the use of

fluoridated water, yet is most often associated with ingestion of toothpaste.¹¹ According to a recent study using National Health and Nutrition Examination Survey (NHANES) data of 2011-12, the prevalence of dental fluorosis (very mild and above) was as high as 61.3% in the United States.¹²

Social media's influence in the dissemination of information and misinformation has been noted in the literature, but research on the topic of fluoride in social media is sparse. In 2014, Mertz and Allukian found that anti-fluoridation sentiments dominated Twitter, Facebook, and YouTube, and overall exceeded pro-fluoridation content.¹³ Seymour et al. investigated anti-fluoride network sociology using conversations surrounding sample publications, and found that this network of individuals were more connected than overall users and that they had a 50% chance of encountering

messages that were negative and not based on data from the sample publication.¹⁴

YouTube is a popular social media site that uses videos to communicate, with over one billion users worldwide.¹⁵ There is a gap in the literature pertinent to the content of fluoride-related YouTube videos. Understanding what type of information about fluoride is being disseminated on social media can help public health practitioners when assessing concerns of fluoride and identify needs for educating the public. The aim of this study was to describe the characteristics of the most widely viewed fluoride-related videos on the video sharing website YouTube, and to compare the content of videos uploaded from different sources.

Methods

Data Collection

The term “fluoride” was searched on YouTube.com on October 20, 2016. Videos were sorted by their total number of views. The top 100 videos in English were retrieved as a sample for analysis. Videos in other languages were excluded. Three additional videos that did not pertain to human health, but rather focused on liquid fluoride thorium reactors were also excluded. In addition to the universal resource locator (URL) of the videos, meta-data of the videos were also collected, including the length of each video (in minutes), the total number of views, and the date of upload.

Manual Coding of Videos

The sample of the 100 most widely viewed fluoride-related videos were manually coded for their source and a delimited scope of content. The three source categories were: “consumer” (a member of the lay public without any health-related professional credentials who uploads a video to provide information on the topic of fluoride), “professional” (a health professional with qualifications to provide information on this topic, such as a dentist or dental hygienist), and “media” (such as episodes from television shows or documentaries and content that originates from Internet-based media outlets). Based on online information provided by the American Dental Association and other sources on fluoride,¹⁶⁻¹⁸ the following content categories were created: community water fluoridation programs; fluoridation of toothpaste; the need for training of health personnel; the need for parent awareness; fluoride supplements; benefits of fluoride on teeth; fluoride does not benefit teeth; too much fluoride is negative; dangers of fluoride; specific dangers to the body; danger in children ages 1 to 5; fluoride is poisonous; conspiracy theory; treatment of fluorosis; and removing fluoride from the body.

Statistical Analysis

All statistical analysis was performed using R statistical software, version 3.2.3.¹⁹ Continuous variables in this dataset (number of views and length of videos) were first analyzed using the Kruskal-Wallis test to look for differences of the continuous variables across the three sources of upload. The number of views and length of videos were also analyzed for pairwise correlations using Spearman’s rho test. Statistical significance was determined at the level of $\alpha=0.05$.

Each content category was a binary variable, with “0” for no (the video did not meet the criteria for that category) and “1” for yes (the video met the criteria for that category). An odds ratio of each type of source uploading in a specific content category was then calculated, using “consumer” as the reference category. Univariate logistic regression analysis was performed for each of the manually coded binary content categories as the outcome variable, with the source of the video as the predictor variable.

Ethical approval

The Institutional Review Board at William Paterson University deems all studies that do not involve human subjects to be exempt. The Institutional Review Board at the Teachers College, Columbia University approved this study.

Results

Of the 100 most frequently viewed, English language fluoride-related videos, 68 were consumer-generated, 14 were professional, and 18 were media videos. One video had a title in both Spanish and English, but the video was in English, with a Spanish subtitle. Table I provides descriptive statistics for the total number of views, number of views per day and video length. Collectively, the videos in this dataset were viewed a total of 14,047,906 times. Videos uploaded by a consumer source had 9,737,845 views (69.32%), followed by media videos (2,572,328 views, 18.31%) and professionally sourced videos (1,737,733 views, 12.37%). The distribution of the number of views per day was skewed, with a mean of 111.01 and a median of 56.54. Some of the most frequently watched videos were in the consumer category (e.g., the video with 648.87 views per day). Professional videos had a lower median of views per day posted on-line (32.61) as compared to consumer (57.92) and media (58.96) videos. Median of the length of the videos was 6.12 minutes. No difference was found between the videos of the aforementioned sources in terms of number of views ($\chi^2=1.467$, $p=0.4802$), views per day ($\chi^2=1.701$, $p=0.4272$) or length of videos ($\chi^2=2.950$, $p=0.2288$). No correlation was found between the number of

Table I. Descriptive statistics for number of views and length of videos by source category of 100 most widely watched English language fluoride-related YouTube videos.

	Consumer (n=68)	Professional (n=14)	Media (n=18)	Overall (n=100)
Total number of views				
Mean [SE*]	143,203.6 [16,789.88]	124,123.8 [26,873.91]	142,907.1 [21,969.32]	140,479.1 [12,584.36]
Median	82,945.5	70,699	128,225.5	93,778
Range	39,418 – 718,943	46,054 – 358,655	46,222 – 445,189	39,418 – 718,943
95% CI**	109,690.9 – 176,716.3	66,066.24 – 182,181.3	96,555.9 – 189,258.3	115,509 – 165,449.2
Total (%)	9,737,845 (69.32)	1,737,733 (12.37)	2,572,328 (18.31)	14,047,906 (100)
Number of views per day				
Mean [SE]	129.50 [18.26]	63.54 [16.29]	78.04 [12.69]	111.01 [13.07]
Median	57.92	32.61	58.96	56.54
Range	12.64 – 648.87	23.95 – 239.86	20.80 – 220.61	12.64 – 648.87
95% CI	93.06 – 165.94	28.35 – 98.74	51.26 – 104.83	85.08 – 136.94
Length of video (minute)				
Mean [SE]	6.64 [0.65]	6.95 [1.22]	8.30 [1.15]	6.98 [0.52]
Median	5.34	6.58	8.31	6.12
Range	0.47 – 21.88	0.47 – 14.88	0.9 – 14.98	0.47 – 21.88
95% CI	5.34 – 7.94	4.30 – 9.59	5.88 – 10.71	5.96 – 8.01
Total (%)	451.67 (64.68)	97.25 (13.93)	149.35 (21.39)	698.27 (100)

*SE: Standard error.

**CI: Confidence interval.

views and video length (Spearman's rho=0.1066, p=0.1455), or between number of views per day and video length (Spearman's rho=0.0619, p=0.2704). As expected, a strong correlation was found between views per day and the total number of views (Spearman's rho=0.7225, p<0.0001).

Table II presents frequencies of each content category grouped by upload sources. Of the 100 videos analyzed, 89 discussed community water fluoridation and 52 mentioned fluoridation of toothpaste. A total of 11 mentioned the need for training of health personnel with regard to fluoridation. Six videos mentioned the need for parent awareness, and only three videos mentioned the need for fluoride supplements.

While 44 videos mentioned the benefits of fluoride on teeth, 20 videos claimed that fluoridation offers no benefit to the teeth, and 40 videos mentioned that too much fluoride has negative effects. Seventy-five of the videos mentioned the dangers of fluoride, 50 mentioned specific dangers that fluoride can cause, and 31 mentioned the dangers of fluoride

in children ages 1-5 years old. Fifty-five videos mentioned that fluoride is poisonous. Thirty-two percent (32/100) of videos mentioned a conspiracy theory. Twenty-nine mentioned the need for treatment of fluorosis, and 22 discussed removing fluoride from the body once it is consumed (Table II).

Using consumer-generated videos as the reference category, the odds ratios of professional videos and media videos showing certain categories of content were obtained (Table III). Univariate logistic regression resulted in significant differences for six content categories. Compared with consumer-generated videos, videos uploaded by a professional source were 9.69 times as likely to mention the benefits of fluoride on teeth (Odds ratio, OR=9.69, p=0.005), 15.52 times as likely to mention fluoridation of toothpaste (OR=15.52, p=0.010), 3.44 times as likely to mention the dangers of fluoride use in children 1-5 years old (OR=3.44, p=0.041), 3.52 times as likely to mention that too much fluoride is negative for the teeth (OR=3.52, p=0.040), and 5.04 times as likely to mention the need for

Table II. Frequencies (and column percentage) of each binary content category of the 100 most widely watched English language fluoride-related YouTube videos by source category.

Content category	Source of Upload (n(% of column N))			
	Consumer (n=68)	Professional (n=14)	Media (n=18)	Total (n=100)
Discusses community water fluoridation programs	58 (85)	14 (100)	17 (94)	89 (89)
Mentions fluoridation of toothpaste	31 (46)	13 (93)	8 (44)	52 (52)
Mentions the need for training of health personnel	5 (7)	4 (29)	2 (11)	11 (11)
Mentions the need for parent awareness	4 (6)	1 (7)	1 (6)	6 (6)
Mentions fluoride supplements	2 (3)	1 (7)	0 (0)	3 (3)
Mentions benefits of fluoride on teeth	26 (38)	12 (86)	6 (33)	44 (44)
Mentions that fluoride does not benefit teeth	13 (19)	5 (36)	2 (11)	20 (20)
Mentions that too much fluoride is negative	23 (34)	9 (64)	8 (44)	40 (40)
Mentions dangers of fluoride	48 (71)	12 (86)	15 (83)	75 (75)
Mentions specific dangers to the body	31 (46)	10 (71)	9 (50)	50 (50)
Mentions danger in children 1-5 years old	19 (28)	8 (57)	4 (22)	31 (31)
Mentions that fluoride is poisonous	35 (51)	8 (57)	12 (67)	55 (55)
Mentions a conspiracy theory	24 (35)	4 (29)	4 (22)	32 (32)
Mentions treatment of fluorosis	25 (37)	0 (0)	4 (22)	29 (29)
Mentions removing fluoride from body	19 (28)	1 (7)	2 (11)	22 (22)

*If all videos belong to one category of contents (i.e., all “Yes”s or all “No”s), then the other category has zero cell count.

training of health personnel (OR=5.04, p=0.032).

Discussion

Findings from this study indicate that fluoride is a prevalent topic on the YouTube platform, with the collective number of video views included in this sample reaching over 14 million. Many of these popular videos were uploaded by consumers, and had an anti-fluoride sentiment. Across all sources of upload, more videos mentioned the dangers of fluoride than the benefits of fluoride. This research is consistent with the findings of others, which have indicated that there is an anti-fluoridation attitude present on social media.^{13,14} In this sample of videos, there was a lack of emphasis on the need to train health care personnel (i.e. dentists, dental hygienists, pediatricians, etc.) about issues related to fluoridation, and a lack of emphasis on the need to increase parents’ awareness about the safety and efficacy of using fluoride properly to prevent the occurrence of dental caries in their children.

Controversy about water fluoridation has a long history in the United States¹⁹ and continues to persist in the both the United States as well as abroad.²⁰⁻²² Social media can play an influential role in supporting groups who are for or against a particular issue and is likely to play an increasingly important role related to support or opposition for fluoridation of public water. Seymour and colleagues illustrated how social media may influence consumers’ attitudes and behaviors and can facilitate connectedness and engagement around opposition to water fluoridation.¹⁴

Nearly 60% of all adults have used the Internet to search about a health issue, about half of which report having read about another person’s medical condition online.²³ Roughly one in five adults have watched a video about a medical issue online.²⁴ In one study, findings indicate that of those who use the Internet, over half are searching about issues for another person.²⁵ Caregivers are often the ones seeking information.²⁵ Fluoride use is an issue that has been debated and discussed in social media forums, and anti-fluoridation movements continue to generate a great deal of discussion. Hence, parents seeking information for their children regarding fluoride may be exposed to information that is inconsistent with current science and recommendations by multiple professional organizations and governmental agencies.¹⁻⁹ Studies on YouTube video content on a variety of topics ranging from vaccination^{26,27} to cancer screening^{28,29} have identified videos discouraging viewers from practices that have been recommended by public health agencies. This has been further confirmed by a review of YouTube studies, which has recommended proceeding with caution when using this medium for patient education purposes.³⁰

Table III. Odds ratios of Professional and Media sources uploading the 100 most widely watched English language fluoride-related YouTube videos compared to Consumer-generated videos.

Content Category (Reference category: Consumer)	Odds Ratio (95% CI)	p-value	Content Category (Reference category: Consumer)	Odds Ratio (95% CI)	p-value
Discusses community water fluoridation programs			Mentions dangers of fluoride		
Professional*	-	-	Professional	2.50 (0.51, 12.20)	0.257
Media	2.93 (0.35, 24.55)	0.321	Media	2.08 (0.54, 8.00)	0.285
Mentions fluoridation of toothpaste			Mentions specific dangers to the body		
Professional	15.52 (1.92, 125.35)	0.010	Professional	2.98 (0.85, 10.46)	0.088
Media	0.95 (0.34, 2.72)	0.931	Media	1.19 (0.42, 3.38)	0.739
Mentions the need for training of health personnel			Mentions danger in children 1-5 years old		
Professional	5.04 (1.15, 22.02)	0.032	Professional	3.44 (1.05, 11.23)	0.041
Media	1.58 (0.28, 8.88)	0.607	Media	0.74 (0.22, 2.52)	0.627
Mentions the need for parent awareness			Mentions that fluoride is poisonous		
Professional	1.23 (0.13, 11.93)	0.858	Professional	1.26 (0.39, 4.01)	0.699
Media	0.94 (0.10, 8.98)	0.958	Media	1.89 (0.63, 5.60)	0.254
Mentions fluoride supplements			Mentions a conspiracy theory		
Professional	2.53 (0.21, 30.10)	0.460	Professional	0.73 (0.21, 2.59)	0.630
Media*	-	-	Media	0.52 (0.16, 1.77)	0.298
Mentions benefits of fluoride on teeth			Mentions treatment of fluorosis		
Professional	9.69 (2.01, 46.81)	0.005	Professional*	-	-
Media	0.81 (0.27, 2.41)	0.702	Media	0.49 (0.15, 1.66)	0.252
Mentions that fluoride does not benefit teeth			Mentions removing fluoride from body		
Professional	2.35 (0.67, 8.20)	0.180	Professional	0.20 (0.02, 1.62)	0.131
Media	0.53 (0.11, 2.59)	0.432	Media	0.32 (0.07, 1.54)	0.156
Mentions that too much fluoride is negative					
Professional	3.52 (1.06, 11.73)	0.040			
Media	1.57 (0.54, 4.50)	0.406			

*Zero cell count in the category resulted in invalid odds ratio estimates and standard errors, thus the corresponding p-values were not meaningful.
CI: Confidence interval.

This study had several limitations. Analysis was limited to the 100 most viewed English-language fluoride-related videos on YouTube. It is acknowledged that this was an arbitrary cutoff point for the sample selection, which was based on prior studies.³¹⁻³⁵ Sampling of videos was confined to English, given the language abilities of the coders. However, limiting by language does not allow for a full picture of what is available on YouTube on the topic of fluoride. The cross-sectional design of the study limits the ability to generalize the findings over time. Given the popularity of YouTube, uploads occur on a daily basis, and view counts are changing continuously. Additionally, demographic information on income, education, and age of those who viewed these particular videos is unknown to the researchers. Future research is warranted on the characteristics of people seeking information about fluoride, and in particular, the negative

aspects of fluoride. Further, only a delimited scope of content was coded and analyzed. Despite these limitations, this study begins to offer some insights into an important topic affecting oral health in the United States and beyond.

Conclusion

Among the 100 most popular English-language fluoride videos on YouTube, there were many more videos uploaded by consumers as compared to professionals. Widely-viewed fluoride-related information on YouTube has an anti-fluoride sentiment, focusing more on the dangers of fluoride rather than the benefits. These data suggest that finding ways to conceptualize and produce videos that attract views is challenging for professionals attempting to disseminate information about the benefits of water fluoridation. Given the widespread reach of YouTube, improving the understanding

of how to communicate accurate information in ways that are acceptable and accessible to at risk audiences warrants consideration as an oral public health research priority.

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