Access to Oral Medicine: Perceptions of Washington State dental providers on using telehealth to deliver oral medicine specialty treatment to their patients

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Abstract

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Background: Telehealth has provided increased specialty access to patients and healthcare providers; however, it is not currently being utilized to deliver oral medicine. In this study, we aim to assess the telehealth related perspectives of licensed oral health providers in the State of Washington and their likelihood to utilize telehealth for oral medicine services.

Methods: A cross-sectional, confidential, online survey study was performed with data collected via REDCap©. Emails were distributed to 8,427 licensed dentists and dental hygienists provided by the Washington State Department of Health public records. Analyses included descriptive statistics, means and standard deviations, as well as a hierarchical multiple regression (HMR) modeled by the COM-B system of the Theoretical Domains Framework.

Results: Among the 927 participants who initiated the survey (11% response rate), 563 (57%) were included in the analysis based on level of completeness. Dental providers indicated a significant lack of adequate access to oral medicine services (M = 2.16, SD =1.70 on a scale from 1 to 5, with 5

indicating Strong Agreement), and a significant likelihood to use telehealth to deliver oral medicine (adjusted: $M = 71.30$, $SD = 25.38$ on a 100-mm VAS scale with 100 being Very Likely). Within the Capabilities, Opportunity and Motivation domains, Motivation was the domain most strongly associated with higher likelihood to use telehealth to deliver oral medicine.

Conclusion: We identified oral health providers' lack of access to oral medicine in Washington State, and are willing to use a telehealth program to deliver oral medicine. Benefits and barriers indicated by providers in this survey may inform the development of a telehealth program where a multidisciplinary team can support other dental providers in the integrated delivery of oral medicine to their patients across Washington State.

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Abbreviations

AEGD - Advanced Education in General Dentistry

BDS - Bachelor of Dental Surgery

CBCT – cone beam computed tomography

COM-B – Capability, Opportunity, Motivation

ENT – Otolaryngologist

GPR - General Practice Residency

HMR – hierarchical multiple regression

HPV - Human Papilloma Virus

IHS – Indian Health Services

OMFP – oral maxillofacial pathology

OMFS – oral maxillofacial surgery

REDCap© - Research Electronic Data Capture

SMS – text/short message service

SPSS - Statistical Package of Social Science

TDF – theoretical domains framework

TMD – temporomandibular disorder

VAS – visual analog scale

WADOH – WA Department of Health

YLD – years lived with disability

Dedication

I dedicate this thesis to my friends and family, especially my parents, David & Jennifer Wong. Dad, you have been with me every step of the way, even if it wasn't always in this world. The lessons you have taught me continue to impact the way I walk my path. Thank you, mom, for your unconditional love, support, and blessings. I continue to learn from your unending strength, warmth and kindness. To Jeremy and Diane, thank you for all of your prayers, laughter, love, and wonderful Judah. To my extended family and friends who help me to cherish the finer things in life. Bel, Jake, and Elsa, it meant so much to have your support at my defense. I am so lucky to have you in my life.

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Introduction

Oral Medicine is defined as "the specialty of dentistry concerned with both the oral care of medically complex patients and with the diagnosis and non-surgical management of medically related disorders or conditions affecting the oral and maxillofacial region."[1] Oral medicine is a critical component of dental education and health care services throughout the world. It serves as an important bridge to several disciplines at the interface between medicine and dentistry. The scope of the specialty is broad, and includes salivary gland disease, oral complications resulting from systemic disease, chemosensory and neurologic impairment of the oral and maxillofacial complex, orofacial pain disorders, temporomandibular disorders, and oral mucosal diseases.[1] The non-surgical nature of the discipline complements the surgical fields to aid in the long-term management of chronic conditions surrounding pain and psychological comorbidities.[2]

According to the Global Burden of Disease investigation from 2017, low back pain, headache pain, and depressive disorders are the leading causes of years lived with disability (YLD).[3] Over one in ten (10.5%) women suffer from temporomandibular joint disorder, and the prevalence in younger to older adults over 70 has been reported to range from 25 – 70%.[4] It is estimated that there is about one Oral Medicine specialist to every one million patients with oral medicine conditions.[5] There are only six Oral Medicine training programs in the United States (U.S.), and the majority of graduates remain in academic positions, rather than primarily in clinical practice.[6] Most universities are located in metropolitan areas, thus direct access to these specialists is somewhat limited outside of these geographic locations, and the need is well documented.[7–9] Many patients seeking oral medicine treatment travel long distances, incurring both travel and treatment costs.

Telehealth comes in many forms, from clinical care or consultations in real-time videoconferencing, to store and forward consultations between health professionals, to distance education of healthcare. The U.S. Health Department of Human Services defines telehealth as "the use of electronic information and telecommunications technologies to support and promote long-distance clinical healthcare, patient and professional health-related education, public health, and health administration."[10]

Although it is a seemingly recent development, the use of telehealth has a history dating as far back as 1879 when the first record of the idea emerged in Lancet, using the telephone to reduce unnecessary office visits.[11,12] The first successful transfer of information occurred in 1948 as a radiology consultation between a roentgenologist and a surgeon.[11,12] More recently, the Department of Veterans Affairs has been one of the leading organizations in the development and utilization of telehealth programs, with 2.1 million telehealth consultations with 677,000 veterans in 2015.[13] In 2016, Kaiser Permanente announced that they had surpassed their in-clinic visits with telehealth visits (52%).[14] Telehealth has demonstrated its success in increasing access to health care, maintaining quality of diagnosis, improving mental health status, adherence and response to treatment, while reducing costs, and visits to the emergency department.[15,16] At the same time, concerns surrounding the true economic impacts, provider burn out and social isolation are considerable factors.[17,18]

With the recent inclusion of the telehealth code on dentistry and nomenclature in 2017, teledentistry has more potential for utilization with both synchronous and asynchronous applications.[19] Despite these developments, the movement to more widespread adoption of teledentistry remains to be seen. Medical specialties including dermatology, pathology, radiology,

and psychology have utilized successful applications of telehealth for decades.[11,13,20] These fields share many similarities with oral medicine. Telehealth delivered oral medicine may help to facilitate access as an interdisciplinary treatment modality. It has been shown that provider and user involvement is at the crux of successful implementation of information and communication technology.[21] The aim of this study was to collect and assess the perceptions of oral health providers (general dentists, dental specialists, and dental hygienists) in using telehealth to deliver oral medicine and to identify key aspects surrounding the perceived benefits and barriers to its use. Doing so may aid in modeling the relationships between behavioral components relating to telehealth delivered oral medicine and oral health providers' perceived likelihood of utilizing this technology.

The Theoretical Domains Framework (TDF) is a comprehensive, theory-informed approach to identifying determinants of behavior. It was developed within behavioral and implementation science and separates 128 key constructs from 33 selected theories into 19 domains.[22] It has been used across several healthcare systems to explain implementation problems and inform implementation interventions.[23] The COM-B system is a newer framework developed from the TDF that involves three essential conditions in understanding Behavior: Capability, Opportunity, and Motivation. A behavioral change wheel relates these core conditions to the 19 TDF domains. Please see Appendix A. for more information. [22,24,25] Although this framework is used more in interventions, we wanted to incorporate the essential conditions as a preliminary step to inform using TDF for future telehealth delivered oral medicine intervention.

The primary study question we posed was: **Among licensed oral health providers in the state of Washington, how strongly will they indicate their likelihood to support utilization of telehealth to deliver oral medicine in a cross-sectional online survey?** (see Appendix B. for our PECOS breakdown)

The hypotheses addressed included:

Hypothesis #1: Oral health providers will indicate a significantly stronger than neutral likelihood to utilize telehealth to deliver oral medicine when resources are available.

Hypothesis #2: The survey will not act as an intervention on oral health providers' self-reported likelihood to utilize telehealth to deliver oral medicine.

Hypothesis #3: Oral health providers will report a less than neutral "adequacy of access to oral medicine."

Hypothesis #4: Behavioral variables related to the Capability, Opportunity, and Motivation to use telehealth to deliver oral medicine will be associated with higher likelihood to use of telehealth to deliver oral medicine.

Methods

Study Design

This was a cross-sectional survey study with confidential data collected electronically via REDCap©[26,27]. Institutional Review Board approval was obtained by the University of Washington Human Subjects Division prior to administering the survey. We followed the recommendations for reporting internet e-Surveys (CHERRIES - Appendix C).[28]

Population Sampling and Recruitment

The population of interest were all licensed dentists and dental hygienists in Washington State. We obtained public records from the Washington State Department of Health (WADOH) for the recruitment of any licensed dentists and dental hygienists with the status of "active" or "military". Exclusion criteria were any licensees with a status other than "active" or "military". In addition, licensees that did not provide an email during registration, or provided an invalid email address were excluded.

Potential participants were invited to participate by email. The email included a cover letter containing the background of the study, confidentiality statement, and explanation that the survey would include a patient scenario for which the diagnosis and management considerations from the perspective of an oral medicine specialist would be revealed at the completion of the survey. Additional marketing of the survey included the distribution of flyers at the Pacific Northwest Dental Conference (June 20-22, 2019). Three additional reminder emails were sent on days 12, 19, and 26 of the study. The survey participation window was from June 20th to July 22nd, 2019.

Data Collection

The questionnaire development was guided by a literature review. The majority of questions were identified and adapted from two previous survey studies related to telehealth, [29,30] and were mapped to the COM-B system. The complete questionnaire underwent prelaunch cognitive (i.e., "think aloud") testing and revision with one dentist. Usability and technical functionality of the questionnaire was then tested by four volunteers (two dentists and two dental hygienists). The questionnaire consisted of seventy-five questions (75) for dental hygienists and seventy-eight (78) questions for dentists. Most response options were four- or five-point Likert-type scales. Other forms of responses included 100-mm visual analog scales (VAS), multiple choice, and limited subjective fields.

The questionnaire began with a question to select the provider that best described the participant at the current time: "*Dentist*" or "*Hygienist*". Branching logic was then used throughout the survey based on the provider type in order to customize questions to be more relevant. The questionnaire was separated into six sections as follows:

1. Current telehealth use (7 questions)
2. Oral medicine experience and need (13 questions)
3. Patient case scenario with the likelihood of using specific telehealth modalities for the case (9 for dental hygienists including a mucosal related case, 10 for dentists including an orofacial pain case)
4. Perceptions of the benefits and barriers to telehealth (20 questions)
5. Comfort with technology (12 for dental hygienists, 13 for dentists)
6. Demographics consisting of *provider type*, *additional training*, *dental school graduation year*, *gender*, *age-range*, *race* and *ethnicity*, and *multilinguality*. Clinical demographics (4) included *practice setting*, *practice type*, *methods of reimbursement*, and *translation frequency* (12 questions)

Please see Appendix D. for the full survey.

We developed a primary outcome question which read, "*If formal telehealth resources were available to deliver oral medicine to your patients, how likely (supportive) would you be (for your office) to use them?*"; this was assessed using a 100-mm VAS with "*Very likely*", "*Neither likely nor unlikely*", and "*Very unlikely*" as anchor points. The identical question was given at both the beginning and the end of the questionnaire in order to measure whether participation in the survey posed as an intervention to increase or decrease respondents' reported likelihood to use telehealth to deliver oral medicine.

Analyses

Survey responses were summarized using summary statistics (including means, standard deviations, frequencies, and percentages) reported by RedCap©.[27,31] The Statistical Package of Social Science (SPSS) version 19 was used for the remaining analyses.[32] Statistical significance was defined at a 95% level of confidence, with alpha set at .05.

To test our first and third hypotheses, we conducted one-sample t-tests set to the midpoint of the responses. For the first hypothesis: Oral health providers will indicate a significantly stronger than neutral *likelihood to utilize telehealth to deliver oral medicine* when resources are available, therefore we used the primary outcome question, and set the chance value to 50. To test the third hypothesis: Oral health providers will significantly indicate a less than neutral adequacy of access to oral medicine, we tested the responses to the 5-point Likert-type statement, "*I have adequate access to oral medicine specialty services.*", and set the chance value to 2.5. A lower number would indicate more disagreement to the statement.

To test our second hypothesis: The survey will not act as an intervention on oral health provider's *likelihood to utilize telehealth to deliver oral medicine* response, we performed a paired-sample t-test. Non-

significant variance between the initial and final primary outcome measurements would indicate that the survey did not act as an intervention on the reported likelihood of participants to use telehealth to deliver oral medicine.

To test our last hypothesis, we conducted a hierarchical multiple regression (HMR), using the *likelihood to utilize telehealth to deliver oral medicine* response as the primary outcome. Due to the non-significant variance between the initial and final measurements, an average between the two measurements was used as the dependent variable. See Appendix E. for additional HMR details.

Independent Variables

General demographic variables were used as the control variables including *dental hygienists*, *specialist, male*, *non-white*, *age-range*, *rural*, and *years since graduation*. The remaining questions were assigned within the three COM-B domains. Each survey question was matched with the standard definitions of each domain:[24]

- Capabilities - physical and psychological ability, knowledge and skill.
- Opportunity - all factors that lie outside the individual that make the behavior possible or prompt it.
- Motivation - brain processes that energize and direct behavior, habitual processes, emotional responding, & analytical decision-making.

The answer to each question was then weighed with a score based on its relatedness to current and reimbursable telehealth utilization. For example, among our telehealth questions, an answer of "*clinical e-care website*" received 3 points, "*video conferencing*" received 2 points, and "*e-mail*", "*telephone*", and "*text/short message service (SMS)*" received 1 point.

See Appendix F. for the specific scoring of each question.

A summary of the questions assigned to domains are as follows:

The Capability domain (9 questions) included *current telehealth use* (4), *current radiology use* (1), *performing biopsies* (1), *using adjuncts for detection of neoplasia* (1), *translation types* (1), and their *attitude to the relationship between chronic pain and mental health* (1).

The Opportunity domain (8 questions) included questions about *the number of oral medicine related patients seen per month* (3), *cone beam computed tomography (CBCT) interpretation* (1), *videoconferencing quality* (1), *referral to oral medicine but no access* (2), and their *attitude to their adequacy of access to oral medicine specialists* (five-point Likert-type scale) (1).

The Motivation domain (41 for dental hygienists, 42 for dentists) included the *referral for biopsy* (1), the *likelihood for using specific modes of telehealth* (6), *perceptions of benefits and barriers surrounding telehealth* (20), their *comfort with different types of technology* (12 for dental hygienists, 13 for dentists), and *referral to oral medicine despite having access to any specialty* (2).

Following the patient scenario, the questionnaire asked whether the participant would *treat the patient themselves* ("*in their office*" for dental hygienists) or if they would *refer the patient*, and *to whom they would refer the patient.* Depending on the referral pattern between the two questions, this question was applied to either the Opportunity or Motivation domain; if they did not answer "*oral medicine*" on the first question, but answered "*oral medicine*" once they had access, it was counted toward the Opportunity domain. If they answered "*oral medicine*" to both of the questions, it counted toward the Motivation domain.

Missing Data

We observed three major characteristics related to missing data: 1. the primary outcome questions had a significant number of answers missing; 2. some data seemed to be missing due to attrition from the impact of the length of the survey; 3. other data seemed to be missing at random. Therefore, the missing data was resolved in different three ways. Please see the Appendix G. for details.

Results

Survey Participants

Licensees from the WADOH public records consisted of 7,314 dental hygienists and 5,576 dentists. Based on our inclusion/exclusion criteria, 4,232 dental hygienists (58%) and 4,569 dentists (82%) licensees were eligible and invited to participate in the study. Of the 8,801 emails sent, 335 emails (3.80%) were returned as undeliverable. Seventy-eight emails (0.89%) were duplicates due to either multiple providers providing the same email address, or providers who held licenses as both a dentist and a dental hygienist. Thirty-six emails (0.41%) were deemed unique, and 39 (0.44%) duplicate emails were removed. Twenty-eight individuals (0.32%) declined to participate. Of the 8,399 remaining invitations, 927 individuals (11%) initiated the survey. Of these, 16 records (0.19%) contained three or fewer responses and were excluded, producing a final response rate of 10.8%. In total, 527 (6.27%) respondents had a completed survey status indicating they had pressed the submit button at the end.

More than half of our participants (58.4%) were female. Dentists accounted for 64.7% while dental hygienists accounted for 35.3%. The majority of our participants were White (79.1%). The age of our participants was also similar to the general population of dental providers with the majority in middle aged ranges with 24.7% being 26-35 years of age, 24.3% being 36-45 years of age, and 19.4% being 56-65 years of age. Participants aged 21-25, and 66 or above composed 1.1% and 10.5%, respectively. Providers who communicate with patients in more than one language composed 34.0% of our participants. Please see Table 1a. for more details.

Practice settings were primarily urban/metropolitan or suburban, composing 43.3% and 43.5%, respectively. Practices in a rural setting composed 12.5% of our participants. The type of practice

providers worked in were mainly private solo and private group at 49.4% and 32.8%, respectively. Community health/public health organizations, academic, managed care, and military made up 15.9%, 6.6%, 2.0%, and 0.9% respectively.

The most common forms of reimbursements included private insurance and private pay, at 83.1% and 50.6%, respectively. Medicaid, Medicare, and Indian Health Services (IHS) made up 20.5%, 8.1% and 3.6%, respectively. Among the dentists, 3.9% had received international Bachelor of Dental Surgery (BDS) training, 8.3% attended an Advanced Education in General Dentistry (AEGD), 10.2% had undergone General Practice Residency (GPR) training, and 27.8% indicated other specialty training. See Table 1b. for details

Results of Hypotheses

We first hypothesized that oral health providers would indicate a significantly stronger than neutral likelihood to use telehealth delivered oral medicine when resources are available. The median responses to the initial and final primary outcome questions were 80/100 and 79/100 respectively. The one-sample t-test revealed the likelihood of using telehealth delivered oral medicine was significantly greater than the neutral level of 50 with a large effect with both our unadjusted data and adjusted values (unadjusted : $M = 72.58$, $SD = 25.58$, $t(530) = 20.34$, $p < 0.001$, $d = 0.884$, adjusted: $M = 71.30$, $SD = 25.38$, $t(530) = 20.34$, $p < 0.001$, $d = 0.840$). Therefore, the data support our hypothesis that participants indicated a significantly stronger than neutral likelihood of using telehealth delivered oral medicine.

Secondly, we hypothesized that our questionnaire would not act as an intervention on oral health providers' likelihood to use telehealth delivered oral medicine. The paired-samples t-test releveled

that there was no significant difference from the initial (M = 74.6, SD = 26.9) and final (M = 75.4, SD = 25.3) questions (t(421) = -0.718, p = 0.473, d = 0.035). Although the effect was weak, the results support our hypothesis that the survey itself did not pose as a significant intervention in the likelihood of telehealth delivered oral medicine.

Thirdly, we hypothesized that oral health providers would significantly indicate more disagreement than neutral with the statement: "*I have adequate access to oral medicine*". The one-sample t-tests revealed the level of agreement to having adequate access to oral medicine was less than the neutral level of 2.5 with a small effect (with smaller numbers indicating more disagreement: M = 2.16, SD =1.70), t(-6.017) = , p < 0.001, d = 0.200). Therefore, the results support our hypothesis that there is statistically significant disagreement to having adequate access to oral medicine.

Finally, we hypothesized that higher scores on the behavioral variables related to the Capability, Opportunity, and Motivation domains of the COM-B system would be associated with a higher likelihood to use of telehealth delivered oral medicine. The results of our four-stage HMR supports our hypothesis. In addition, each model accounted for significant association both independently and cumulatively. Model 1: demographics with four variables (p < 0.15): *provider type-dental hygienist*, *gender-male*, *race-non-white*, and *practice setting-rural accounted* for 4.2% of the association (R = .226, Adj R^2 = .042, F (3,548) = 8.981, p < .001). Model 2: when adding the Capability domain with three added variables (p < 0.15): translation type, current telehealth use score, and the knowledge of chronic pain related to mental health accounted for 7.0% of the association (R = .284, Adj R^2 = .070, F (3,545) = 6.640, p < .001). Model 3: when adding the Opportunity domain with two added variables (p < 0.15): radiology use, and inadequate access to oral medicine accounted for 9.5% of the association (R = .329, Adj R^2 = .095, F (2,543) = 8.527, p < .001). Model 4: when adding the

Motivation domain with five added variables ($p < 0.15$) accounted for 47.4% of the association ($R = .698$, Adj $R^2 = .475$, $F(5,538) = 79.704$, $p < .001$). (Table 2a.)

Eight variables demonstrated significant association ($p < 0.05$) in the final model:

1. dental hygienists indicated a 7.71-point greater likelihood than dentists.

2. For Likert-scale level of disagreement in adequacy in access to oral medicine, 1.38 more likelihood points were indicated.

3. Providers who indicated a referral of the patient case to oral medicine when they had access initially, as well as access to any specialty indicated 3.00 greater likelihood points.

4. Providers who referred to oral medicine for biopsies indicated 1.95 greater likelihood points

5. Providers who agreed with telehealth delivered oral medicine benefits and disagreed with telehealth delivered oral medicine barriers indicated 1.298 greater likelihood points

6. Providers who were more comfortable with technology indicated 0.18 greater likelihood points.

Two variables demonstrated less likelihood:

7. Providers from a rural practice setting indicated 5.53 less likelihood points than providers in other settings, and

8. Providers who indicated stronger likelihood to use specific modes of telehealth indicated 0.37 less likelihood points.

See Table 2b. for details.

The HMR results between the unadjusted primary outcome with the adjusted primary outcome results were negligible. The only statistically significant difference was that the variable - *current video quality* had a $p < 0.15$, in the adjusted primary outcome, but not in the unadjusted primary outcome and was therefore retained in the adjusted primary outcome HMR, but not in the unadjusted primary outcome HMR. This variable however did not yield a significant coefficient in the final adjusted HMR. Please see Appendix E. for details of the full HMR.

Additional analyses were done to investigate the finding of less likelihood for providers form a rural practice setting. A further look at the demographics between rural and non-rural revealed similar composition patterns except with the percentages for age. Among the providers who practice in non-rural areas, more respondents (40.5%) were in the age range of 36-45 years compared to 24.7% of in this age range who practice in a rural setting. The other ranges did not have as large of a difference. Also, the comfort in technology mean was lower among providers in a rural setting vs. non-rural (M = 3.05, SD = 0.59 vs. M = 3.16, SD = 0.59 respectively). Cross analysis of the two factors together found that the comfort in technology among providers 36-45-years of age who practice in rural versus non-rural areas, revealed a much lower mean among providers in the rural setting (M = 2.86, SD = 0.66 vs. M = 3.23 SD = 0.61). Although this information is not necessarily representative of the general population (n=17), it helps to shed light on the lower association in the HMR analysis. See Appendix H. for details.

Current oral medicine Experience and Need

The majority of dentists and dental hygienists reported currently seeing 1-4 patients per month, with an oral medicine related condition (49.3%, 56.8% respectively). When calculating the possible minimum and maximum number of patients dentists and dental hygienists reports represent, the averages were 3.36 (SD = 3.66) and 3.55 (SD = 4.09) respectively, with one of the following conditions: *mucosal changes or lesions (i.e. white patches, persistent ulcers, etc.)*, *orofacial pain (i.e. temporomandibular disorder (TMD)*, *atypical facial pain, neuropathic pain, etc.)*, *oral manifestations or complexity of systemic disease (i.e. oncological, sleep disorder, etc.)*. Orofacial pain was the condition reported most with dentists reporting 2.69-5.02 (SD = 3.33, 3.54) and dental hygienists reporting 3.93 – 6.29 (SD = 4.10, 3.92) patients per month. Please see Table 3. for details of all oral medicine experience and need responses.

Twenty-seven percent (27.2%) of dentists and 15.6% of dental hygienists reported using some form of adjunct for oral neoplasia. Of these, 43.4% dentists and 10.9% dental hygienists reported using Cytology, 13.1% dentists and 3.6% dental hygienists reported using toluidine blue, 38.4% dentists and 26.4% dental hygienists reported using fluorescence, and 26.3% dentists, and 10% dental hygienists reported "*other*". dentists' subjective responses for other included "*biopsy*" (1.92%), "*referral*" (0.82%), "*velscope*" (0.82%), "*visual inspection*" (0.82%), "*high magnification*" (0.01%), and "*salivary testing*" (0.01%). dental hygienists did not respond with other adjuncts.

Excluding dentist specialists that routinely do biopsies (oral maxillofacial pathology (OMFP), oral maxillofacial surgery (OMFS), pediatric dentistry, periodontics, oral implantology, and oral medicine), 65.4% of dentists reported *never* taking and 2.6% reported *always* taking their own biopsies. A large majority of dentists *refer to OMFS* for biopsies (94.7%), whereas 18.6% *refer to a periodontist*, 18.3% *refer to an oral medicine*, 13.6% *refer to an otolaryngologist* (ENT), 2.2% *refer to another general dentist*, and 2.2% marked *other*. Other professions that were written in included "oncologist", "pathologist", and "UW".

Excluding specialists who routinely diagnose with CBCT (the above specialists in addition to endodontists and orthodontists), the majority of dentists (93.9%) indicated that they have digital radiography, including a panoramic unit (79.4%). Of the 22.6% of providers indicating having CBCT in their office, the majority (80%) report providing their own interpretations. Forty percent (40%) report referring the CBCT to an oral radiologist, while 12.9% refer to another general dentist.

Among the questions related to mental health, 34.8% of dentists and 6.1% of dental hygienists report having referred patients from their office to a mental health provider. Of these, the majority

(80% DE and 66.7% dental hygienists) have referred between 1-5 patients. Among dentists, 27.8% report referring 6-20 patients, and 7.9% have referred 21-50 patients. On their view of the statement "*Mental health and chronic pain are closely related to each other.*" The majority agreed with 35.9% *Strongly Agree*, and 42.8% *Agree*. 19.9% were *neither agree nor disagree*, 1.2% *disagree*, and 0.2% *strongly disagree*.

Current telehealth Utilization

The majority of dentists have used at least three forms of telehealth. The top five modes they currently use are *store and forward via e-mail* (73.4%); *consultation with specialist without patient present via telephone* (64.6%); *consultation with specialist without patient present via email* (62.1%); *real-time conference with patient present via telephone conference* (39.0%); and *real-time conference with patient present via e-mail* (36.3%).

dental hygienists indicated the top five modes they currently use are *consultation with dentists without patient present* (30.7%); *real-time conference with patient present via telephone conference* (25.6%); *real-time conference with patient present via e-mail* (24.1%); *consultation with dentists without patient present via telephone* (20.6%); and *real-time conference with patient present via Text/Short Message Service (SMS)* (15.1%). Please see Table 4. for details.

Provider Comfort in Using Technology

The top three types of technology providers report being the most comfortable with were *browsing the internet for information about dentistry* (M = 3.78, SD = 0.57); *receiving continuing education electronically* (M = 3.70, SD = 0.61); and *scheduling patient appointments on the computer* (M = 3.61, SD = 0.85). The technology that providers were least comfortable with were all of the items that related with common telehealth related technology: beginning with the least comfortable, they were: *using*

telehealth to treat patients (M = 2.11, SD = 1.03); *using telehealth as a patient yourself* (M = 2.44, SD = 1.05); *using telehealth to refer patients* (M = 2.49, SD = 0.98); and *using video conferencing software* (M = 2.59, SD = 0.99). Please see Table 5. for details.

Perceptions and Likelihood for telehealth delivered oral medicine

When comparing the likelihood providers are to use different modalities of telehealth, the most likely identified by both providers was *store and forward on a secure telehealth website* (M = 2.97, SD = 1.27); *use the phone to consult without patient present* (M = 2.97, SD = 1.22); and *provide information to patient to use a secure telehealth delivered oral medicine website* (M = 2.70, SD = 1.35). *Using speaker phone to consult with the patient present* was indicated as an unlikely scenario by both providers (M = 1.69, SD = 1.41). Interestingly, there was disagreement between dentists and dental hygienists about having the patient present or not and their likelihood to use videoconferencing to consult. dentists preferred consulting in the presence of the patient ($M_{present}$ = 1.93 (SD = 1.48), M_{absent} = 1.72 (SD = 1.54)); while dental hygienists preferring consulting in the absence of the patient (M_{absent} = 2.62, (SD = 1.33), $M_{present}$ = 2.56 (SD = 1.28)). Please see Table 6. for details

The perceptions to the benefits and barriers of telehealth delivered oral medicine were supportive of using the technology. The top three most agreed upon statements were benefits: "*telehealth delivered oral medicine will fill an existing service gap.*" (M = 2.99, SD = 0.88), "*telehealth delivered oral medicine will improve timeliness of appropriate patient care.*" (M = 2.96, SD = 0.84), and "*telehealth delivered oral medicine will improve access to appropriate patient care.*" (M = 2.94, SD = 0.80). The least agreed upon statements were barriers: "*telehealth delivered oral medicine will jeopardize patient privacy.*" (M = 1.30, SD = 0.83), "*telehealth delivered oral medicine will be difficult for me to learn to use.*" (M = 1.34, SD = 0.84), and "*telehealth delivered oral medicine will hinder dentist-patient relationships.*" (M = 1.35, SD = 0.83). Three beneficial

statements had a lower than neutral mean indicating slight disagreement. They included "*telehealth delivered oral medicine will improve the overall patient experience in my office."* (M = 2.42, SD = 0.84), "*telehealth delivered oral medicine will help to improve productivity of dental staff.*" (M = 2.40, SD = 0.95), and "*telehealth delivered oral medicine will help to avoid a face visit by an oral medicine specialist.*" (M = 2.39, SD = 0.87). Please see Table 7. for details.

Open-ended Comments or Questions

One hundred and sixty-one participants (28.6%) contributed a qualitative comment or question in the open-ended text box at the end of the questionnaire. Many participants agreed with using telehealth to deliver oral medicine, while some disagreed. Among the concerns, in order of most common to least, included cost or insurance coverage, time consumption, lacking a physical contact exam, the availability of the oral medicine specialists, social isolation, liability, quality of technology, and privacy. Factors mentioned that providers were interested in gaining through using telehealth delivered oral medicine included: access to oral medicine, access for patients with low income, patients with disabilities, patients in the minority, continuity of care, and patient compliance. Some indicated previous experience with telehealth and were proponents. Others stated that they were less familiar, while some stated that they had never encountered telehealth prior to the survey.

Discussion

To the best of our knowledge, this is the first study to assess the perceptions of oral health providers in using telehealth to deliver oral medicine. Our results demonstrate, if given the resource, oral health providers in Washington State are likely to use telehealth to deliver oral medicine with a strong statistical significance. The respondents also indicated they have a lack of adequate access to oral medicine, which confirms the need for more access to the oral medicine specialty.[7–9] Although our survey did not act as an intervention on participants' likelihood to use telehealth, we did not measure their attitudes post-survey, after providing additional information about the diagnosis and treatment recommendations. Due to the fact that the next steps for managing the case(s) were well within the scope of a well-informed general dentists and dental hygienists, we hypothesize that providing this information may have demonstrated the potential for education and practice building opportunities.

The results of our HMR demonstrated significance in two different areas. First, the association between demographic variables, Capability, and Opportunity were significant. When the Motivation domain was added to the model, it accounted for an almost 4-fold greater variance compared with the addition of each of the other two domains. This is consistent with the fact that our primary outcome was related to participants' attitudes toward telehealth, not their current use of telehealth. Therefore, we observed that factors related to Motivation would explain variation in attitude, more than Capability or Opportunity. On the other hand, actual utilization of telehealth might be associated more strongly with capabilities and opportunities but would need to be demonstrated by future work. Secondly, the HMR supports our final hypothesis that variables related to the COM-B behavioral system would be associated with a higher reported likelihood of telehealth delivered oral medicine use, for which pertained to six out of the eight significant variables. However, we did

identify two factors associated with reduced likelihood. First, addressing the *likelihood for telehealth modes* variable, the results within the *comfort in technology* question revealed that the four least comfortable telehealth modes were also the modes that are the most modern and reimbursable types.[33] This highlights the importance of careful and well planned provision of proper resources for training upon any introduction of more modern telehealth modes.[21] Despite the reduced comfort level indicated, two of the top modes of likely telehealth delivered oral medicine usage were *store and forward on a secure telehealth delivered oral medicine website* and *recommending patients to use the website*. In addition, a high level of support on the benefits and barriers questions suggests the motivation (willingness) to learn. Interestingly, *using videoconferencing to consult with the oral medicine specialist, with the patient present*, was the least likely mode indicated by dentists, but was in contrast, a highly likely mode among dental hygienists. This also highlights the potential for different roles within the dental team in using telehealth delivered oral medicine.[21]

Regarding the negative association among participants who practice in a rural setting and their likelihood to use telehealth delivered oral medicine, this result is the opposite of what we expected. Further analysis of the demographics between providers from rural settings versus non-rural settings revealed differences with the composition in age, specifically among those aged 36-45 years. In addition, comfort in technology was found to be lower among providers from a rural setting compared with providers in a non-rural setting. From a study in a rural area of Australia, investigators found challenges related to acceptance of the need for travel; empowerment and paternalism; and trust and misconceptions about telehealth[34]. Further work in incorporating and training providers from rural areas will be paramount to address the limited access of oral medicine in remote areas.

The number of reported oral medicine patients seen per month was not a very high figure, however, the fact that dental hygienists reported more oral medicine patients than dentists could mean a difference in the focus of each of the providers like we mentioned previously. We also hypothesize that many conditions are under-diagnosed because they are not recognized. Although this accounts for a small subset of our participants, several of the subjective responses for adjuncts (detection aid, but non-essential tool) used to detect neoplasias indicated a lack of knowledge of the definition of an adjunct and included a lack of evidence-based tools. Oral squamous cell carcinoma is one of the most common Human Papilloma Virus (HPV)-associated cancers with an average of 11,000 cancers annually estimated to be HPV-attributable (2000 for females and 9100 for males)[35], although the prognosis of HPV related oropharyngeal cancers is significantly better than others, it is also the only oropharyngeal cancer on the rise.[36,37] Dental providers should become the next line of prevention for HPV related cancers: through not only patient education, but also primordial prevention by administering vaccines.[38,39] However, like some of our responses indicated, it has been shown in other studies that there is an overall lack of knowledge, and an emotional difficulty of nonexperts in verbal communication with patients diagnosed with oral squamous cell carcinoma by professionals.[40,41] This points to the importance and opportunity for the use of telehealth education for both providers to learn didactically, but also to observe and model the conversations experts have with patients.

Many areas of our study demonstrate additional telehealth delivered oral medicine potential as a platform for the interdisciplinary care of patients. The vast majority (94.7%) of our providers indicated sometimes referring patients to OMFS to take biopsies. While the surgical intervention is very important in detecting and potentially excising neoplasias, the potential longer term, non-surgical management and monitoring of conditions is well suited for oral medicine. The two

specialists can work well in concert with the general dentists to provide higher quality multidisciplinary care. Twenty-three percent (22.6%) of the general dentists indicated that they have a CBCT in their office. This was a "select all that apply" question, however, and a large percentage (80%) of these providers report diagnosing their own scans, and 12.9% refer their scans to another general dentist, at least some of the time. Although 40% indicated they refer to an oral radiologist, these numbers beg the question whether the tomographs are being properly interpreted. The American Dental Association has issued recommendations including the proper education and training of dental providers who will be liable for the full volume of the images.[42] While additional details were out of the scope of this study, telehealth delivered oral medicine could help to better incorporate oral radiologists in the ability to identify, diagnose, and treat/manage CBCT detected conditions earlier.

Another area where telehealth can help to facilitate needed integrated and multidisciplinary care is surrounding mental health and chronic pain. Like it was stated in the introduction, chronic pain and depression are among the top leading causes for YLD by the recent Global Burden of Disease Study. Twenty to fifty percent of patients with chronic pain have comorbid depression.[43,44] Yet 21.4% of our participants did not indicate agreement that mental health and chronic pain are related, and it has been demonstrated that mental health is underrecognized among healthcare providers.[45] People who suffer from chronic pain have reduced treatment options for optimal pain control, [46] and they are more likely to develop chronic post-operative pain after surgical procedures.[47,48] It is evaluated that 80% of Americans have some anxiety regarding dental treatment and 5-14% of them feel intense dental anxiety.[49] To go full circle, anxiety and fear about pain are linked to a higher likelihood of developing chronic pain.[50]

Only 34.8% of dentists in our sample had referred their patients to a mental health provider. Of these, 80.0% had only referred 1 to 5 patients before. It has been repeatedly shown in studies that compare telepsychiatry with in-clinic visits that when providing cognitive behavioral therapy, there were no differences between groups measured by numerous factors including Clinical Global Impressions score, appointment and medication adherence, and satisfaction rates.[51] Substance abuse among dental patients has a large impact on both dental and Oral Medicine treatment. Substance use disorder treatment delivered by telehealth has been reported as being underutilized.[52] Telehealth delivered oral medicine could be a platform to connect general dentists and dental hygienists with mental health providers who are specialized in the dental, orofacial, oral-systemic, and substance related concerns with which patients suffer from: providing stress management, dental fears, cancer management counseling, cognitive behavioral therapy for pain and anxiety among other techniques. This multimodal and multidisciplinary approach has been shown to be important to successful management for people with a complex combination of health history and conditions.[53]

Among our qualitative comments, the cost of telehealth, social isolation, and time were the most common concerns. However, studies have demonstrated reduced cost for specialty care to Medicaid patients, while receiving rapid treatment guidance.[54] Rather than social isolation, providers are finding similar or increased adherence to telehealth appointments.[55] The predominantly fee-based reimbursement system in dentistry is no exception for careful and selective ways in utilizing telehealth for many aspects of our multifaceted field. While Washington State has a parity law, it covers only Medicaid, which means when comparing any given service delivered via telehealth with the same service in-clinic, Medicaid must reimburse the same amount. Some states have parity laws that also cover private insurance. It is a dynamic time in healthcare reform in the inclusion of telehealth legislation.[56] With more and more use of telehealth, one can hope more reimbursement

will follow suit, in order to reduce the cost of healthcare for all stakeholders. While direct monetary reimbursement needs to be addressed, additional, more long-lasting value includes continued education, and subsequently practice building and better overall care.

Strengths and Limitations

This study was a descriptive, cross-sectional, online-only questionnaire which comes with its limitations and report bias. A low response rate is routinely observed with whole population sampling, as it has been shown, we trade sampling error for response rate error.[57] It was evident that the length of the survey contributed to attrition, missing questions and possibly survey fatigue. Providers recruited were limited to dentists and dental hygienists, when it would be valuable to collect information on other members of a dental team as well as other non-oral health providers

Regarding the generalizability of our results, although our response rate was low (10.8%), we compared the demographic composition of our respondents with two population sources: WADOH information, and dentist demographics from the Center for Healthcare Workforce. The participant percentages reflected fairly closely with our general population of oral health providers. This may demonstrate our study population as a more representative sample of the overall population than the response rate implies. Please see Appendix H. for the graphic representation.

Future work may include piloting a telehealth delivered oral medicine program with the incorporation of additional health professions, in the interest of the interdisciplinary nature of oral medicine. More investigation of the economic impacts and other potential barriers could contribute toward possible healthcare reform and the well-informed implementation of guidelines to increase the access and ease of using this technology to care for our patients.

Conclusion

The results of our study indicate a significant lack of adequate access to oral medicine services and a significant likelihood to use telehealth to deliver oral medicine. The HMR revealed several significant variables associated with the likelihood to use telehealth to deliver oral medicine. The lower association among providers in a rural setting was especially important. We are interested in using our results toward the careful adoption of telehealth within oral medicine in order to increase access to patients. Connecting dental clinicians with oral medicine specialists will not only provide more comprehensive management of patients but will also enable access to additional education and training to both interested general practitioners, and additional members of the dental team. Due to the complexity and chronicity of many of the conditions treated by an oral medicine specialist, a successful multimodal oral medicine approach also includes integrated access to psychology, oral pathology, oral radiology, oral maxillofacial surgery, otolaryngology, and rheumatology in addition to dental specialties.

Conflict of Interest

The authors report no conflict of interest in this study.

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Table 1a. Individual Characteristics of Participants

	DDS		RDH		Total	
	n	%	n	%	n	%
Provider Type						
Dentist	364	64.7			364	64.7
Dental Hygienist			199	35.3	199	35.3
Gender	**355**	9*	**195**	4*	**550**	13*
Female	134	37.7	187	95.9	321	58.4
Male	220	62.0	5	2.6	225	40.9
Transgender	0	0.0	0	0.0	0	0.0
Gender Non-Binary	0	0.0	0	0.0	0	0.0
I would prefer to self describe	0	0.0	0	0.0	0	0.0
I would prefer not to say	1	0.3	3	1.5	4	0.7
Ethnicity - Hispanic, Latino, or Spanish origin	**360**	4*	**197**	2*	**557**	6*
Yes	17	4.7	7	3.6	24	4.3
No	343	95.3	190	96.4	533	95.7
Race	**356**	8*	**198**	1*	**554**	9*
Native American or Alaska Native	7	2.0	6	3.0	13	2.3
White	260	73.0	178	89.9	438	79.1
Black or African	7	2.0	1	0.5	8	1.4
Asian	71	19.9	10	5.1	81	14.6
Hawaiian or Pacific Islander	6	1.7	2	1.0	8	1.4
Other	13	3.7	4	2.0	17	3.1
I would prefer not to say	10	2.8	9	4.5	19	3.4
Age Range	**364**	0*	**199**	0*	**563**	0*
21-25	0	0.0	6	3.0	6	1.1
26-35	94	25.8	45	22.6	139	24.7
36-45	83	22.8	54	27.1	137	24.3
46-55	64	17.6	45	22.6	109	19.4
56-65	75	20.6	38	19.1	113	20.1
66 or above	48	13.2	11	5.5	59	10.5
Dental school graduation year	**360**	4*	**199**	2*		
	Min	1961	Min	1964		
	Max	2018	Max	2018		
	StDev	14	StDev	13.52		
	Median	2001	Median	2003		
Dentist Training	**363**	1*	**Dental Specialty**		**101**	0*
General Dentistry (DDS, DMD, IDDS)	264	72.7	Dental Anesthesiology		4	4.0
General Dentistry outside of US (BDS)	14	3.9	Dental Public Health		0	0.0
Advanced Education in General Dentistry (AEGD)	30	8.3	Endodontics		12	11.9
General Practice Residency (GPR)	37	10.2	OMF Pathology		2	2.0
Dental Specialty	101	27.8	OMF Radiology		2	2.0
			OMF Surgery		12	11.9
			Orthodontics		22	21.8
			Pediatric dentistry		19	18.8
			Periodontics		14	13.9
			Prosthodontics		8	7.9
			Oral Implantology		1	1.0
			Oral Medicine		11	10.9
			Orofacial Pain		2	2.0

Bolded values represent total in category. * - n missing

Table 1b. Practice Characteristics of Participants

	DDS		RDH		Total	
	n	%	n	%	n	%
Type of practice	**364**	0*	**197**	2*	**561**	2*
Private solo	155	42.6	122	61.9	277	49.4
Private group	127	34.9	57	28.9	184	32.8
Community health/public health organi	71	19.5	18	9.1	89	15.9
Managed care	4	1.1	7	3.6	11	2.0
Military	5	1.4	0	0.0	5	0.9
Academic	32	8.8	5	2.5	37	6.6
Region of practice	**362**	2*	**199**	0*	**561**	2*
Urban or Metropolitan	171	47.2	72	36.2	243	43.3
Suburban	146	40.3	98	49.2	244	43.5
Rural	42	11.6	28	14.1	70	12.5
Other	3	0.8	1	0.5	4	0.7
Most common form of reimbursement	**359**	5*	**198**	1*	**557**	6*
Private Pay	183	51.0	99	50.0	282	50.6
Private Insurance	286	79.7	177	89.4	463	83.1
Medicaid	88	24.5	26	13.1	114	20.5
Medicare	34	9.5	11	5.6	48	8.1
Indian Health Services (IHS)	14	3.9	6	3.0	20	3.6
Communicates with patients in more than	**363**	1*	**199**	0*	**562**	1*
Yes	147	40.5	44	22.1	191	34.0
No	216	59.5	155	77.9	371	66.0
Percentage of patients using a translator	**356**	8*	**194**	5*	**550**	13*
	Min	Max	Min	Max	Min	Max
	0	100	0	75	0	100
	Mean	StDev	Mean	StDev	Mean	StDev
	12.6	18.4	9.8	11.5	11.6	16.4
Median	6.0		5.5		6.0	
Primary translation types	**286**	78*	**146**	53*	**432**	131*
Friend of family member that presents	232	81.1	120	82.2	352	81.5
Staff member/other colleague	147	51.4	73	50.0	220	50.9
Hired in person translator	73	25.5	26	17.8	99	22.9
Telephone translator	57	19.9	12	8.2	69	16.0
Video conferenced translator	17	5.9	5	3.4	22	5.1
Machine translator (i.e. google)	24	8.4	10	6.8	34	7.9
Other translator	3	1.0	3	2.1	6	1.4
Video conferencing quality in office	**363**	1*	**198**	1*	**561**	2*
High quality	171	47.1	61	30.8	232	41.4
Medium quality	127	35	75	37.9	202	36.0
Low quality	15	4.1	9	4.5	24	4.3
Non-functional	6	1.7	2	1.0	8	1.4
I don't know	44	12.1	51	25.8	95	16.9

Bolded values represent a total in category. * - n missing

Table 2a. Analysis of Variance

Model	R	R^2	Adj R^2	SEE	ΔR^2	ΔF	df1	df2
1	.216[a]	.047	.042	24.7921	.047	8.981***	3	548
2	.284[b]	.080	.070	24.4180	.034	6.64***	3	545
3	.329[c]	.108	.095	24.0876	.028	8.527***	2	543
4	.698[d]	.488	.475	18.3415	.379	79.704***	5	538

significance *: 0.01-0.05, **: 0.00-0.01, ***: 0.0001 to 0.001

a. Predictors: (constant), rural, non-white, dental hygienist
b. Predictors: (constant), rural, non-white, dental hygienist, psych relation to pain, translation mode used, current TH use
c. Predictors: (constant), rural, non-white, dental hygienist, psych relation to pain, translation modes used, current TH use, current radiology use, inadequate access to OM
d. Predictors: (constant), rural, non-white, dental hygienist, psych relation to pain, translation modes used, current TH use, current radiology use, inadequate access to OM, initial and final ref. to OM, biopsy ref., TH-OM benefits and barriers, comfort in technology, TH mode likelihood
e. Dependent Variable: Likelihood of using TH-OM

Table 2b. HMR: Final Model Coefficients

4	(constant)	-5.867	8.057		-.728	ns		
	dental hygienist	9.657	1.971	.183	4.899	***	.682	1.466
	non-white	3.107	1.870	.053	1.662	ns	.939	1.065
	rural	-5.535	2.439	-.071	-2.270	*	.973	1.027
	translation modes used	.607	.563	.035	1.078	ns	.921	1.086
	current TH use	.438	.270	.058	1.626	ns	.757	1.322
	psych. relation to pain	-1.674	1.027	-.052	-1.630	ns	.948	1.055
	current radiology use	.546	.465	.037	1.173	ns	.959	1.043
	inadequate access to OM	1.419	.687	.067	2.067	*	.914	1.094
	initial and final ref. to OM	3.067	1.193	.081	2.570	*	.961	1.041
	biopsy ref.	1.950	.713	.086	2.735	**	.952	1.050
	TH mode likelihood	-.373	.085	-.157	-4.365	***	.738	1.356
	TH-OM benefits and barriers	1.285	.091	.518	14.190	***	.714	1.401
	comfort in technology	.181	.081	.079	2.230	*	.749	1.334

significance levels: ns: not significant, *: 0.01-0.05, **: 0.00-0.01, ***: 0.0001 to 0.001

a. Dependent Variable: Likelihood of using TH-OM

Table 3. Current Oral Medicine Experience and Need

	DDS		RDH		Total	
	n	%	n	%	n	%
# Patients seen in office per month	M = 3.36	SD = 3.66	4.55	SD = 4.09	3.96	SD = 3.86
Mucosal changes or lesions (i.e. white patches, persistent ulcers, etc.)	**363**	1*	**199**	0*	**562**	1*
< 1	99	27.3	36	18.1	135	24.0
1-4	179	49.3	113	56.8	292	52.0
5-8	63	17.4	32	16.1	95	16.9
9-12	9	2.5	12	6.0	21	3.7
> 12	13	3.6	6	3.0	19	3.4
	M_{min} = 2.02	SD = 2.97	2.33	SD = 3.05	2.18	SD = 3.00
	M_{max} = 4.06	SD = 3.44	4.69	SD = 3.44	4.38	SD = 3.45
Orofacial pain (i.e. Temporomandibular disorder (TMD), atypical facial pain, neuropathic pain,	**362**	2*	**199**	0*	**561**	2*
< 1	68	18.8	24	12.1	92	16.4
1-4	182	50.3	87	43.7	269	48.0
5-8	76	21	50	25.1	126	22.5
9-12	19	5.2	20	10.1	39	7.0
> 12	17	4.7	18	9.0	35	6.2
	M_{min} = 2.61	SD = 3.31	3.85	SD = 4.10	3.23	SD = 3.73
	M_{max} = 4.87	SD = 3.60	6.15	SD = 4.00	5.51	SD = 3.78
Oral manifestations or complexity of systemic disease (i.e. oncological, sleep disorder, etc.)	**360**	4*	**198**	1*	**558**	5*
< 1	122	33.9	27	13.6	149	26.7
1-4	144	40.0	84	42.4	228	40.9
5-8	46	12.8	49	24.7	95	17.0
9-12	28	7.8	17	8.6	45	8.1
> 12	20	5.6	21	10.6	41	7.3
	M_{min} = 2.41	SD = 3.55	4.04	SD = 4.29	3.23	SD = 3.81
	M_{max} = 4.23	SD = 4.06	6.23	SD = 4.17	5.23	SD = 4.22
Adjuncts for oral neoplasia utilized	**99**	265*	**110**	89*	**209**	354*
Cytology	43	43.4	12	10.9	55	26.3
Toludine blue	13	13.1	4	3.6	17	8.1
Fluorescence	38	38.4	29	26.4	67	32.1
Other	26	26.3	11	10	37	17.7
Not sure	n/a		63	57.3	63	30.1
Biopsy in own office	**363**	1*	**198**	1*	**561**	0*
Always	28	7.7	5	2.5	33	5.9
Frequently	43	11.8	18	9.1	61	10.9
Infrequently	81	22.3	36	18.2	117	20.9
Never	211	58.1	133	67.2	344	61.3
Not sure	n/a		6	3	6	1.1
Biopsy referal	**331**	232*	**186**	13*	**517**	219*
General dentist	8	2.4	1	0.5	9	1.7
Oral surgeon	315	95.2	166	89.2	481	93.0
Periodontist	62	18.7	30	16.1	92	17.8
Oral Medicine	70	21.1	42	22.6	112	21.7
Otolaryngologist	52	15.7	29	15.6	81	15.7
Other	8	2.4	8	4.3	16	3.1
Not Sure	n/a		4	2.2	4	0.8
Biopsy Interpretation	**351**	212*			**351**	212*
Self	4	1.1			4	1.1
Oral pathologist	326	92.9			326	92.9
General pathologist	69	19.7			69	19.7
Other	7	2.0			7	2.0
Radiography modalities in office					**556**	7*
Film radiography (non-digital)					41	7.4
Digital radiography					526	94.6
Panoramic radiography					449	80.8
Cone beam computed tomography (CBCT)					165	29.7
Other					13	2.3
CBCT Interpretation	**103**	62*	**62**	103*		
Self (General dentist in office)	84	81.6	55	88.7		
Another general dentist	8	7.8	2	3.2		
Oral radiologist	46	44.7	7	11.3		
General radiologist	6	5.8	3	4.8		
Other	8	7.8	5	8.1		
Not sure	n/a	n/a	5	8.1		

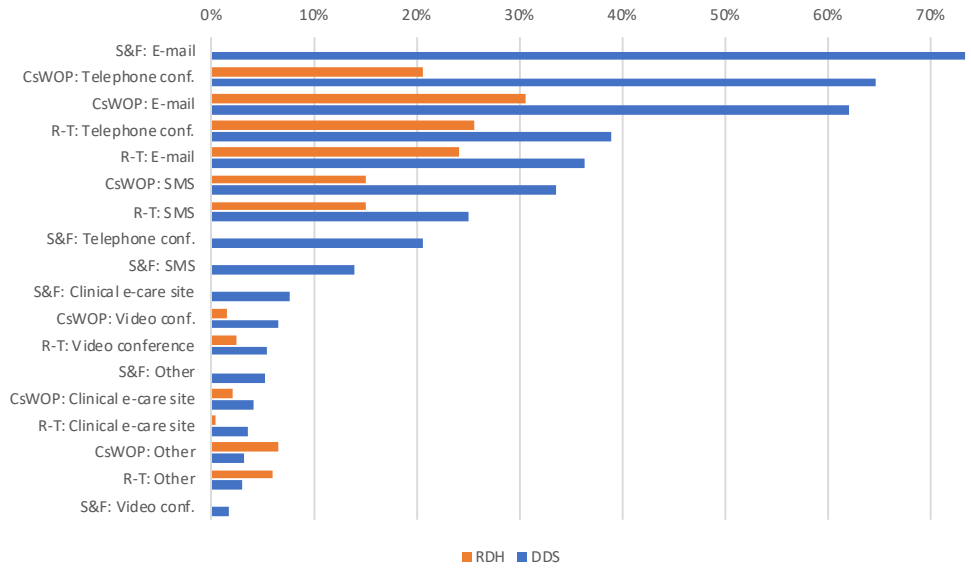
Bolded values represent a total in category. * - n missing

Table 3. Current Oral Medicine Experience and Need (continued)

	DDS		RDH		Total	
	n	%	n	%	n	%
View on statement: "Mental health and chronic pain are closely related to each other."	364	0*	199	0*	**563**	0*
Strongly Agree	131	36.0	71	35.7	202	35.9
Agree	148	40.7	93	46.7	241	42.8
Neither agree nor disagree	79	21.7	33	16.6	112	19.9
Diagree	5	1.4	2	1.0	7	1.2
Strongly Disagree	1	0.3	0	0.0	1	0.2
History of referring patients to psychiatrist, psychologist, or other mental health provider	**362**	2*	197	2*	**559**	4*
Yes	126	34.8	12	6.1	138	24.7
No	236	65.2	118	59.9	354	63.3
Not Sure			68	34.5	68	12.2
# of patients referred	**126**	232*	**12**	187*	**138**	419*
1-5	80	63.5	8	66.7	88	63.8
6-20	35	27.8	1	8.3	36	26.1
21-50	10	7.9	0	0.0.	10	7.2
51-100	0	0.0	0	0.0	0	0.0
> 100	1	0.8	0	0.0	1	0.7
I'm not sure	n/a	n/a	3	25	3	2.2
View on statement: "I (we) have adequate access to Oral Medicine specialty services."	**363**	1*	**199**	0*	**562**	1*
Strongly Agree	38	10.5	26	13.1	64	11.4
Agree	113	31.1	62	31.2	175	31.1
Neither agree nor disagree	59	16.3	46	23.1	105	18.7
Diagree	116	32.0	55	27.6	171	30.4
Strongly Disagree	37	10.2	10	5	47	8.4
Patient scenario	**363**	1*	**199**	0*	**562**	1*
Treat patient myself (themselves)	135	37.2	45	22.6	180	32.0
Refer to a specialist	228	62.8	137	68.8	365	64.9
I'm not sure	n/a	n/a	17	8.5	17	3.0
Specialist currently have access to to be referred	**224**	140*	**137**	62*	**361**	78*
Dental Anesthesiology	0	0.0	0	0	0	0.0
Dental Public Health	2	0.9	2	1.5	4	1.1
Endodontics	121	54.0	4	2.9	125	34.6
Oral and Maxillofacial Pathology	12	5.4	54	39.4	66	18.3
Oral and Maxillofacial Radiology	6	2.7	3	2.2	9	2.5
Oral and Maxillofacial Surgery	41	18.3	78	56.9	119	33.0
Orthodontics and Dentofacial Orthopedics	5	2.2	2	1.5	7	1.9
Pediatric dentistry	1	0.4	2	1.5	3	0.8
Periodontics	3	1.3	33	24.1	36	10.0
Prosthodontics	1	0.4	2	1.5	3	0.8
Oral Implantology/Implant Dentistry	0	0.0	3	2.2	3	0.8
Oral Medicine	114	50.9	38	27.7	152	42.1
Orofacial Pain	70	31.3	2	1.5	72	19.9
I'm not sure	8	3.6	4	2.9	12	3.3
Specialist to to be referred if access to any	**219**	145*	**134**	65*	**353**	210*
Dental Anesthesiology	1	0.5	5	3.7	6	1.7
Dental Public Health	0	0.0	6	4.5	6	1.7
Endodontics	91	41.6	24	17.9	115	32.6
Oral and Maxillofacial Pathology	27	12.3	97	72.4	124	35.1
Oral and Maxillofacial Radiology	8	3.7	11	8.2	19	5.4
Oral and Maxillofacial Surgery	25	11.4	56	41.8	81	22.9
Orthodontics and Dentofacial Orthopedics	12	5.5	18	13.4	30	8.5
Pediatric dentistry	5	2.3	21	15.7	26	7.4
Periodontics	7	3.2	47	35.1	54	15.3
Prosthodontics	5	2.3	20	14.9	25	7.1
Oral Implantology/Implant Dentistry	4	1.8	19	14.2	23	6.5
Oral Medicine	146	66.7	83	61.9	229	64.9
Orofacial Pain	130	59.4	22	16.4	152	43.1
I'm not sure	2	0.9	12	9	14	4.0

Bolded values represent a total in category. * - n missing

Table 4. Current Telehealth Utilization



S&F: store and forward, R-T: Real time, CsWOP: Consult without patient

	DDS		RDH		Total	
	n	%	n	%	n	%
Real-time conference with patient present	**203**	161*	**99**	199*	**302**	261*
Video conference	20	9.9	5	5.1	25	8.3
Telephone conference	142	70.0	51	51.5	193	63.9
Clinical e-care website	13	6.4	1	1.0	14	4.6
Text/Short Message Service (SMS)	91	44.8	30	30.3	121	40.1
E-mail	132	65.0	48	48.5	180	59.6
Other	11	5.4	12	12.1	23	7.6
Consultation with dentist without patient present	n/a		**104**	95*	**104**	95*
Video conference			3	2.9	3	2.9
Telephone conference			41	39.4	41	39.4
Clinical e-care website			4	3.8	4	3.8
Text/Short Message Service (SMS)			30	28.8	30	28.8
E-mail			61	58.7	61	58.7
Other			13	12.5	13	12.5
Consultation with specialist without patient present	**300**	64*			**300**	64*
Video conference	24	8.0			24	8.0
Telephone conference	235	78.3			235	78.3
Clinical e-care website	15	5.0			15	5.0
Text/Short Message Service (SMS)	122	40.7			122	40.7
E-mail	226	75.3			226	75.3
Other	12	4.0			12	4.0
Store and forward: collect patient information information and sent to specialist	**290**	74*			**290**	74*
Video conference	6	2.1			6	2.1
Telephone conference	75	25.9			75	25.9
Clinical e-care website	28	9.7			28	9.7
Text/Short Message Service (SMS)	51	17.6			51	17.6
E-mail	267	92.1			267	92.1
Other	19	6.6			19	6.6
Of the patients refered to MEDICAL providers, percentage of telehealth utilization					**348**	16*
Min	Max	Mean	StDev	Median		
0	100.0	19.1	30.6	3.0		
Of the patients refered to DENTAL providers, percentage of telehealth utilization					**340**	24*
Min	Max	Mean	StDev	Median		
0	100.0	36.8	38.7	20.0		

Bolded values represent a total in category. * - n missing

Table 5. Provider Comfort in Using Technology

Statement	n	*M*	*SD*
Browsing the internet for information about dentistry	561	3.78	0.57
Receiving continuing education electronically	559	3.70	0.61
Scheduling patient appointments on the computer	562	3.61	0.85
Using an Electronic Health Record	560	3.60	0.78
Generating, accessing, and sending digital radiographs	562	3.55	0.78
Accessing online-electronic evidence-based resources (i.e. MEDLINE, PUBMED, UpToDate)	560	3.52	0.76
Generating, accessing, and sending digital photographs	561	3.52	0.80
Communicating with patients via email	561	3.33	1.02
Using video conferencing software	560	2.67	1.07
Using telehealth to refer patients *	363	2.59	0.99
Using telehealth to help refer patients **	199	2.49	0.98
Using telehealth as a patient yourself	562	2.44	1.05
Using telehealth to treat patients *	361	2.11	1.03

* DE only, **DH only, Note: Higher mean value indicates stronger agreement

Table 6. Likelihood for Usage of Telehealth Delivered Oral Medicine Modalities

6	**Store and forward**: enter appropriate information regarding your patient encounter in a secure telehealth website for later response from the Oral Medicine specialist.
5	**WITHOUT** the patient present, use the **PHONE** to **consult** with the Oral Medicine specialist.
4	Provide the **information to the patient** to utilize the **secure telehealth website** to contact the Oral Medicine specialist in real-time.
3	**WITH** the patient present, use **VIDEO CONFERENCE** to consult in **real-time** with the Oral Medicine specialist.
2	**WITHOUT** the patient present, use **VIDEO CONFERENCE** to consult with the Oral Medicine specialist.
1	**WITH** the patient present, use **SPEAKER PHONE** to consult in **real-time** with the Oral Medicine specialist.

		n	*M*	*SD*
Both	6	543	2.97	1.27
	5	547	2.97	1.22
	4	547	2.70	1.35
	3	542	2.15	1.44
	2	542	2.04	1.53
	1	544	1.69	1.41
Dentists	5	361	2.97	1.24
	6	358	2.88	1.30
	4	363	2.60	1.41
	3	360	1.93	1.48
	2	357	1.72	1.54
	1	359	1.50	1.41
Dental Hygienists	5	198	3.13	1.20
	4	199	2.97	1.18
	3	197	2.88	1.20
	2	198	2.62	1.33
	3	195	2.56	1.28
	1	198	2.04	1.35

Higher mean values indicate greater likelihood

Table 7. Perceptions of Telehealth Delivered Oral Medicine

Statement	n	*M*	*SD*
TH-OM will fill an existing service gap.	560	2.99	0.88
TH-OM will improve timeliness of appropriate patient care.	563	2.96	0.84
TH-OM will improve access to appropriate patient care.	558	2.94	0.80
TH-OM will help to reduce the number of encounters between the patient and multiple providers/emergency department.	560	2.87	0.86
TH-OM will improve the overall quality of health care delivered in my office.	559	2.64	0.85
TH-OM when coupled with evidence based, consensus-developed care, may reduce the variability of treatment and management.	559	2.63	0.75
TH-OM will increase overall efficiency.	560	2.60	0.86
TH-OM will improve the overall patient experience in my office.	561	2.42	0.84
TH-OM will help to improve productivity of dental staff.	562	2.40	0.95
TH-OM will help to avoid a face-to-face visit by an oral medicine specialist.	559	2.39	0.87
TH-OM will not be accurate or complete enough compared to a to a face-to face visit.	560	2.26	0.95
TH-OM will be too expensive to implement and use.	557	1.89	0.66
TH-OM will be difficult for the patient to learn to use	560	1.87	0.74
TH-OM will have unintended negative consequences.	552	1.69	0.77
TH-OM will be depersonalizing.	560	1.61	0.92
TH-OM will take too much technology expertise to implement.	558	1.50	0.80
TH-OM will reduce effectiveness of patient care.	559	1.35	0.78
TH-OM will hinder dentist-patient relationships.	559	1.35	0.83
TH-OM will be difficult for me to learn to use.	558	1.34	0.84
TH-OM will jeopardize patient privacy.	558	1.30	0.83

Larger mean value indicates stronger agreement. Red line delineates agreement from disagreement.

- indicates a beneficial feature of TH-OM - indicates a barrier to TH-OM, Note: Higher mean indicates stronger agreement.

Appendix A. – Theoretical Domains Framework and the COM-B system

Mapping of the Behaviour Change Wheel's COM-B system to the TDF Domains (adapted from Cane et al, 2012,		
COM-B component		**TDF Domain**
Capability	Psychological	Knowledge
		Skills
		Memory, Attention and Decision Processes
		Behavioural Regulation
	Physical	Skills
Opportunity	Social	Social Influences
	Physical	Environmental Context and Resources
Motivation	Reflective	Social/Professional Role & Identity
		Beliefs about Capabilities
		Optimism
		Beliefs about Consequences
		Intentions
		Goals
	Automatic	Social/Professional Role & Identity
		Optimism
		Reinforcement
		Emotion

Coulson et. Al, 2016

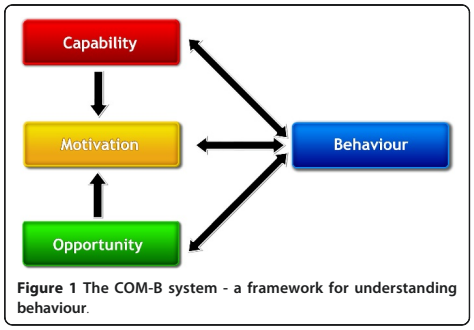
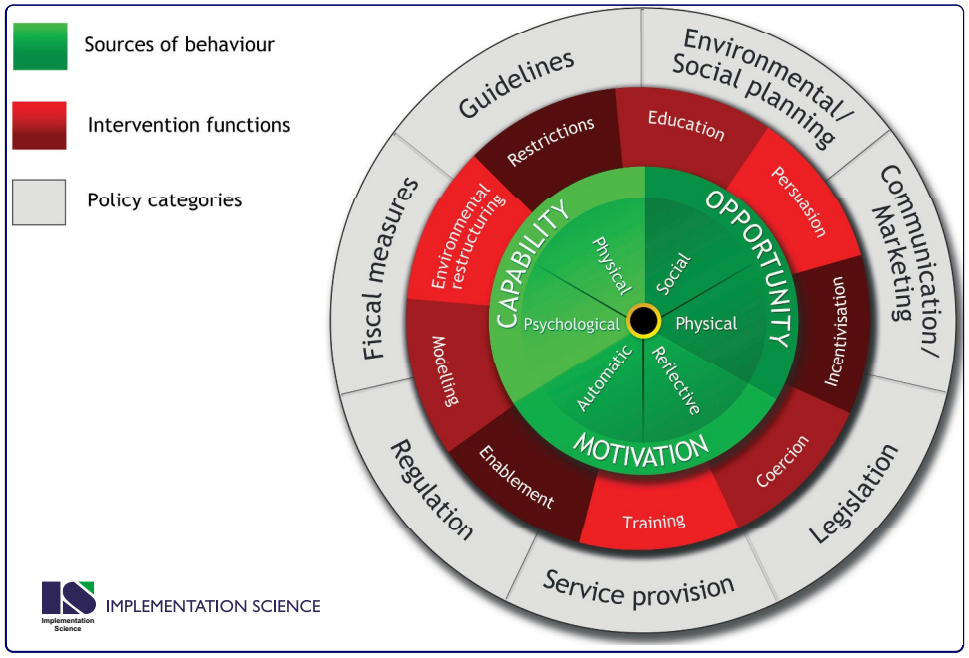


Figure 1 The COM-B system - a framework for understanding behaviour.



The behavior change wheel: A new method for characterizing and designing behavior change interventions (Michie et al.)

Appendix B. - PECOS

The PECOS framework was used to define the scope of the study. The population, exposure, comparator, outcome/objective, setting (PECOS) are outlined below.

Population
- Licensed Dentists and Dental Hygienists in the State of Washington

Exposure and Comparisons
- Dentists vs. dental hygienists
- dentists general vs. additional training
- Rural vs urban practice settings
- High vs low volume of oral medicine cases seen

Outcome
- Primary Outcome
    - Likelihood or support to use telehealth delivered oral medicine
- Secondary Outcomes
    - Telehealth delivered medicine perceptions
        - table with questions
    - comfort in technology
    - outcome vs. variable

Objective: To collect and assess the perceptions of oral health providers in using telehealth delivered oral medicine

Setting: Cross-sectional, observational, online REDCap© questionnaire

Among licensed oral health providers in the state of Washington, how strongly will they indicate their likelihood to support utilization of telehealth to deliver oral medicine in a cross-sectional online survey?

Appendix C. - CHERRIES

Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category	*Checklist Item*	*Explanation*	*Study*
Design			
	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Cross-sectional, observational study. - Licensed dentists and dental hygienists in Washington State - Convenience sample – willing to participate - Active license, with email address registered - DOH public records - PNDC flyers placed at UW table
IRB (Institutional Review Board) approval and informed consent process			
	IRB approval	Mention whether the study has been approved by an IRB.	UWIRB # STUDY00007067 Under FWA #00006878 Consent information and a link to the survey will be emailed to potential participants. Potential participants can contact the Investigator if they have questions. Comprehension is inferred when a participant completes the survey.
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Included in the email cover letter as well as the beginning of the survey. Participants were informed that their responses would remain confidential and that the survey would take approximately 15 minutes to complete. The investigator's name, e-mail and phone number were provided. The purpose of the study was also included in the email cover letter.
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Public records obtained by the DOH were stored on the PI computer under a password. These records were not shared with any other investigator. Emails from these public records were added to REDCap©: provided unique survey links to each potential participant. Responses remained de-identified. Demographic data were cross checked with study demographics (not linked with respondent information)
Development and pre-testing			
	Development, and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Consulted with committee composed of a public health faculty, two oral medicine dental faculty, or which one is also an oral radiologist, a pain psychology faculty when designing preliminary instrument. Usability and technical functionality were tested Piloted initial instrument with two dental hygienists and three dentists. DOH public records obtained. Included: - All licensees with an email registered. - Credential status: Active or Military Excluded: - Credential status:

			- Dentists: Active on probation, active with conditions, active with restrictions, closed, denied licensure, expired, inactive, pending, retired active, revoked, summary suspension, superseded, surrender, suspended, terminated, voluntary surrender - Dental hygienists: active not renewable, active on probation, active with conditions, closed, expired, pending, superseded, suspended, terminated, voluntary surrender.
Recruitment process and description of the sample having access to questionnaire			
	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Closed survey: unique link was provided via email only.
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Contact was primarily made via e-mail.
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	Flyers were provided at the PNDC UW table, and handed out in person, to advertise the survey and instructed interested providers to look for email invitation with unique link..
Survey administration			
	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	REDCap website was utilized to send email invitations, administer the survey, and capture responses.
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	n/a surveys were only provided directly to email. Was not available on a public website.
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Voluntary survey
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary	Non-monetary incentive to provide the treatment and management considerations

		incentives such as an offer to provide the survey results)?	from the perspective of an Oral Medicine specialist provided on page immediately following submitting survey.
	Time/Date	In what timeframe were the data collected?	Survey remained open for 31 days.
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	No randomization
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions.	Conditional questioning was utilized based on whether a participant indicated they were a dental hygienist, or dentist. - Wording was adapted based on the provider type
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Number of questions also depended on provider type, Dental Hygienist: 75, Dentist: 78. Number of questions per page ranged from 1-12 questions
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Survey consisted of 12 pages
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JAVAScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or "rather not say", and selection of one response option should be enforced.	n/a
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	Respondents were able to change their answers while they were on a page, however they were not able to review previous pages.
Response rates			
	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	neither IP addresses nor cookies were utilized (this is not an available feature within REDCap©); therefore, unique visitors, and consequently view rate, cannot be determined.
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary.	Not able to be determined
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	Not able to be determined

	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	527/927 = 56.9% completion rate
Preventing multiple entries from the same individual			
	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent?)	Cookies were not used.
	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	IP address analysis or features available
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	Not applicable
	Registration	In "closed" (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	Users were provided a unique survey link, for which the user could click save & return, then a return code is provided in order to log in the next time.

Analysis			
	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	Questionnaires with less than 50% of the demographic questions answered were excluded
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point and describe how this point was determined.	A cut off point was not used.
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	n/a

This checklist has been modified from Eysenbach G. Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res. 2004 Sep 29;6(3):e34 [erratum in J Med Internet Res. 2012; 14(1): e8.]. Article available at https://www.jmir.org/2004/3/e34/; erratum available https://www.jmir.org/2012/1/e8/.

Appendix D1. – REDCap© Questionnaire for Dentists

For the purposes of this survey, the words below will be defined as the following:

Oral medicine - the discipline in dentistry that studies, diagnoses, and provides treatment and management for those with conditions relating to oral pathology, chronic recurrent medical disorders of the oral and maxillofacial region, and oral manifestations to systemic disease.

Oral Medicine is primarily a non-surgical specialty with procedures limited to diagnostic biopsies, small excisions, therapeutic injections, and other minor surgical interventions. In many cases, conditions are managed medically with the use of topical and systemic medications.

Conditions for which oral medicine specialists diagnose and manage include:

- Oral mucosal and salivary gland diseases
- Oral complications resulting from systemic disease
- Oral complications from cancer treatment
- Chemosensory and neurologic impairment of the oral and maxillofacial complex
- Orofacial pain including temporomandibular disorders

Telehealth - the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration. Technologies include videoconferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications (as defined by The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services).

Tele-OM - The discipline of Oral Medicine delivered via telehealth methods.

survey progress bar: [*----------]

Please select the type of dental provider that best describes you currently.
- ○ Hygienist
- ◉ Dentist

reset

Please select the type of dentistry for which you are trained. (select all that apply)
- ☐ General Dentistry (DDS, DMD, IDDS)
- ☐ General Dentistry outside of US (BDS)
- ☐ Advanced Education in General Dentistry (AEGD)
- ☐ General Practice Residency (GPR)
- ☐ Dental Specialty

Which of the following forms of telehealth have you used? [-*---------]

	Video conference	Telephone conference	Clinical e-care website	Text/Short Message Service (SMS)	E-mail	Other
Real-time conference with patient present	☐	☐	☐	☐	☐	☐
Consultation with a specialist without patient present	☐	☐	☐	☐	☐	☐
Store and forward: collect patient information and send to specialist	☐	☐	☐	☐	☐	☐

Of the patients that you refer to MEDICAL providers, for what percentage do you use telehealth?

0% 50% 100%

Change the slider above to set a response

reset

Of the patients that you refer to DENTAL providers, for what percentage do you use telehealth?

0% 50% 100%

Change the slider above to set a response

reset

If formal telehealth resources were available for you to deliver oral medicine to your patients, how likely would you be to use them?

Unlikely — Neither unlikely nor likely — Likely

Change the slider above to set a response

reset

Section 1: Oral Medicine [--*---------]

On average, how many times per month do you encounter patients with each of the following conditions? For each category below, please give your best estimate of the number of patients seen each month.

	<1	1-4	5-8	9-12	>12
Mucosal changes or lesions (i.e. white patches, persistent ulcers, etc.)	○	○	○	○	○
Orofacial pain (i.e. Temporomandibular disorder (TMD), atypical facial pain, neuropathic pain, etc.)	○	○	○	○	○
Oral manifestations or complexity of systemic disease (i.e. oncological, sleep disorder, etc.)	○	○	○	○	○

reset

Do you utilize any of the following adjuncts for detection of oral neoplasia?
- ☐ Cytology
- ☐ Toludine blue
- ☐ Fluorescence
- ☐ Other

How often do you do take your own biopsies?
- ○ Always
- ○ Frequently
- ○ Infrequently
- ○ Never

reset

Who does the biopsy interpretation? (select all that apply)
- ☐ Self
- ☐ Oral pathologist
- ☐ General pathologist
- ☐ Other

Does your office have any of the following radiography modalities? (select all that apply)
- ☐ Film radiography (non-digital)
- ☐ Digital radiography
- ☐ Panoramic radiography
- ☐ Cone beam computed tomography (CBCT)
- ☐ Other

What is your view on the following statement?

"Mental health and chronic pain are closely related to each other."
- ○ Strongly Agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly Disagree

reset

Have you ever referred your patient to a psychiatrist, psychologist, or other mental health provider?
- ○ Yes
- ○ No

reset

What is your view on the following statement?

"I have adequate access to Oral Medicine specialty services."
- ○ Strongly Agree
- ○ Agree
- ○ Neither agree nor disagree
- ○ Disagree
- ○ Strongly Disagree

reset

REDCap©: Questionnaire for Dentists continued

Section 2: Patient Scenario [---*-------]

A 52-year-old female presents to your office and says, "I have a bad tooth ache" while pointing to #18. The constant, 7 out of 10 pain has been going on for the last 3 months. She has had root canal therapy by an endodontist on #19 (3 months ago) which initially helped reduce her pain for less than a week, but it has returned. She states that she would like a second opinion about treatment options for this tooth.

Vitals: blood pressure: 132/84, pulse: 90, temperature: 98.7

Medical History: fibromyalgia, hypothyroidism, anxiety, depression

Medications: sertraline (Zoloft) 100mg, levothyroxine 25mg, gabapentin 100mg

Social History: single mom, works as a nurse in the ICU. Does not smoke or drink alcohol.

Family History: anxiety, depression, alcohol abuse

Dental History: Multiple crowns, Difficulty with anesthesia, xerostomia

Clinical Findings: left sided ear ache, pain on palpation only of bilateral masseters, temporalis, limited opening (30mm), no swelling

Radiographic Findings: #18 normal, #19 well obturated with no abnormalities.

Pulp testing:

tooth #	palpation	percussion	cold	EPT	PPD	mobility
18	++	++	wnl	15	323, 323	wnl
19	++	+	-	80	323, 323	wnl
20	++	+	wnl	20	323, 323	wnl
15	wnl	+	wnl	18	323, 323	wnl

Note: The treatment considerations and management of this patient scenario, from the perspective of an Oral Medicine specialist, will be provided at the conclusion of the survey.

How would you proceed with this patient?

- Treat patient myself
- Refer to a specialist

reset

Section 2: Patient scenario (continued) [----*------]

Let's say you wanted to refer this patient to an Oral Medicine specialist. If given the resources, how likely are you to use each of the following tele-OM options in order to refer the patient?

	Very Likely	Somewhat Likely	Neither likely nor unlikely	Somewhat Unlikely	Very Unlikely
WITH the patient present, use VIDEO CONFERENCE to consult in real-time with the Oral Medicine specialist.	○	○	○	○	○
WITH the patient present, use SPEAKER PHONE to consult in real-time with the Oral Medicine specialist.	○	○	○	○	○
WITHOUT the patient present, use VIDEO CONFERENCE to consult with the Oral Medicine specialist.	○	○	○	○	○
WITHOUT the patient present, use the PHONE to consult with the Oral Medicine specialist.	○	○	○	○	○
Store and forward: enter appropriate information regarding your patient encounter in a secure telehealth website for later response from the Oral Medicine specialist.	○	○	○	○	○
Provide the information to the patient to utilize the secure telehealth website to contact the Oral Medicine specialist in real-time.	○	○	○	○	○

reset

Section 3: Tele-OM [-----*------]
[1 of 5]

Please indicate how much you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-Oral Med will improve timeliness of appropriate patient care.	○	○	○	○	○
Tele-Oral Med will fill an existing service gap.	○	○	○	○	○
Tele-Oral Med will jeopardize patient privacy.	○	○	○	○	○
Tele-Oral Med will help to reduce the number of encounters between the patient and multiple providers/emergency department.	○	○	○	○	○
Tele-Oral Med will help to improve productivity of dental staff.	○	○	○	○	○

reset

Section 3: Tele-OM [------*-----]
[2 of 5]

Please indicate how much you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-OM will be depersonalizing.	○	○	○	○	○
Tele-OM will have unintended negative consequences.	○	○	○	○	○
Tele-OM will improve the overall quality of health care delivered in my office.	○	○	○	○	○
Tele-OM will be too expensive to implement and use.	○	○	○	○	○
Tele-OM will improve access to appropriate patient care.	○	○	○	○	○

reset

Section 3: Tele-OM [-------*----]
[3 of 5]

What are your views of the following statements?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-OM will hinder dentist-patient relationships.	○	○	○	○	○
Tele-OM will increase overall efficiency.	○	○	○	○	○
Tele-OM will be difficult for the patient to learn to use.	○	○	○	○	○
Tele-OM will be difficult for me to learn to use.	○	○	○	○	○
Tele-OM will take too much technology expertise to implement.	○	○	○	○	○

reset

REDCap©: Questionnaire for Dentists continued

Section 3: Tele-Oral Med [--------*---]
[4 of 5]

Please indicate how much you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-OM, when coupled with evidence-based, consensus-developed care, may reduce the variability of treatment and management.	○	○	○	○	○
Tele-OM will reduce effectiveness of patient care.	○	○	○	○	○
Tele-OM will not be as accurate or complete as a face-to-face visit.	○	○	○	○	○
Tele-OM will improve the overall patient experience in my office.	○	○	○	○	○
Tele-OM will help to avoid a face-to-face visit by an oral medicine specialist.	○	○	○	○	○

Section 3: Technology [--------*--]
[5 of 5]

Please indicate how comfortable you are using each of the following forms of technology.

	Very comfortable	Somewhat comfortable	Neither comfortable nor uncomfortable	Somewhat uncomfortable	Very uncomfortable
Communicating with patients via email	○	○	○	○	○
Scheduling patient appointments on the computer	○	○	○	○	○
Using an Electronic Health Record	○	○	○	○	○
Generating, accessing, and sending digital photographs	○	○	○	○	○
Generating, accessing, and sending digital radiographs	○	○	○	○	○
Using video conferencing software	○	○	○	○	○
Browsing the internet for information about dentistry	○	○	○	○	○
Accessing online-electronic evidence-based resources (i.e. MEDLINE, PUBMED, UpToDate)	○	○	○	○	○
Receiving continuing education electronically	○	○	○	○	○
Using telehealth to refer patients	○	○	○	○	○
Using telehealth to treat patients	○	○	○	○	○
Using telehealth as a patient yourself	○	○	○	○	○

Section 4: Demographics [---------*-]
[1 of 2]

Which of the following best describes the type of practice in which you typically work? (select all that apply)
- ☐ Private solo
- ☐ Private group
- ☐ Community health/public health organization
- ☐ Managed care
- ☐ Military
- ☐ Academic

Which of the following best describes the area in which you practice?
- ○ Urban or Metropolitan
- ○ Suburban
- ○ Rural
- ○ Other

Which of the following best describes the most common form(s) of reimbursement in your practice? (select all that apply)
- ☐ Private Pay
- ☐ Private Insurance
- ☐ Medicaid
- ☐ Medicare
- ☐ Indian Health Services (IHS)

Based on your internet connection, what level of video conferencing quality are you able to achieve at your office?
- ○ High quality
- ○ Medium quality
- ○ Low quality
- ○ Non-functional
- ○ I don't know

Do you communicate with patients in more than one language?
- ○ Yes
- ○ No

For what percentage of your patients do you utilize a translator?
0% 50% 100%
Change the slider above to set a response

What year did you graduate from dental school?
yyyy

In terms of gender, how do you describe yourself? (select all that apply)
- ☐ Female
- ☐ Male
- ☐ Transgender
- ☐ Gender Non-Binary
- ☐ I would prefer to self-describe
- ☐ I would prefer not to say

Do you consider yourself to be of Hispanic, Latino, or Spanish origin?
- ○ Yes
- ○ No

What race or races do you consider yourself to be? (Mark one or more)
- ☐ Native American or Alaska Native
- ☐ White
- ☐ Black or African
- ☐ Asian
- ☐ Hawaiian or Pacific Islander
- ☐ Other
- ☐ I would prefer not to say

Please select your age range?
- ○ 21-25
- ○ 26-35
- ○ 36-45
- ○ 46-55
- ○ 56-65
- ○ 66 or above

Final Questions: [----------*]

If formal telehealth resources were available for you to deliver oral medicine to your patients, how likely would you use them?
Unlikely Neutral Likely
Change the slider above to set a response

Is there anything else about telehealth, or tele-Oral Med that we didn't ask about that you think is important to consider?
Expand

Form Status

Complete? Incomplete

Save & Exit Form | Save & ... | -- Cancel --

Appendix D2. – REDCap© Questionnaire for Dental Hygienists

For the purposes of this survey, the words below will be defined as the following:

Oral medicine - the discipline in dentistry that studies, diagnoses, and provides treatment and management for those with conditions relating to oral pathology, chronic recurrent medical disorders of the oral and maxillofacial region, and oral manifestations to systemic disease.

Oral Medicine is primarily a non-surgical specialty with procedures limited to diagnostic biopsies, small excisions, therapeutic injections, and other minor surgical interventions. In many cases, conditions are managed medically with the use of topical and systemic medications.

Conditions for which oral medicine specialists diagnose and manage include:

- Oral mucosal and salivary gland diseases
- Oral complications resulting from systemic disease
- Oral complications from cancer treatment
- Chemosensory and neurologic impairment of the oral and maxillofacial complex
- Orofacial pain including temporomandibular disorders

Telehealth - the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration. Technologies include videoconferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications (as defined by The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services).

Tele-OM - The discipline of Oral Medicine delivered via telehealth methods.

survey progress bar: [*----------]

Please select the type of dental provider that best describes you currently.
- (•) Hygienist
- ( ) Dentist

reset

Which of the following forms of telehealth have you used? [-*---------]

	Video conference	Telephone conference	Clinical e-care website	Text/Short Message Service (SMS)	E-mail	Other
Real-time conference with patient present	☐	☐	☐	☐	☐	☐
Consultation with dentist without patient present	☐	☐	☐	☐	☐	☐

If formal telehealth resources were available to deliver oral medicine to your patients, how supportive would you be for your office to use them?

Unsupportive — Neither unsupportive nor supportive — Supportive

Change the slider above to set a response

reset

Section 1: Oral Medicine [--*---------]

On average, how many times per month do you encounter patients with each of the following conditions? For each category below, please give your best estimate of the number of patients seen each month.

	< 1	1-4	5-8	9-12	>12
Mucosal changes or lesions (i.e. white patches, persistent ulcers, etc.)	○	○	○	○	○
Orofacial pain (i.e. Temporomandibular disorder (TMD), atypical facial pain, neuropathic pain, etc.)	○	○	○	○	○
Oral manifestations or complexity of systemic disease (i.e. oncological, sleep disorder, etc.)	○	○	○	○	○

reset

Do the dentist(s) in your office utilize any of the following adjuncts for detection of oral neoplasia?
- ☐ Cytology
- ☐ Toludine blue
- ☐ Fluorescence
- ☐ Other
- ☐ Not sure

How often do(es) the dentist(s) in your office take their own biopsies?
- ( ) Always
- ( ) Frequently
- ( ) Infrequently
- ( ) Never
- ( ) Not sure

reset

Does your office have any of the following radiography modalities? (select all that apply)
- ☐ Film radiography (non-digital)
- ☐ Digital radiography
- ☐ Panoramic radiography
- ☐ Cone beam computed tomography (CBCT)
- ☐ Other

What is your view on the following statement?

"Mental health and chronic pain are closely related to each other."
- ( ) Strongly Agree
- ( ) Agree
- ( ) Neither agree nor disagree
- ( ) Disagree
- ( ) Strongly Disagree

reset

Has the dentist(s) in your office ever referred your patients to a psychiatrist, psychologist, or other mental health provider?
- ☐ Yes
- ☐ No
- ☐ I'm not sure

What is your view on the following statement?

"We have adequate access to Oral Medicine specialty services."
- ( ) Strongly Agree
- ( ) Agree
- ( ) Neither agree nor disagree
- ( ) Disagree
- ( ) Strongly Disagree

reset

Section 2: Patient Scenario [---*-------]

A 70-year-old female presents to your office for a new patient exam and prophy. When you ask her about other concerns, she says, "I've noticed these red and white patches on my gums, and I have had to stop eating spicy foods because it really stings."

Vitals: blood pressure:113/77, pulse: 68, temperature: 98.1

Medical History: hypertension, hypercholesterolemia, gastroesophageal reflux disease, hay-fever, cataracts

Medications: lisinopril / hydrochlorothiazide 20-12.5mg, simvastatin 40mg, caltrate 600 + vitamin D

Social History: retired, just moved into town to be closer to her children and grandchildren.

Family History: none reported

Dental History:
history of periodontitis and 4 quadrant scaling and root planing. She has been on 4 month recalls.
Previous records show a diagnosis of chronic moderate periodontitis.
Plaque: mild, Calculus: mild
She has been experiencing these mucosal symptoms off and on for the last 10 years.

Clinical Findings:
see intraoral photos below. Mucosa appears slightly dry. No other significant clinical findings.

Note: The treatment considerations and management of this patient scenario, from the perspective of an Oral Medicine specialist, will be provided at the conclusion of the survey.

In your experience, how would the dentist(s) in your practice proceed for this patient's mucosal condition?
- ( ) Treat patient themselves
- ( ) Refer to a specialist
- ( ) I'm not sure

reset

Section Section 2: Patient scenario (continued) [----*------]

Let's say the dentist in your office wanted to refer this patient to an Oral Medicine specialist. If given the resources, how likely are you to support the use of each of the following tele-OM options in order to refer the patient?

	Very Likely	Somewhat Likely	Neither likely nor unlikely	Somewhat Unlikely	Very Unlikely
WITH the patient present, use VIDEO CONFERENCE to consult in real-time with the Oral Medicine specialist.	○	○	○	○	○
WITH the patient present, use SPEAKER PHONE to consult in real-time with the Oral Medicine specialist.	○	○	○	○	○
WITHOUT the patient present, use VIDEO CONFERENCE to consult with the Oral Medicine specialist.	○	○	○	○	○
WITHOUT the patient present, use the PHONE to consult with the Oral Medicine specialist.	○	○	○	○	○
Store and forward: enter appropriate information regarding your patient encounter in a secure telehealth website for later response from the Oral Medicine specialist.	○	○	○	○	○
Provide the information to the patient to utilize the secure telehealth website to contact the Oral Medicine specialist in real-time.	○	○	○	○	○

reset

REDCap©: Questionnaire for Dental Hygienists continued

Section 3: Tele-OM [-----*------]
[1 of 5]

Please indicate how much you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-Oral Med will improve timeliness of appropriate patient care.	○	○	○	○	○
Tele-Oral Med will fill an existing service gap.	○	○	○	○	○
Tele-Oral Med will jeopardize patient privacy.	○	○	○	○	○
Tele-Oral Med will help to reduce the number of encounters between the patient and multiple providers/emergency department.	○	○	○	○	○
Tele-Oral Med will help to improve productivity of dental staff.	○	○	○	○	○

Section 3: Tele-OM [------*-----]
[2 of 5]

Please indicate how much you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-OM will be depersonalizing.	○	○	○	○	○
Tele-OM will have unintended negative consequences.	○	○	○	○	○
Tele-OM will improve the overall quality of health care delivered in my office.	○	○	○	○	○
Tele-OM will be too expensive to implement and use.	○	○	○	○	○
Tele-OM will improve access to appropriate patient care.	○	○	○	○	○

Section 3: Tele-OM [-------*----]
[3 of 5]

What are your views of the following statements?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-OM will hinder dentist-patient relationships.	○	○	○	○	○
Tele-OM will increase overall efficiency.	○	○	○	○	○
Tele-OM will be difficult for the patient to learn to use.	○	○	○	○	○
Tele-OM will be difficult for me to learn to use.	○	○	○	○	○
Tele-OM will take too much technology expertise to implement.	○	○	○	○	○

Section 3: Tele-Oral Med [--------*---]
[4 of 5]

Please indicate how much you agree or disagree with each of the following statements.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Tele-OM, when coupled with evidence-based, consensus-developed care, may reduce the variability of treatment and management.	○	○	○	○	○
Tele-OM will reduce effectiveness of patient care.	○	○	○	○	○
Tele-OM will not be as accurate or complete as a face-to-face visit.	○	○	○	○	○
Tele-OM will improve the overall patient experience in my office.	○	○	○	○	○
Tele-OM will help to avoid a face-to-face visit by an oral medicine specialist.	○	○	○	○	○

Section 3: Technology [---------*--]
[5 of 5]

Please indicate how comfortable you are using each of the following forms of technology.

	Very comfortable	Somewhat comfortable	Neither comfortable nor uncomfortable	Somewhat uncomfortable	Very uncomfortable
Communicating with patients via email	○	○	○	○	○
Scheduling patient appointments on the computer	○	○	○	○	○
Using an Electronic Health Record	○	○	○	○	○
Generating, accessing, and sending digital photographs	○	○	○	○	○
Generating, accessing, and sending digital radiographs	○	○	○	○	○
Using video conferencing software	○	○	○	○	○
Browsing the internet for information about dentistry	○	○	○	○	○
Accessing online-electronic evidence-based resources (i.e. MEDLINE, PUBMED, UpToDate)	○	○	○	○	○
Receiving continuing education electronically	○	○	○	○	○
Using telehealth to help refer patients	○	○	○	○	○
Using telehealth as a patient yourself	○	○	○	○	○

Section 4: Demographics [---------*-]
[1 of 2]

Which of the following best describes the type of practice in which you typically work? (select all that apply)
- ☐ Private solo
- ☐ Private group
- ☐ Community health/public health organization
- ☐ Managed care
- ☐ Military
- ☐ Academic

Which of the following best describes the area in which you practice?
- ○ Urban or Metropolitan
- ○ Suburban
- ○ Rural
- ○ Other

Which of the following best describes the most common form(s) of reimbursement in your practice? (select all that apply)
- ☐ Private Pay
- ☐ Private Insurance
- ☐ Medicaid
- ☐ Medicare
- ☐ Indian Health Services (IHS)

Based on your internet connection, what level of video conferencing quality are you able to achieve at your office?
- ○ High quality
- ○ Medium quality
- ○ Low quality
- ○ Non-functional
- ○ I don't know

Do you communicate with patients in more than one language?
- ○ Yes
- ○ No

For what percentage of your patients do you utilize a translator?
0% 50% 100%
Change the slider above to set a response

What year did you graduate from hygiene school?
yyyy

In terms of gender, how do you describe yourself? (select all that apply)
- ☐ Female
- ☐ Male
- ☐ Transgender
- ☐ Gender Non-Binary
- ☐ I would prefer to self-describe
- ☐ I would prefer not to say

Do you consider yourself to be of Hispanic, Latino, or Spanish origin?
- ○ Yes
- ○ No

What race or races do you consider yourself to be? (Mark one or more)
- ☐ Native American or Alaska Native
- ☐ White
- ☐ Black or African
- ☐ Asian
- ☐ Hawaiian or Pacific Islander
- ☐ Other
- ☐ I would prefer not to say

Please select your age range?
- ○ 21-25
- ○ 26-35
- ○ 36-45
- ○ 46-55
- ○ 56-65
- ○ 66 or above

Final Questions: [----------*]

If formal telehealth resources were available to deliver oral medicine to your patients, how supportive would you be for your office to use them?
Unsupportive — Neither unsupportive nor supportive — Supportive
Change the slider above to set a response

Is there anything else about telehealth, or tele-Oral Med that we didn't ask about that you think is important to consider?
Expand

Form Status

Complete? Incomplete

Save & Exit Form | Save & ...

Appendix E. - Hierarchical Multiple Regression (HMR)

The model for the study is given as;

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki}$$

The β values are called regression weights and are computed in a way that minimizes the sum of squared deviations;

$$\sum_{i=1}^{k} (Y_i - Y_i')^2$$

In this model there were K predictor variables rather than two and K+1 regression weights which were estimated, one for each of the K predictor variable and one for the constant (β_0) term.[58]

Tests were conducted to assess the fit of our models and validity of the assumptions of the hierarchical multiple regression (HMR). We checked for normal distribution of our outcome variable using an histogram (see below); and for adequate ratio of number of observations to number of independent variables (at least 15 observations to 1 variables)[59] High multicollinearity between the independent variables was ruled out by verifying Pearson's correlation was below 0.8, the variance inflation factor (VIF) was below 10, and the tolerance was above 0.1.

To construct the most parsimonious model, we included the variables in the models one domain at a time in sequence, and within each domain, retained in the model the variables with a level of significance less than 0.15.[60] The order of inclusion in the model were demographics, followed by capability, opportunity and motivation. This purposeful selection of the variables within each

domain allowed us to construct a final model that included all four domains with their selected independent variable. We compared models by testing for differences in the R^2 statistics between models.

Figure. 2 – Primary Outcome Histogram

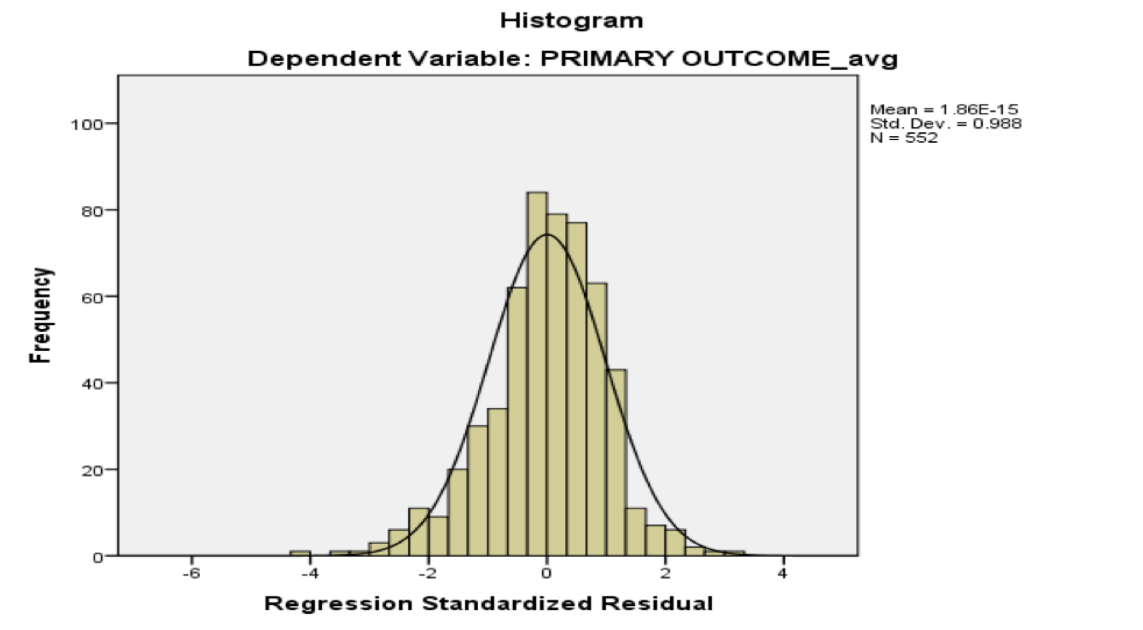
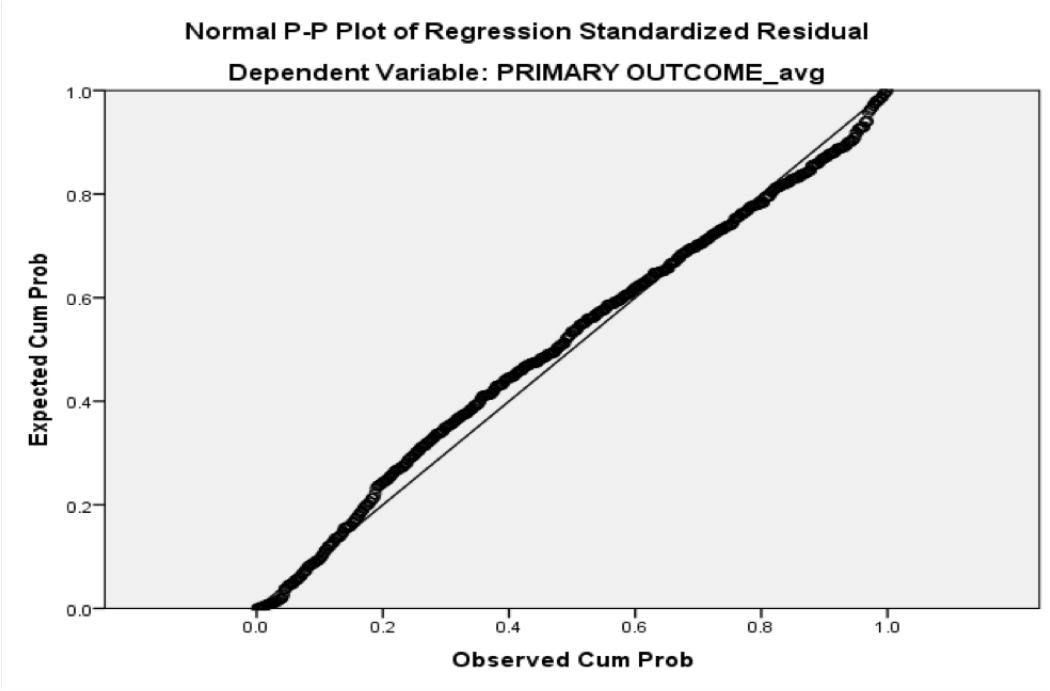


Figure 3. – P-P Plot



ANOVA

Model		Sum of Squares	df	Mean Square	F
	Regression	16561.165	3	5520.388	8.981
	Residual	336828.374	548	614.650	
1***	Total	353389.539	551		
	Regression	28438.180	6	4739.697	7.949
	Residual	324951.359	545	596.241	
2***	Total	353389.539	551		
	Regression	38333.235	8	4791.654	8.258
	Residual	315056.305	543	580.214	
3***	Total	353389.539	551		
	Regression	172400.394	13	13261.569	39.421
	Residual	180989.145	538	336.411	
4***	Total	353389.539	551		

significance *: 0.01-0.05, **: 0.00-0.01, ***: 0.0001 to 0.001

a. Predictors: (constant), rural, non-white, dental hygienist
b. Predictors: (constant), rural, non-white, dental hygienist, psych relation to pain, translation mode used, current TH use
c. Predictors: (constant), rural, non-white, dental hygienist, psych relation to pain, translation modes used, current TH use, current radiology use, inadequate access to OM
d. Predictors: (constant), rural, non-white, dental hygienist, psych relation to pain, translation modes used, current TH use, current radiology use, inadequate access to OM, initial and final ref. to OM, biopsy ref., TH-OM benefits and barriers, comfort in technology, TH mode likelihood
e. Dependent Variable: Likelihood of using TH-OM

The ANOVA revealed the significance of each of the four models were less than .001. It was noted in particular that the F value was largest for the model with 13 predictors. The F values were the overall predictive effects which were different from the F for the amount of change experienced when adding each additional domain.

Full Table of Coefficients

Model		B	SE	β	t	Sig.	Tolerance	VIF
1	(constant)	68.235	1.556		43.854	***		
	dental hygienist	9.553	2.236	.181	4.272	***	.968	1.033
	non-white	3.942	2.487	.067	1.585	ns	.970	1.031
	rural	-9.772	3.255	-.125	-3.002	**	.998	1.002
2	(constant)	55.262	4.677		11.817	***		
	dental hygienist	13.193	2.469	.250	5.344	***	.770	1.298
	non-white	4.331	2.451	.074	1.767	ns	.968	1.033
	rural	-8.565	3.219	-.110	-2.661	**	.990	1.010
	translation modes used	2.268	.727	.130	3.122	**	.979	1.022
	current TH use	.979	.349	.129	2.804	**	.800	1.249
	psych. relation to pain	2.053	1.335	.063	1.537	ns	.994	1.007
3	(constant)	43.709	5.534		7.898	***		
	dental hygienist	13.462	2.443	.255	5.509	***	.765	1.307
	non-white	4.114	2.420	.070	1.700	ns	.967	1.034
	rural	-9.434	3.188	-.121	-2.960	**	.983	1.018
	translation modes used	1.734	.729	.099	2.378	*	.946	1.057
	current TH use	.966	.345	.127	2.802	**	.798	1.253
	psych. relation to pain	1.906	1.318	.059	1.447	ns	.993	1.007
	current radiology use	.677	.601	.046	1.127	ns	.992	1.008
	inadequate access to OM	3.496	.882	.164	3.962	***	.955	1.047
4	(constant)	-5.867	8.057		-.728	ns		
	dental hygienist	9.657	1.971	.183	4.899	***	.682	1.466
	non-white	3.107	1.870	.053	1.662	ns	.939	1.065
	rural	-5.535	2.439	-.071	-2.270	*	.973	1.027
	translation modes used	.607	.563	.035	1.078	ns	.921	1.086
	current TH use	.438	.270	.058	1.626	ns	.757	1.322
	psych. relation to pain	-1.674	1.027	-.052	-1.630	ns	.948	1.055
	current radiology use	.546	.465	.037	1.173	ns	.959	1.043
	inadequate access to OM	1.419	.687	.067	2.067	*	.914	1.094
	initial and final ref. to OM	3.067	1.193	.081	2.570	*	.961	1.041
	biopsy ref.	1.950	.713	.086	2.735	**	.952	1.050
	TH mode likelihood	-.373	.085	-.157	-4.365	***	.738	1.356
	TH-OM benefits and barriers	1.285	.091	.518	14.190	***	.714	1.401
	comfort in technology	.181	.081	.079	2.230	*	.749	1.334

significance levels: ns: not significant, *: 0.01-0.05, **: 0.00-0.01, ***: 0.0001 to 0.001

a. Dependent Variable: Likelihood of using TH-OM

Appendix F. - COM-B: Assigned Domains and Scoring

Capability

Question	Answer Choices	Pts
Translation Type		
	Friend of family member that presents with patient	0
	Staff member/other colleague	0
	Hired in person translator	1
	Telephone translator	2
	Video conferenced translator	3
	Machine translator (i.e. google)	3
	Other translator	
Adjuncts for oral neoplasia utilized		
	cytology	3
	toludine blue	3
	fluorescence	3
Biopsy in own office		
	always	4
	frequently	3
	infrequently	2
	never	1
Current telehealth usage		
Real-time conference with patient present	Video conference	2
	Telephone conference	1
	Clinical e-care website	3
	Text/Short Message Service (SMS)	1
	E-mail	1
Consultation with dentist without patient present	Video conference	2
	Telephone conference	1
	Clinical e-care website	3
	Text/Short Message Service (SMS)	1
	E-mail	1
Consultation with specialist without patient present	Video conference	2
	Telephone conference	1
	Clinical e-care website	3
	Text/Short Message Service (SMS)	1
	E-mail	1
Store and forward: collect patient information and sent to specialist	Video conference	2
	Telephone conference	1
	Clinical e-care website	3
	Text/Short Message Service (SMS)	1
	E-mail	1
Radiography modalities in office	Film radiography (non-digital)	0
	Digital radiography	1
	Panoramic radiography	2
	Cone beam computed tomography	3
View on statement: "Mental health and chronic pain are closely related to each other	Strongly Agree	4
	Agree	3
	Neither agree nor disagree	2
	Disagree	1
	Strongly Disagree	0
Opportunity		
	High quality	3
	Medium quality	2
	Low quality	1
Video Conferencing in office	Non-functional	0
Current oral medicine patients		
Mucosal changes or lesions (i.e. white patches, persistent ulcers, etc.)	<1	1
	1-4	2
	5-8	3
	9-12	4
	>12	5
Orofacial pain (i.e. Temporomandibular disorder (TMD), atypical facial pain, neuropathic pain, etc.)	<1	1
	1-4	2
	5-8	3
	9-12	4
	>12	5
Oral manifestations or complexity of systemic disease (i.e. oncological, sleep disorder, etc.)	<1	1
	1-4	2
	5-8	3
	9-12	4
	>12	5
CBCT interpretation		
	self	0
	other general dentist	0
	Oral Radiologist	2
	Medical Radiologist	2
	other	1
View on statement: "I (we) have adequate access to Oral Medicine specialty services	Strongly Agree	1
	Agree	2
	Neither agree nor disagree	3
	Disagree	4
	Strongly Disagree	5
No referral to OM - referral to OM		
Specialist currently have access to be referred	(points contingent on answers to both questions, see below)	
Specialist to be referred if access to any	all other specialties	0
	OM for only second question	2

Motivation

Question	Answer Choices	Pts
Biopsy referral		
Where do you refer patients for biopsies? (select all that apply)	General dentist	1
	Oral surgeon	1
	Periodontist	1
	Oral Medicine	2
	Otolaryngologist	1
	Other	1
Likelihood for usage of Tele-Oral Medicine modalities		
WITH the patient present, use VIDEO CONFERENCE to consult in real-time with the Oral Medicine specialist	Very Likely	2
	Somewhat Likely	4
	Neither likely nor unlikely	6
	Somewhat Unlikely	8
	Very Unlikely	10
WITH the patient present, use SPEAKER PHONE to consult in real-time with the Oral Medicine specialist.	Very Likely	1
	Somewhat Likely	2
	Neither likely nor unlikely	3
	Somewhat Unlikely	4
	Very Unlikely	5
WITHOUT the patient present, use VIDEO CONFERENCE to consult with the Oral Medicine specialist.	Very Likely	2
	Somewhat Likely	4
	Neither likely nor unlikely	6
	Somewhat Unlikely	8
	Very Unlikely	10
WITHOUT the patient present, use the PHONE to consult with the Oral Medicine specialist.	Very Likely	1
	Somewhat Likely	2
	Neither likely nor unlikely	3
	Somewhat Unlikely	4
	Very Unlikely	5
Store and forward: enter appropriate information regarding your patient encounter in a secure telehealth website for later response from the Oral Medicine specialist in real-time. Provide the information to the patient to utilize the secure telehealth website to contact the Oral Medicine specialist in real-time.	Very Likely	2
	Somewhat Likely	4
	Neither likely nor unlikely	6
	Somewhat Unlikely	8
	Very Unlikely	10
Provider comfort in utilizing technology		
Communicating with patients via email	Very Comfortable	4
	Somewhat Comfortable	3
	Neither Comfortable or Uncomfortabl	2
	Somewhat Uncomfortable	1
	Very Uncomfortable	0
Scheduling patient appointments on the computer	same as above	4-0
Using an Electronic Health Record	same as above	4-0
Generating, accessing, and sending digital photographs	same as above	8-0
Generating, accessing, and sending digital radiographs	same as above	8-0
Using video conferencing software	same as above	8-0
Browsing the internet for information about dentistry	same as above	4-0
Accessing online-electronic evidence-based resources (i.e. MEDLINE, PUBMED, UpToDate)	same as above	8-0
Receiving continuing education electronically	same as above	12-3
Using telehealth to refer patients	same as above	12-3
Using telehealth to help refer patients	same as above	12-3
Using telehealth to treat patients	same as above	12-3
Using telehealth as a patient yourself	same as above	12-3

Question	Answer Choices	Pts
Perceptions of Tele-Oral Medicine survey results		
Tele-Oral Med will improve timeliness of appropriate patient care.	Strongly Agree	4
	Agree	3
	Neither agree nor disagree	2
	Disagree	1
	Strongly Disagree	0
Tele-Oral Med will fill an existing service gap	same as above	4-0
Tele-Oral Med will jeopardize patient privacy.	same as above	0-4
Tele-Oral Med will help to reduce the number of encounters between the patient and multiple providers/emergency department.	same as above	4-0
Tele-Oral Med will help to improve productivity of dental staff.	same as above	4-0
Tele-OM will be depersonalizing.	same as above	0-4
Tele-OM will have unintended negative consequences.	same as above	0-4
Tele-OM will improve the overall quality of health care delivered in my office.	same as above	4-0
Tele-OM will be too expensive to implement and use.	same as above	0-4
Tele-OM will improve access to appropriate patient care.	same as above	4-0
Tele-OM will hinder dentist-patient relationships.	same as above	0-4
Tele-OM will increase overall efficiency.	same as above	4-0
Tele-OM will be difficult for the patient to learn to use	same as above	0-4
Tele-OM will be difficult for me to learn to use.	same as above	0-4
Tele-OM will take too much technology expertise to implement.	same as above	0-4
Tele-OM when coupled with evidence-based, consensus-developed care, may reduce the variability of treatment and management.	same as above	4-0
Tele-OM will reduce effectiveness of patient care.	same as above	0-4
Tele-OM will not be accurate or complete enough compared to a face-to face visit.	same as above	0-4
Tele-OM will improve the overall patient experience in my office.	same as above	4-0
Tele-OM will help to avoid a face-to-face visit by an oral medicine specialist.	same as above	4-0
Patient Scenario		
How would you proceed with this patient? (In your experience, how would the dentist(s) in your practice proceed	treat myself	0
	refer	2
Referral to OM - continue referral to OM		
Specialist currently have access to be referred	(points contingent on answers to both	
Specialist to be referred if access to any	all other specialties	0
	OM for both questions	2

Appendix G. - Missing Data

We observed three major characteristics related to missing data: 1. The primary outcome questions had a significant number of answers missing, 2. Some data were missing due to attrition from the impact of the length of the survey 3. Other data seemed to be missing at random. Therefore, the missing data was resolved in different three ways:

In addressing the primary outcome questions, unlike any of the other questions in the survey, approximately 7% of participants left this question blank. The slider box to record a value had a default position in the center of the scale. We hypothesized that due to the physical design of the survey, many participants who meant to record their answer as "neither likely nor unlikely" simply did not change the position of the slider. (see figure below) To account for this, for participants who completed the rest of the survey, we included the value of 50 as a response. The adjusted values demonstrated a *median* of 74 and 75 respectively (M = 70.2, 70.2, SD = 26.9, 25.8).

To address the missing data due to attrition, an exclusion of subjects for the final analysis was based on the fact that the demographics section was at the end of the survey. 563 participants that had completed the majority of demographics questions were included in the final HMR analysis.

Lastly, the MCAR and ML algorithms were used to impute the remaining missing data as explained in the methods section. The MCAR test confirmed that all missing values were completely at random: χ^2 (1362, N=536) = 326.032, p = 1.000.

Appendix H. Participants from Rural Area vs. Non-rural Areas

Comfort in technology

Participants in a rural area — Mean of means: 3.05	n	M	SD
Browsing the internet for information about dentistry	70	3.76	0.67
Receiving continuing education electronically	70	3.64	0.59
Scheduling patient appointments on the computer	70	3.51	0.99
Using an Electronic Health Record	70	3.50	0.91
Generating, accessing, and sending digital radiographs	70	3.46	0.81
Generating, accessing, and sending digital photographs	70	3.41	0.88
Accessing online-electronic evidence-based resources (i.e. MEDLINE, PUBMED, UpToDate)	69	3.41	0.75
Communicating with patients via email	70	3.13	1.17
Using telehealth to help refer patients **	42	2.69	0.92
Using video conferencing software	70	2.51	1.05
Using telehealth as a patient yourself	69	2.35	1.04
Using telehealth to refer patients *	28	2.21	1.03
Using telehealth to treat patients *	42	2.10	0.88

Participants in a non-rural area — Mean of means: 3.16	n	M	SD
Browsing the internet for information about dentistry	491	3.79	0.56
Receiving continuing education electronically	491	3.71	0.61
Scheduling patient appointments on the computer	491	3.63	0.82
Using an Electronic Health Record	491	3.61	0.76
Generating, accessing, and sending digital radiographs	491	3.56	0.77
Accessing online-electronic evidence-based resources (i.e. MEDLINE, PUBMED, UpToDate)	490	3.54	0.76
Generating, accessing, and sending digital photographs	491	3.53	0.79
Communicating with patients via email	490	3.36	0.99
Using video conferencing software	491	2.70	1.07
Using telehealth to refer patients *	475	2.57	1.00
Using telehealth to help refer patients **	437	2.54	0.97
Using telehealth as a patient yourself	491	2.46	1.05
Using telehealth to treat patients *	473	2.12	1.05

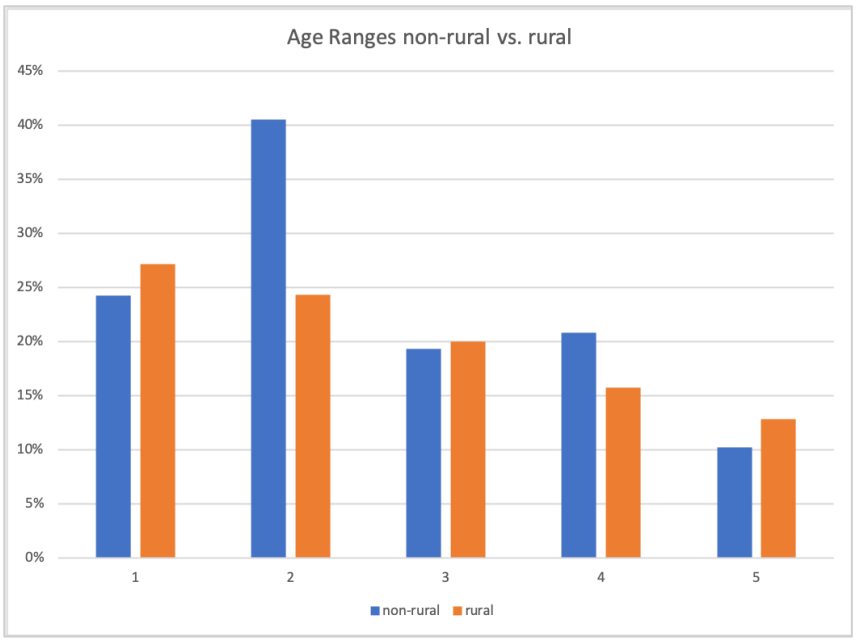
* DE only, **DH only, Note: Higher mean value indicates stronger agreement

Perceptions of telehealth delivered oral medicine

participants in rural area	n	M	SD
TH-OM will fill an existing service gap.	70	2.96	0.84
TH-OM will improve timeliness of appropriate patient care.	70	2.90	0.76
TH-OM will improve access to appropriate patient care.	70	2.89	0.69
TH-OM will help to reduce the number of encounters between the patient and multiple providers/emergency department.	70	2.80	0.75
TH-OM when coupled with evidence based, consensus-developed care, may reduce the variability of treatment and management.	70	2.63	0.62
TH-OM will improve the overall quality of health care delivered in my office	70	2.59	0.77
TH-OM will help to avoid a face-to-face visit by an oral medicine specialist.	70	2.41	0.88
TH-OM will increase overall efficiency.	70	2.40	0.86
TH-OM will help to improve productivity of dental staff.	70	2.39	0.79
TH-OM will improve the overall patient experience in my office.	70	2.31	0.71
TH-OM will not be accurate or complete enough compared to a to a face-to face visit.	70	2.24	1.06
TH-OM will be difficult for the patient to learn to use	70	2.09	0.70
TH-OM will be too expensive to implement and use.	70	2.01	0.69
TH-OM will take too much technology expertise to implement.	70	1.80	0.81
TH-OM will have unintended negative consequences.	67	1.78	0.65
TH-OM will be depersonalizing.	70	1.70	0.89
TH-OM will be difficult for me to learn to use.	70	1.67	0.94
TH-OM will hinder dentist-patient relationships.	70	1.43	0.79
TH-OM will reduce effectiveness of patient care.	70	1.37	0.66
TH-OM will jeopardize patient privacy.	70	1.30	0.73

participants in non-rural area	n	M	SD
TH-OM will fill an existing service gap.	490	2.99	0.89
TH-OM will improve timeliness of appropriate patient care.	491	2.97	0.86
TH-OM will improve access to appropriate patient care.	490	2.94	0.82
TH-OM will help to reduce the number of encounters between the patient and multiple providers/emergency department.	491	2.88	0.87
TH-OM will improve the overall quality of health care delivered in my office	490	2.65	0.86
TH-OM when coupled with evidence based, consensus-developed care, may reduce the variability of treatment and management.	489	2.63	0.77
TH-OM will increase overall efficiency.	490	2.63	0.85
TH-OM will improve the overall patient experience in my office.	491	2.44	0.85
TH-OM will help to improve productivity of dental staff.	491	2.41	0.97
TH-OM will help to avoid a face-to-face visit by an oral medicine specialist.	490	2.39	0.87
TH-OM will not be accurate or complete enough compared to a to a face-to face visit.	490	2.26	0.94
TH-OM will be too expensive to implement and use.	488	1.87	0.65
TH-OM will be difficult for the patient to learn to use	491	1.84	0.74
TH-OM will have unintended negative consequences.	488	1.68	0.79
TH-OM will be depersonalizing.	490	1.60	0.92
TH-OM will take too much technology expertise to implement.	491	1.45	0.79
TH-OM will reduce effectiveness of patient care.	490	1.35	0.80
TH-OM will hinder dentist-patient relationships.	490	1.34	0.83
TH-OM will be difficult for me to learn to use.	490	1.30	0.81
TH-OM will jeopardize patient privacy.	491	1.29	0.84

Larger mean value indicates stronger agreement. Red line delineates agreement from disagreement.
- indicates a beneficial feature of TH-OM - indicates a barrier to TH-OM, Note: Higher mean indicates stronger agreement.



Appendix I. - Population vs. Participant Demographics