

## ORIGINAL ARTICLE

# Teledentistry utilization by oral health professionals and policy considerations: A mixed methods case study

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## Abstract

**Objectives:** To examine variations in the delivery of teledentistry after the COVID-19 pandemic and to explore oral health professionals' utilization of various teledentistry modes of delivery.

**Methods:** In this mixed methods case study, we collected teledentistry claims data from patient electronic health records ( $n = 78,756$ ) encompassing various types of teledentistry utilization in clinical settings and through community outreach from a Dental Support Organization (DSO) in Oregon from January 2021 to November 2022. We analyzed the patient demographic and claims data using descriptive statistics and logistic regression analyses to identify patterns of teledentistry service delivery. Qualitatively, we conducted virtual interviews ( $n = 13$ ) through Microsoft Teams with oral health professionals about their experiences with teledentistry utilization. We used inductive and deductive coding to code individual transcripts and identify common themes among provider experiences.

**Results:** Out of the 78,756 electronic health record claims for teledentistry, 75.7% used synchronous audio, 13.4% used synchronous video, and 10.9% used asynchronous teledentistry methods. We observed a 8.6% increase in synchronous audio teledentistry utilization at the end of the study period, compared with a 4.2% increase in synchronous video and a 4.4% decrease in asynchronous teledentistry. Oral health professionals interviewed reported choosing the type of teledentistry delivery based on patient and provider access to the virtual teledentistry platform.

**Conclusion:** Oral health professionals' knowledge of and experiences with teledentistry need to be considered when developing policy and best practices for the use of teledentistry for patient care.

## KEY WORDS

access to care, attitude, dentistry, experience, knowledge, oral health, perspective, policy, qualitative, teledentistry

## INTRODUCTION

Access to oral health care is a complex problem with many moving parts including, but not limited to, the cost of care, dental workforce challenges, personal limitations, and social constructs [1, 2]. The availability of virtual

access to an oral health provider, or teledentistry, has the potential for improved access to oral health care [3–5]. Teledentistry is an electronic or virtual method of providing oral health care services to patients who may not otherwise be able to attend a traditional dental visit [3, 5]. This method of patient care utilizes technology to gather

information about the patient's current oral health needs, compare the patient's oral health condition with their existing dental records when available, and determine next steps for in-person care [4, 6, 7].

Teledentistry is categorized into two main types, asynchronous and synchronous. With the improvement of technology and adaptations based on patient needs, synchronous teledentistry can be further classified into video and audio, or telephone, teledentistry [5]. These types of teledentistry can be differentiated by clinical care or community outreach delivery. Asynchronous teledentistry occurs when the patient sees an oral health provider (generally a dental hygienist) in person, receives dental care related to their chief complaint within the provider's scope of practice abilities, then receives further diagnosis and treatment planning at a later time after a dentist reviews the patient's electronic dental records [5, 6]. Synchronous teledentistry occurs when the patient and oral health provider communicate in real time using an audio call or video platform to discuss, evaluate, and determine next steps for a dental related question or problem [5, 6, 8]. When possible, synchronous audio teledentistry can be accompanied by patient images sent to the provider through an electronic method such as encrypted text or email [4, 5, 8, 9]. Although variations exist between states' Medicaid allowances with teledentistry reimbursement, most states allow some variation of synchronous video, synchronous audio, and asynchronous teledentistry that is delivered by a licensed oral health professional [4, 7, 10]. For commercial and private dental payors, many states honor "payment parity" which requires the payment of services rendered regardless if they were provided virtually or in person [6, 7, 9, 11].

Most forms of clinical teledentistry, with the exception of synchronous audio, are delivered through a software application or platform that allows for safe and secure transmission of the patient's personal and health related information and allows for formal documentation of the patient's consent to care and acknowledgment of limitations related to teledentistry [3, 8]. While synchronous audio generally does not contain the transmission of patient health records or other identifiable information, the dental provider is responsible for ensuring the patient's personal health information is protected at all times [6]. For example, the synchronous audio call should occur in a private environment for both the oral health provider and patient to help ensure patient privacy; if photographs are shared via text, texting platforms using encryption should be used and photographs saved to the patient's electronic health record (EHR) as soon as possible; and the patient's identity should be confirmed by sharing a photo identification card through an encrypted platform [12]. For this type of teledentistry, providers are also required to provide a verbal informed consent surrounding expectations and limitations with synchronous audio teledentistry along with any financial responsibilities to the patient [6].

Prior to 2020, teledentistry was recognized as a method to reach underserved individuals in Dental Health Professional Shortage Areas (DHPSAs), often occurring in rural communities, to help reduce oral health inequities [2, 13, 14]. Teledentistry has demonstrated promise as a tool to improve oral health outcomes related to timely access to a dental provider; cost savings related to triaging patients for the care needed; and flexibility for patients who cannot get to an appointment [15, 16]. Further, teledentistry has been an important tool for alleviating workforce issues with oral health providers [3, 13, 17]. Barriers to teledentistry can include a lack of confidence in the effectiveness of teledentistry by patients, providers, and policy makers, challenges with technology literacy and availability, perceived cost effectiveness, lack of broadband internet, and challenges with reimbursement for teledentistry services [3, 10, 14–16].

In 2020, COVID-19 related restrictions with in-person dental service delivery increased interest in using teledentistry to address patient and provider needs [13–15, 18]. For several months during the onset of the COVID-19 pandemic, dental offices were closed or had limited care available to patients [14, 19, 20]. Many dental clinics scrambled to develop protocols and technical support for teledentistry, which proved to be an effective mediator for providing definitive and palliative dental care [8, 14, 18]. New evidence is now available showing the immediate and long-term effectiveness of using teledentistry for various oral health related consultations, oral health instructions, follow-up care, and triage [6]. Qualitative research surrounding dentist and dental hygienists' acceptance of using teledentistry for patient care delivery tends to be favorable, especially among dentists who are confident in their diagnosing and treatment planning skills [18, 20–22]. However, research exploring the circumstances and rationale of when and why providers use different teledentistry types remains limited.

The objective of this mixed methods case study is to understand why oral health professionals select and use various types of teledentistry to deliver oral health care services to meet patient needs. We sought to gain understanding surrounding the types of teledentistry providers use for different oral care services; providers' decision-making process in using teledentistry; and providers' experiences with teledentistry to inform the regularization of teledentistry in everyday practice.

## METHODS

### Setting and site

We collected data from EHRs ( $n = 78,756$ ) for asynchronous and synchronous teledentistry clinical services and community outreach program delivered by a large Dental Support Organization (DSO) in Oregon between January 2021 and November 2022. A DSO is an organization that

dental clinics contract with to help with business management logistics such as administration, billing, and workforce [23]. The DSO from which the data was collected is composed of 50 dental clinics and provides oral health care to over 60,000 commercially ensured patients and 300,000 Medicaid beneficiaries which comprises approximately 30% of dental care for the citizens of Oregon's [24].

## Clinical teledentistry settings

Asynchronous teledentistry visits in this study consisted of a dental hygienist gathering patient information, such as chief complaint documentation, health and dental histories, risk assessments, radiographs, and intraoral images from the patient as needed. Based on this information, the dental hygienist then provided preventive or therapeutic care, such as dental prophylaxis (cleanings), fluoride varnish applications, and periodontal therapy. Upon completion of these services, the dental hygienist stored and forwarded the electronic data to a dentist (generally in a separate location), for further review, a definitive diagnosis, and treatment plan. After the clinical team receives the treatment plan from the dentist, the patient is then contacted for further instruction and appointment scheduling. Patients returning to the dental clinic for follow up care based on the dentists' recommendations may or may not see the same provider who reviewed the initial patient records.

Synchronous teledentistry in this study occurred when an oral health provider communicated with a patient in real time using an audio call or video platform to discuss, evaluate, and determine next steps for a dental related question or problem.

## Community teledentistry settings

Synchronous audio used for community outreach was provided by expanded practice dental hygienists (EPDH), who have additional certification from the state of Oregon and a collaborative agreement with a dentist to provide patient care in community settings [25]. Due to limitations that remained during the study period with direct patient access in community settings and the lack of a remote synchronous video platform, the EPDHs conducted community outreach to Medicaid recipients through synchronous audio. EPDHs provide preventive oral health care through oral health education, oral health risk assessments, and helping patients schedule an in-person dental visit. In Oregon, individuals who are Medicaid beneficiaries are assigned to a dental provider, who is then responsible for reaching out to and assisting them with oral health education and accessing oral health care [24, 25].

Data collection consisted of a convergent parallel design in which quantitative data and qualitative data were collected and analyzed concurrently to identify and understand findings synergistically [26]. Patient identifiers were removed, and the data was aggregated to prevent identification of individual patients and study participants. The research protocol was determined exempt by WCG Internal Review Board.

## Quantitative strand-dental clinics

Data on clinic-based services delivered via teledentistry was collected from clinical dental claims, EHRs, and MouthWatch® teledentistry platform<sup>30</sup> from dental clinics with varied geographic and community profiles.

Table 1 shows the Current Dental Terminology (CDT) codes that were used to identify teledentistry services including asynchronous teledentistry (D9996) and synchronous teledentistry (D9995) services [6, 27]. Asynchronous and synchronous teledentistry were further classified by CDT codes for limited evaluation (D0140), re-evaluation (D0171), problem focused evaluation (D0170), and assessment of patient (D0191) and by the severity of care that was needed: Emergency, Urgent,

**TABLE 1** Current Dental Terminology (CDT) codes, definitions, and applications.

| Current Dental Terminology (CDT) codes for identifying services provided |   |  |
|--|---|--|
| CDT codes  | CDT code definition   | CDT code teledentistry application                             |
| D9995  | Synchronous teledentistry—<br>Real time virtual communication with an oral health provider.   | Synchronous (video or audio)                                   |
| D9996  | Asynchronous teledentistry—<br>In-person visit with an oral health provider with a second provider reviewing records to provide a diagnosis and treatment plan. | Asynchronous (store-and-forward patient data for later review) |
| D0140 <sup>a</sup>   | Limited oral evaluation   | Asynchronous, synchronous (video)                              |
| D0170 <sup>a</sup>   | Re-evaluation of a problem  | Asynchronous, synchronous (video)                              |
| D0191 <sup>a</sup>   | Assessment of patient   | Asynchronous, synchronous (video or audio)                     |
| D0601, D0602, D0603  | Low, moderate, and high caries risk assessment  | Synchronous audio  |
| D1330  | Oral hygiene instruction  | Synchronous audio  |
| D1310  | Nutritional counseling  | Synchronous audio  |
| D1320  | Tobacco counseling  | Synchronous audio  |

<sup>a</sup>These codes are further classified in the teledentistry platform as Emergency, Urgent, or Routine based on the patient's oral health condition.

or Routine. Emergency care referred to a patient who was having pain or discomfort and needed to be seen within the next 24 h, Urgent care referred to a patient who was having pain or discomfort but did not need to be seen immediately, and Routine care referred to a patient who was not having pain or discomfort but rather needed to be seen to maintain oral health. Synchronous teledentistry procedures were further coded by delivery type, audio or video. Patients receiving a teledentistry appointment were divided into three age groups: 0–18, 19–64, and 65+. Patients were also stratified by gender (male or female) and by race/ethnicity (White, Asian, Black/African American, Hispanic/Latino, Other). Oral health professionals who delivered teledentistry were identified as doctor or dental hygienist.

Logistic regression was performed for the clinical data with asynchronous versus synchronous teledentistry use as the dependent variable and patient age, gender, and race/ethnicity as independent variables. Logistic regression was also performed for the clinical data with synchronous audio versus synchronous video as the dependent variables and age, race, gender, and provider type as independent variables. Provider type was not included in the regression analysis for asynchronous versus synchronous teledentistry due to very low numbers of dental hygienists represented in those types of teledentistry use. We used R 4.2.0 to conduct the analysis.

### Quantitative strand-community outreach

A platform separate from the clinical claims data called ADIN was used to retrieve data for services provided through synchronous audio teledentistry [26]. Data collected during the analysis consisted of oral health services including, caries risk assessments (D0601, D0602, or D0603), oral hygiene instruction (D1330), nutritional counseling (D1310), and tobacco counseling (D1320).

### Qualitative strand

We used a case study phenomenological research paradigm to conduct the qualitative aspect of the research, which seeks to explore the essence of a phenomenon within structured bounds of a case [28]. The bounds of this case was teledentistry utilization within a large DSO in Oregon in which we sought to explore why oral health professionals were choosing various types of teledentistry for patient care. We utilized a semi-structured interview guide to identify nuances among study participants [28] with their varied professional roles (dentist, dental hygienist, or support team), type of dental setting where they worked (clinic or community outreach), patient needs, and organizational requirements in regard to teledentistry utilization. Oral health providers and support team members who use teledentistry were recruited by

circulating a company-wide invitation to participate. Study participants were provided a research summary, informed consent, and demographic survey before the qualitative interview began. The interviewer had experience as a clinical dental hygienist lending to natural discussion with oral health professionals about patient care delivery through teledentistry.

The interviews were conducted and recorded using Microsoft Teams and lasted an average of 30 min per interview. Recordings were sent to a third-party transcriptionist and were anonymized. Transcriptions were uploaded into Dedoose software, where they were coded using a combination of deductive codes identified in existing literature and inductive codes that emerged during initial data familiarization. Coding saturation was considered when new or novel information about study participant's experiences with using teledentistry, a review of the data, and memo writing confirmed that there was consistency among the experiences reported by the study participants. At this point, recruiting and enrolling new participants ended [28]. The quality of coding and theme building was strengthened by having two team members experienced in qualitative methods conduct a data analysis review. Results were identified based on the strength of themes in regard to the volume of qualitative evidence.

## RESULTS

Teledentistry utilization data collection was limited prior to January 2021 due to significant changes in data collection and accuracy that occurred with the implementation of the MouthWatch<sup>®</sup> platform and changes with community outreach from in-person visits to synchronous audio teledentistry in response to the onset of the COVID-19 pandemic in 2020.

### Teledentistry experience within the DSO in a clinical setting (quantitative)

#### Descriptive statistics

See Tables 2 and 3 for descriptive statistics regarding the provision of asynchronous and synchronous teledentistry. The overall clinic-based teledentistry was delivered to 78,756 out of 360,000 unique patients, which accounts for almost 22% of the DSO's patient population. Approximately, three fourth of teledentistry appointments were delivered as synchronous audio (75.7%) compared with synchronous video (13.4%) and asynchronous (10.9%). Synchronous audio usage increased from 67.1% in 2021 to 75.7% in 2022, while synchronous video and asynchronous visits fell by more than 4% each during the same time.

Patients identifying as female and White received both asynchronous and synchronous teledentistry



TABLE 2 (Continued)

|   | Asynchronous teledentistry use |       | Synchronous teledentistry use |       |
|---|--------------------------------|-------|-------------------------------|-------|
|   | N                              | %     | N                             | %     |
| D0170 Emergency   |                                |       |                               |       |
| Yes   | 0                              | 0.0%  | 0                             | 0.0%  |
| No  | 35,530                         | 100%  | 70,120                        | 100%  |
|   | 35,530                         | 100%  | 70,120                        | 100%  |
| D0170 Urgent  |                                |       |                               |       |
| Yes   | 0                              | 0.0%  | 2                             | 0.0%  |
| No  | 35,530                         | 100%  | 70,118                        | 100%  |
|   | 35,530                         | 100%  | 70,120                        | 100%  |
| D0170 Routine   |                                |       |                               |       |
| Yes   | 0                              | 0.0%  | 1                             | 0.0%  |
| No  | 35,530                         | 100%  | 70,119                        | 100%  |
|   | 35,530                         | 100%  | 70,120                        | 100%  |
|   | Asynchronous Teledentistry use |       | Synchronous Teledentistry use |       |
|   | N                              | %     | N                             | %     |
| Total D0191 (Oral assessment of a patient) <sup>b</sup> |                                |       |                               |       |
| Yes   | 163                            | 0.5%  | 10,731                        | 15.3% |
| No  | 35,367                         | 99.5% | 59,389                        | 84.7% |
|   | 35,530                         | 100%  | 70,120                        | 100%  |
| D0191 Emergency   |                                |       |                               |       |
| Yes   | 30                             | 0.1%  | 2631                          | 3.8%  |
| No  | 35,500                         | 99.9% | 67,489                        | 96.2  |
|   | 35,530                         | 100%  | 70,120                        | 100%  |
| D0191 Urgent  |                                |       |                               |       |
| Yes   | 72                             | 0.2%  | 5360                          | 7.6%  |
| No  | 35,458                         | 99.8% | 64,760                        | 92.4% |
|   | 35,530                         | 100%  | 70,120                        | 100%  |
| D0191 Routine   |                                |       |                               |       |
| Yes   | 61                             | 0.2%  | 2740                          | 3.9%  |
| No  | 35,469                         | 99.8% | 67,380                        | 96.1% |
|   | 35,530                         | 100%  | 70,120                        | 100%  |

<sup>a</sup>Missing data were the result of inconsistent reporting by dental clinics.

<sup>b</sup>As not all asynchronous teledentistry visits included an oral evaluation CDT code, these totals do not equal the total number of teledentistry visits.

services in greater percentages than males and individuals not identifying as White. Younger individuals (0–18 years) received more asynchronous care, while older individuals (19–64 years) received more synchronous (audio and video) care (Tables 2 and 3). Synchronous video in the clinic setting was used most often by dentists to consult and provide a treatment plan for Emergency and Urgent care (82.2%) compared with Routine care (17.7%). Dental hygienists engaged with patients using synchronous video most often for Routine care (96.4%).

Synchronous audio was most often used by dentists to consult with and provide a treatment plan for patients who needed Emergency or Urgent care (80.7%). When dental hygienists engaged with patients using

synchronous audio it was most often for Routine care (99.1%).

### Regression analysis results

Table 4 shows the results of the logistic regression analysis predicting synchronous versus asynchronous teledentistry use. Females were less likely to receive care through synchronous teledentistry than males (OR = 0.93; 95% CI = 0.90–0.97;  $p < 0.001$ ). Compared to children aged 0–18, adults aged 19–64 had significantly greater odds of receiving care through synchronous as opposed to asynchronous teledentistry (OR = 3.50; 95% CI = 3.37–3.64;  $p < 0.001$ ). These odds were decreased for adults 65 and

**TABLE 3** Descriptive statistics regarding the provision of different types of synchronous teledentistry.

| <b>Synchronous teledentistry use</b>                                     |              |       |              |       |
|--|--------------|-------|--------------|-------|
|  | <b>Video</b> |       | <b>Audio</b> |       |
|  | <i>N</i>     | %     | <i>N</i>     | %     |
| <b>Age</b>   |              |       |              |       |
| 0–18   | 5330         | 45.0% | 16,681       | 28.6% |
| 19–64  | 6053         | 51.1% | 39,169       | 67.2% |
| 65+  | 454          | 3.8%  | 2433         | 4.2%  |
|  | 11,837       | 100%  | 58,273       | 100%  |
| <b>Gender<sup>a</sup></b>  |              |       |              |       |
| Male   | 5487         | 46.5% | 24,267       | 41.8% |
| Female   | 6309         | 53.5% | 33,788       | 58.2% |
|  | 11,796       | 100%  | 58,055       | 100%  |
| <b>Race<sup>a</sup></b>  |              |       |              |       |
| White  | 3393         | 80.4% | 21,355       | 86.5% |
| Asian  | 120          | 2.8%  | 130          | 0.5%  |
| Black/African American   | 44           | 1.0%  | 270          | 1.1%  |
| Hispanic/Latino  | 587          | 13.9% | 2204         | 8.9%  |
| Other  | 75           | 1.8%  | 722          | 2.9%  |
|  | 4219         | 100%  | 24,681       | 100%  |
| <b>Provider type</b>   |              |       |              |       |
| Dentist  | 9048         | 76.4% | 52,960       | 90.9% |
| Dental Hygienist   | 2789         | 23.6% | 5323         | 9.1%  |
|  | 11,837       | 100%  | 58,283       | 100%  |
| <b>Total D0140 (Limited oral evaluation)<sup>b</sup></b>                 |              |       |              |       |
| Yes  | 48           | 0.4%  | 207          | 0.4%  |
| No   | 11,789       | 99.6% | 58,076       | 99.6% |
|  | 11,837       | 100%  | 58,283       | 100%  |
| <b>D0140 Emergency</b>   |              |       |              |       |
| Yes  | 29           | 0.2%  | 50           | 0.1%  |
| No   | 11,808       | 99.8% | 58,233       | 99.9% |
|  | 11,837       | 100%  | 58,283       | 100%  |
| <b>D0140 Urgent</b>  |              |       |              |       |
| Yes  | 17           | 0.1%  | 138          | 0.2%  |
| No   | 11,820       | 99.9% | 58,145       | 99.8% |
|  | 11,837       | 100%  | 58,280       | 100%  |
| <b>D0140 Routine</b>   |              |       |              |       |
| Yes  | 2            | 0.00% | 19           | 0.00% |
| No   | 11,835       | 100%  | 58,264       | 100%  |
|  | 11,837       | 100%  | 58,283       | 100%  |
| <b>Synchronous teledentistry use</b>                                     |              |       |              |       |
|  | <b>Video</b> |       | <b>Audio</b> |       |
|  | <i>N</i>     | %     | <i>N</i>     | %     |
| <b>Total D0170 (Re-evaluation of an oral health problem)<sup>b</sup></b> |              |       |              |       |
| Yes  | 1            | 0.0%  | 2            | 0.0%  |
| No   | 11,836       | 100%  | 58,281       | 100%  |
|  | 11,837       | 100%  | 58,283       | 100%  |

(Continues)

TABLE 3 (Continued)

| Synchronous teledentistry use                           |        |       |        |       |
|---|--------|-------|--------|-------|
|   | Video  |       | Audio  |       |
|   | N      | %     | N      | %     |
| D0170 Emergency   |        |       |        |       |
| Yes   | 0      | 0.0%  | 0      | 0.0%  |
| No  | 11,837 | 100%  | 58,283 | 100%  |
|   | 11,837 | 100%  | 58,283 | 100%  |
| D0170 Urgent  |        |       |        |       |
| Yes   | 0      | 0.0%  | 2      | 0.0%  |
| No  | 11,837 | 100%  | 58,284 | 100%  |
|   | 11,837 | 100%  | 58,284 | 100%  |
| D0170 Routine   |        |       |        |       |
| Yes   | 1      | 0.0%  | 0      | 0.0%  |
| No  | 11,836 | 100%  | 58,283 | 100%  |
|   | 11,837 | 100%  | 58,283 | 100%  |
| Total D0191 (Oral assessment of a patient) <sup>b</sup> |        |       |        |       |
| Yes   | 816    | 6.9%  | 9915   | 17.0% |
| No  | 11,021 | 93.1% | 48,368 | 83.0% |
|   | 11,837 | 100%  | 58,283 | 100%  |
| D0191 Emergency   |        |       |        |       |
| Yes   | 320    | 2.7%  | 2311   | 4.0%  |
| No  | 11,517 | 97.0% | 55,972 | 96.0% |
|   | 11,837 | 100%  | 58,283 | 100%  |
| D0191 Urgent  |        |       |        |       |
| Yes   | 334    | 2.8%  | 5026   | 8.6%  |
| No  | 11,503 | 97.2% | 53,257 | 91%   |
|   | 11,837 | 100%  | 58,283 | 100%  |
| D0191 Routine   |        |       |        |       |
| Yes   | 162    | 1.4%  | 2578   | 4.4%  |
| No  | 11,675 | 98.6% | 55,705 | 95.6% |
|   | 11,837 | 100%  | 58,283 | 100%  |

<sup>a</sup>Missing data were the result of inconsistent reporting by dental clinics.

<sup>b</sup>As not all asynchronous teledentistry visits included an oral evaluation CDT code, these totals do not equal the total number of teledentistry visits.

older but were still significant (OR = 1.63; 95% CI = 1.50–1.76;  $p < 0.001$ ). Compared to White individuals, individuals had significantly higher odds of receiving care through synchronous versus asynchronous teledentistry if they identified as Black (OR = 1.66; 95% CI = 1.34–2.09;  $p < 0.001$ ), Asian (OR = 1.46; 95% CI = 1.17–1.83;  $p < 0.001$ ) or described their race/ethnicity as “other” (OR = 1.23; 95% CI = 1.17–1.29;  $p < 0.001$ ). Individuals identifying as Hispanic/Latino had significantly lower odds of experiencing synchronous teledentistry (OR = 0.60; 95% CI = 0.57–0.64;  $p < 0.001$ ) than White individuals.

Table 5 shows the results of the logistic regression analysis predicting synchronous video teledentistry versus synchronous audio teledentistry use. Females were less likely to receive care through video teledentistry than

males (OR = 0.88; 95% CI = 0.76–0.85;  $p < 0.001$ ). Compared to children aged 0–18, adults aged 19–64 had significantly lower odds of receiving care through video teledentistry as opposed to audio teledentistry (OR = 0.80; 95% CI = 0.76–0.85;  $p < 0.001$ ). These odds were decreased for adults 65 and older but were still significant (OR = 0.71; 95% CI = 0.63–0.79;  $p < 0.001$ ). Compared to White individuals, individuals had significantly higher odds of receiving care through synchronous audio versus synchronous video teledentistry if they identified as Asian (OR = 3.48; 95% CI = 2.75–4.41;  $p < 0.001$ ), Black (OR = 1.48; 95% CI = 1.20–1.82;  $p < 0.001$ ), described their race/ethnicity as “other” (OR = 1.68; 95% CI = 1.59–1.77;  $p < 0.001$ ), or identified as Hispanic/Latino (OR = 1.18; 95% CI = 1.08–1.28;  $p < 0.001$ ).



**TABLE 4** Logistic regression model predicting synchronous teledentistry use by patient characteristics (versus asynchronous teledentistry use).

|                        | Odds ratio | 95% CI    | <i>p</i> -value |
|------------------------|------------|-----------|-----------------|
| Age                    |            |           |                 |
| 0–18                   | -          | -         | -               |
| 19–64                  | 3.50       | 3.37–3.64 | <0.001          |
| 65+                    | 1.63       | 1.50–1.76 | <0.001          |
| Gender                 |            |           |                 |
| Male                   | -          | -         | -               |
| Female                 | 0.93       | 0.90–0.97 | <0.001          |
| Race                   |            |           |                 |
| White                  | -          | -         | -               |
| Asian                  | 1.46       | 1.17–1.83 | <0.001          |
| Black/African American | 1.66       | 1.34–2.09 | <0.001          |
| Hispanic/Latino        | 0.60       | 0.57–0.64 | <0.001          |
| Other                  | 1.23       | 1.17–1.29 | <0.001          |

**TABLE 5** Logistic regression model predicting video synchronous teledentistry use by patient characteristics (versus audio synchronous teledentistry use).

|                        | Odds ratio | 95% CI    | <i>p</i> -value |
|------------------------|------------|-----------|-----------------|
| Age                    |            |           |                 |
| 0–18                   | -          | -         | -               |
| 19–64                  | 0.80       | 0.76–0.85 | <0.001          |
| 65+                    | 0.71       | 0.63–0.79 | <0.001          |
| Gender                 |            |           |                 |
| Male                   | -          | -         | -               |
| Female                 | 0.88       | 0.84–0.92 | <0.001          |
| Race                   |            |           |                 |
| White                  | -          | -         | -               |
| Asian                  | 3.48       | 2.75–4.41 | <0.001          |
| Black/African American | 1.48       | 1.20–1.82 | <0.001          |
| Hispanic/Latino        | 1.18       | 1.08–1.28 | <0.001          |
| Other                  | 1.68       | 1.59–1.77 | <0.001          |

### Teledentistry experience with community outreach (quantitative)

In addition to the clinic-based synchronous audio teledentistry, 7531 patients received synchronous (audio) teledentistry through community outreach. Oral health services that were provided included caries risk assessment (99.9%), oral hygiene instruction (99.0%), nutritional counseling (98.9%), and/or tobacco counseling (2.0%). Of the 7527 individuals who received a caries risk assessment, the largest proportion were high caries risk (70.6%) compared with moderate caries risk (18.5%), and low caries risk (10.7%). See Table 6 for the community outreach services provided via synchronous audio teledentistry.

**TABLE 6** Synchronous audio teledentistry services provided by expanded practice dental hygienist through community outreach (children ages 0–18 years).

|   | <i>N</i> | %     |
|---|----------|-------|
| Total                                   | 7531     | 100%  |
| D0601 (caries risk assessment-low)      | 810      | 10.7% |
| D0602 (caries risk assessment-moderate) | 1399     | 18.5% |
| D0603 (caries risk assessment-high)     | 5318     | 70.6% |
| D1310 (nutritional counseling)          | 7448     | 98.9% |
| D1320 (tobacco counseling)              | 150      | 2.0%  |
| D1330 (oral hygiene instruction)        | 7455     | 99.0% |

### Teledentistry experience among oral health professionals (qualitative)

Thirteen participants were recruited to participate in the qualitative portion of the study: dentists ( $n = 4$ ), dental hygienists ( $n = 3$ ), EPDH ( $n = 3$ ) and support team members ( $n = 3$ ). Study participants mostly identified as female (84.6%). The range of overall provider experience as an oral health professional included 1–5 years ( $n = 5$ ), 6–10 years ( $n = 4$ ), 11–15 years ( $n = 2$ ), and 20+ years ( $n = 2$ ).

We analyzed data by applying a combination of deductive codes derived from existing literature on the topic and inductive codes derived from the data itself, then identifying major themes. To assure analytic quality, the research team discussed codes and themes and reached consensus on the final analysis [28]. These themes included: 1. Providers deliver oral health care services using a variety of teledentistry types; 2. Teledentistry implementation involves both successes and challenges; 3. Variation and flexibility are essential for optimizing teledentistry. We summarize each theme below; see Data S1 for additional quotational evidence from the qualitative interviews.

#### Theme 1: Providers deliver oral health care services using a variety of teledentistry types

Interview participants described using synchronous audio and video calls in a clinical setting to help patients having an oral health related issue. When a patient called the clinic, the receptionist would collect as much information from the patient as possible about their condition and either a teledentistry visit would be scheduled or the dentist would reach out to the patient when they had availability in their schedule. One dentist returned teledentistry calls during the lunch hour or after the clinic had closed for the day. As one participant explained:

...if an emergency patient calls in—we'll set up a synchronous teledentistry visit where

the doctor will get on. Sometimes it's via just phone, sometimes it's video. ... and then the goal is to get the patient in the office for whatever they need after that.

The majority of interview participants explained that synchronous audio calls were used when a video platform was not accessible to the patient or to the provider. When patients provided photos of their teeth and gums via text or email, it gave providers the information needed to determine the next steps for the oral health care for the patient. A dental hygienist stated:

Our WIC (Women, Infant, Child) program is still not open for in-person appointments. And so there's a whole population of women, infant children who are not being seen. I'm doing audio where they're sending me pictures.

Clinics were facing challenges retaining enough dentists and dental hygienists to meet patient demands. In these situations, asynchronous teledentistry was used to help patients receive preventive oral health care or begin the intake process for identifying an oral health problem. In this type of care the dentists' time could be better utilized by being able to review patient records at a later time rather than having to be in-person for the patient oral health evaluation. Asynchronous teledentistry provided a less physical option compared with in-person clinical care for dentists who otherwise would have been retired or preferred to work fewer clinical hours.

## Theme 2: Teledentistry implementation involves both successes and challenges

Overall, oral health providers found the use of all types of teledentistry to be successful and useful due to the opportunity to provide timely access to oral health care for patients who had pain and swelling. As one dentist described of a patient with an urgent need:

We had to use the phone and photo route for her. The photo clearly showed a lower tooth that had a big filling that broke. ...we just did [treatment] the same day.

State statutes vary in their allowances for a dental hygienist being able to diagnose and treatment plan without a dentist present leading to inefficiencies with patient care and overburden of dentist responsibilities. One dentist commented on all oral health professionals being able to work to the top of their scope of training:

... if you can do something ... you should do it and if you can't than you just jump up to

the next level who can. And so you know at some point it does jump up to me, creating a bottleneck.

A dental hygienist spoke about challenges with asynchronous teledentistry such as patients are not always accepting of asynchronous teledentistry due to the delay in receiving an official diagnosis and treatment planning or when there is a discrepancy between the patient's chief complaint and the dentist's diagnosis.

I mean the hygienist, she's [not allowed to] diagnose, and she can't [even if] it was obvious there might have been an error in the review. The teledentist can't see every problem just from looking at the review.

This particular DSO was also having challenges with finding enough dentists to staff their individual dental clinics, especially in remote areas, leading to an increased reliance on teledentistry.

... because our offices across the state are short-staffed, where they (patients) don't hear back from somebody.

Receiving payment from payors is also a challenge in teledentistry utilization, which depends upon the longevity or permanence of Oregon's synchronous audio teledentistry provision, which originally passed at the height of the COVID-19 pandemic [27]. One study participant commented,

... apparently, we're not going to be able to bill for an audio consult in the near future as the COVID-19 emergency provision expires. We can still do it; we just can't bill it as a service.

At the dental clinic level, participants reported feeling they did not have adequate training with the teledentistry platform, therefore making electronic appointment challenging. Staff turnover can add to the challenge of having mature knowledge of the teledentistry platform and respective logistics. One participant explained,

I have a teledentistry training packet. ... it's not hands on.

In addition to challenges accessing the virtual teledentistry platform, oral health professionals had difficulties with obtaining updated patient documents and HIPAA authorization, receiving EHRs from medical providers, and connecting community outreach services with services provided in a dental clinic. Several study participants in clinical and community outreach settings reported patients often will not answer a

teledentistry call if they do not recognize the phone number.

Traditional dental settings consist of dentists and their support teams working closely together to streamline and collaborate on patient care. Communication challenges exist when dentists and dental hygienists do not have opportunities to build in-person relationships and understand each other's oral health care knowledge and experiences. This can lead to a disconnect in diagnosis and treatment plan recommendations. As one dental hygienist explained:

He's (the teledentist) at a completely different location ... there's just like certain things that's kind of hard and I don't know how he works.

Several study participants agreed that providers often have different approaches on the type of patient care they provide depending on the patient's individual needs and oral health history.

Finally, patients play an important role in the success of teledentistry. They must be able to access the teledentistry platforms offered to them and feel that they are receiving care that meets their individualized needs. In addition to technology, factors that were mentioned for patients having difficulty accessing teledentistry included age, language, and disability. As one participant described:

I had a patient in a home care facility who was bedridden. It was a challenge to get to the patient on the screen. The caregiver had to put the phone so I could see the patient.

Although this patient faced challenges engaging in synchronous video teledentistry, the provider emphasized that without the teledentistry option, this patient would not have had any dental care for their oral health problem.

### Theme 3: Variation and flexibility are essential for optimizing teledentistry

During the qualitative interviews, study participants often spoke about the importance of having the flexibility to use the teledentistry platform that is best for patient and provider efficiency and success. One dentist spoke about why a synchronous audio visit from a dentist is different from a receptionist navigating appointment urgency and scheduling logistics. From this example we can also understand the financial and resource implications of a dental provider conducting phone calls with patients compared to a receptionist or other team member who is not responsible for providing clinical care.

... the provider has the requisite skills as a licensed practitioner to provide preliminary assessments, diagnosis, how to effectively manage pain, even though our team is educated ... there are complicated cases where you need a practitioner to advise the patients safely.

Another dentist echoed the need for synchronous audio teledentistry:

I really truly hope that we're able to continue to use the phone because I think there's a lot of access issues if it's only video.

Qualitative interviews with providers helped explain the types of teledentistry that were recorded in the EHR. Dental clinic type and location, as well as patient ability to access various teledentistry platforms were factors in teledentistry utilization.

## DISCUSSION

This practice-based mixed methods study documents how oral health professionals in one DSO are using teledentistry, and their perspectives on its benefits as a tool to improve access and efficiency to patient oral health care delivery. As documented by other studies, we found that providers have success with using teledentistry in clinical and community settings, however, also face challenges such as variable technical skills among staff members and patients; broadband limitations among patients; and payor limitations on teledentistry reimbursement.

Our findings on service volume and providers' favorable perspective on synchronous audio appointments, with and without supporting images, deviates from recent literature, which emphasize the superiority of video-based synchronous teledentistry appointments [14]. Video may seem to better approximate a traditional dental visit and may be favored among providers, policymakers, and other stakeholders who have optimum access to the latest technology and digital connectivity. By contrast, participants in our study emphasized the importance of retaining audio-only synchronous visits as an important option for reaching patients who face broadband, technology, and other barriers to attending synchronous video visits. From this one DSO case study, over 60,000 individuals were able to have direct contact with a licensed oral health professional through synchronous audio teledentistry. This finding must be considered in the geographic context of our study; the 25 counties who had teledentistry utilization in this study were designated as frontier (2), rural (17), and urban (6) [29]. At the same time, the prevalence of broadband disparities nationwide indicate the importance of legitimizing and strengthening audio-based synchronous teledentistry. Data S2 describes

the geographic designation and availability of a dental provider within each county according to its federal designation as a DHPSA [13].

Teledentistry utilization is based on a series of decision making which revolves around appointment availability to see a dentist and/ or a dental hygienist, the urgency of the patients need, and the patients ability to attend an in-person visit. If an in-person appointment is not feasible, the synchronous teledentistry path is followed to determine if the visit can occur through a video platform or if a synchronous audio visit is the best option for the patient and the provider. This research suggests having multiple types of teledentistry delivery available in various settings is important. Patients who were less likely to receive care using synchronous video, which requires the highest level of technical skills and internet availability from the patient than other types of teledentistry, were those aged 65 and older and those who identified as Hispanic or Latino. This demonstrates the importance of having alternative options for patients to connect with an oral health provider.

Suggested improvements for synchronous audio teledentistry from providers included having a secure platform where community outreach professionals can securely save pictures sent by patients, along with clinical notes, and oral health assessments directly to the patient chart. Also, for clinician-initiated calls, the caller identification number patients see needs to reflect the call is from an oral health provider to increase the likeliness the patient will recognize and answer the call. Suggested improvements for video platform interactions included simplifying the consent process and paperwork updates by allowing for updates from patients and caregivers rather than asking them to download and fill out online forms. Further, video calls should notify the patient to wait for the dentist or dental hygienist to join the call as they may be delayed while caring for other patients.

Improvements for asynchronous teledentistry included consistent training and calibration among all clinicians and support team members. Clinicians and team members should be encouraged to reach out to each other as well as patients when additional information is needed to accurately determine a diagnosis and treatment plan for a patient.

To best serve the communities in which they practice, oral health professionals need to be able to work to the top of their scope and use all of the tools available to them to meet patient needs without legislative, payor, or corporate regulations that are not based on evidence or practical applications. The importance of utilizing dental hygiene professionals' full scope of education and licensure was illustrated with the results from the quantitative and qualitative data. Opportunities can be identified with synchronous care provided to

help identify patient concerns and triage appropriate care. Collaboration between dentists, dental hygienists, and support teams can help reach more patients, ultimately improving access to oral health care and reducing oral disease burden among individuals and communities.

Limitations of this study included dental providers belonging to the same DSO within one state. Also, the provision of dental services according to provider type is difficult to discern as all not oral health providers (e.g., dental hygienists) are allowed to submit to payers for reimbursement. As a requirement of the Health Insurance Portability and Accountability Act (HIPAA) health care providers who are submitting patient's health information electronically for reimbursement needs to have a National Provider Identification (NPI) number [30]. Future studies should include analysis of the EHR data and claims data along with, provider and patient perspectives to identify patterns and trends in teledentistry utilization from other dental clinics in other states who use teledentistry. Additionally, comparison for teledentistry utilization among those with private or public dental benefits could further inform policy implications for access to dental care options.

Teledentistry can be a tool to help improve access to a timely dental visit for those who might not otherwise have access to care. From the clinical data obtained from this study, patients who most often received a teledentistry visit were predominately white, adult, and female patients. It is important to learn more about who is not getting teledentistry dental delivery and why. Also important to include in demographic data collection is a patient's geographic location, which may suggest increased barriers to transportation and broadband internet, and thus impact one's ability to access to a timely dental appointment. Lastly, if providers are not being reimbursed for synchronous audio teledentistry then data collected for care provided to minority and marginalized communities may not be collected or reported, perpetuating problems with identifying those who need access to oral health care.

Findings from this study demonstrate the importance of prioritizing inclusive teledentistry as it is formalized through national and state service delivery regulation, reimbursement norms, provider education and training, patient privacy considerations, and other processes. Although the technology surrounding teledentistry delivery is constantly improving, the merits of dental care delivery via audio only cannot be dismissed. Policy changes and improvements surrounding teledentistry must prioritize equitable access to teledentistry-delivered care. Teledentistry rules and regulations must be strict enough to ensure optimum patient care, yet flexible enough to allow for the utilization of the best technology to meet patient needs and to allow for

advances in technology that we may not have yet realized.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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### SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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