

Role of teledentistry in enabling improved oral care outcomes

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Key points

Understanding the benefits that teledentistry can have on improving access to dental care, especially in developing countries.

Being able to identify the barriers to primary dental care in developing nations.

Having a summary of teledentistry projects to date, and how successful they have been.

Abstract

Nowadays, the link between oral health and general health is clearly understood and supported by many global bodies, including the World Health Organisation. Yet, oral diseases remain prevalent worldwide, necessitating a practical approach. This opinion paper seeks to clarify the role of teledentistry as an adjunct for improving oral health when access to oral care services is one of the major concerns.

While prevention is the best option, many people lack regular oral care access, missing vital maintenance for mouth and body health. Limited evidence-based education further hinders effective oral hygiene routines. This holds true for remote/rural populations, low socioeconomic groups and individuals with physical/mental disabilities which could make visiting a dental practice more difficult.

We examined recent teledentistry publications, highlighting outcomes and suggesting evidence-backed oral health guidance via tailored teledentistry models. Two virtual roundtables were conducted with a global working group experienced in teledentistry and dental access barriers. This panel was made up of representatives from the UK, Belgium, Vietnam, Indonesia, Bangladesh, Ghana and Tunisia.

We conclude that teledentistry effectively aids dental referrals, early disease detection, treatment planning, compliance and viability, particularly in regions with limited dental access. The advantage of teledentistry lies in expanding the reach of care. Telehealth and teledentistry are value-driven, yet larger, standardised research is needed to fully harness the potential of teledentistry in bridging underserved populations with oral care experts, ultimately fostering optimal oral health. Education on the capabilities and benefits of teledentistry should become part of the curriculum of future dental professionals and broadly leveraged on continuing education platforms.

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Introduction

Untreated oral diseases, including tooth decay, gum disease and oral cancers, affect almost half of the global population. Global oral disease case numbers have increased by 1 billion over the last 30 years, untreated dental decay being the most common health condition worldwide.¹ The estimated global average prevalence of caries is 43% for deciduous teeth and 29% for permanent teeth.² Overall, 75% of the untreated caries is found in middle-income countries – a clear indication that many people do not have access to appropriate oral health care, which includes prevention, control of risk factors and restorative services.²

People want their health systems to deliver universal access to quality care without fear of financial hardship. They want them to

offer effective protection against oral health emergencies and disease and they want to be able to thrive in healthy communities, where public health actions and appropriate policies secure a better life and wellbeing. People increasingly hold their health authorities accountable for meeting those expectations.

At the heart of the United Nations' Sustainable Development Goals around health lies the aspiration to ensure that all individuals can access health care and preventive services without enduring financial burdens. However, to date, oral health has been a neglected issue on the global health agenda.²

The adoption of a resolution on oral health at the World Health Organisation's (WHO's) World Health Assembly in May 2021 was an important step forward.^{3,4} The proposed Global Oral Health Strategy, together with its

Global oral health action plan and monitoring framework, provide unique and unprecedented opportunities for real change.²

The WHO's goals of advancing oral health coverage have been challenged and delayed because of the COVID-19 pandemic. However, these challenges can be addressed and health inequalities reduced by harnessing the full potential of digital solutions to enhance health systems and services.⁵

The significance of information and communication technologies (eHealth) in enhancing health systems and services has been acknowledged by WHO. The importance of these technologies is evident through the many resolutions on eHealth that have been embraced by the World Health Assembly and the regional committees. Telemedicine, and equally teledentistry, has been an important public health tool since the introduction of IT devices in practice. Since the COVID-19 pandemic, it has shown to effectively help overcome barriers for people accessing health professionals and has become a unique tool for communication between patients and professionals.⁶

In 2021, WHO published a paper on digital oral health, outlining ways of implementing mobile technologies for oral health.⁷ This guide comprised of four oral health modules: 1) literacy to improve oral health literacy of individuals and communities; 2) training providing evidence for expansion of e-learning for oral health professionals; 3) early detection outlining how to use remote diagnostic tools; and finally 4) surveillance for collecting epidemiological data and monitoring of quality care and service delivery.

Although this technology-supported and dentist-supervised care model has been shown to improve timing and quality of screening, it is new, and in the literature, we can only find accounts of small-scale and contrasting setups of projects using teledentistry to achieve the desired oral health goals.

For this paper, we have reviewed the latest literature on teledentistry projects and try to explain how digital solutions may be the key to democratise oral health and reduce barriers for access to dental professionals.

Definition

'Teledentistry is the use of electronic information, imaging and communication technologies, including interactive audio, video, data communications, as well as store and forward technologies, to provide

and support dental care delivery, diagnosis, consultation, treatment, transfer of dental information, and education' (American Teledentistry Association).⁸

There are two main types of teledentistry: synchronous and asynchronous. Synchronous teledentistry involves real-time interaction between the patient and provider, while the latter involves collecting patient data, possibly uploading it to the cloud, integrating eHealth solutions and using remote patient monitoring. Both types of teledentistry can be used for diagnosis, treatment planning, consultation, or second opinions.

According to the American Dental Association's comprehensive policy statement on teledentistry, it includes, but is not limited to, live video (synchronous), store and forward (asynchronous), remote patient monitoring and mobile health. The usage of modern telecommunication is combined with routine dental management procedures, aiming to deal with dental treatment needs, such as emergency conditions, in an effective and timely manner. It can also manage dental problems despite geographical distances, especially in rural, border and remote areas.^{8,9}

Barriers to accessing oral health care

Limitation of access to care

The COVID-19 pandemic has shown that limitation of access to care can become an imminent and serious global issue. All countries involved in the working groups unanimously cite limited dental workforce (dentists, dental nurses, dental therapists, dental hygienists, clinical dental technicians) in both developed and under-developed countries which is of major concern, affecting the provision of optimal oral care particularly for people in rural areas or overpopulated cities.

The timeline of dentists to qualify and begin work is a challenge in some countries. In Vietnam, new dentists need hospital practice first, delaying their dental work for over seven years.

Urban areas attract dentists due to financial benefits, leaving rural areas underserved. This causes minor dental issues to worsen, harming overall health and life quality. Bangladesh is a clear example of this. The country has 12,000 dentists for 170 million people, resulting in a 1-to-14,000 dentist-patient ratio. However, most dentists are in cities, causing much higher ratios in remote regions. (Please see below section on world oral health profiles for data on

available workforce and subsequent prevalence of caries and periodontal diseases with specific age groups in selected countries).

Health inequalities

Health inequalities are one of the most important problems of social injustice worldwide and are increasingly recognised as a serious, public health concern.

Oral health inequalities exist globally throughout the life course among and between different population groups. People in lower socioeconomic groups are more likely to have poorer oral health than their counterparts in higher groups and to limit their visits to oral health care services to urgent emergency calls.^{10,11} Lack of access to oral health services affects the most vulnerable and disadvantaged populations most. People on low incomes, people living with disabilities, older people living alone or in care homes, those living in remote and rural communities and people from minority groups carry a higher burden of oral diseases.¹²

Financial constraints

Financial constraints may negatively contribute to the level of dental care delivered to people in certain poor socioeconomic groups. Inequalities in the level of financial burden for provision of dental care are highly variable and depend not only on socioeconomic status but even more on the dental care system/regime in place in the specific country.

Travel expenses or difficulties to reach a dental professional may be another financial barrier for many.

The costs of dental treatment in comparison to annual income is extremely high in developing nations. This means many dental practices base themselves in higher income areas, such as the larger, modern cities. High costs of dental treatment mean that in some rural and mountain areas, there are no dental clinics or dentists at all.

Despite many countries having a national insurance scheme for the poorer population, dental health is often not a priority for people on low incomes.

Other specific barriers

Other specific barriers for not visiting a dentist regularly could be the waiting time to get an appointment. Specific populations may face other limitations, such as impaired mobility and emotional barriers, for example, fear of going to the dentist. Older people, and

Table 1 Summarised data from oral health country profiles

	USA	UK	Germany	India	Argentina	Bangladesh	Ghana	Indonesia	Vietnam
Number of dentists	199,528	35,000	71,039	271,744	68,079	9,608	400	15,744	?
Dentists per 10,000 population	6.1	5.2	8.6	2.0	15.3	0.6	0.1	0.6	?
Prevalence of untreated caries in deciduous teeth in children 9–11 years old (%)	42.6	19.5	29.1	43.3	41.0	43.5	38.9	46.9	46.5
Prevalence of untreated caries in permanent teeth in children >5 years old (%)	24.3	30.6	31.7	28.8	36.9	30.4	25.3	26.8	28.0
Prevalence of severe periodontal disease in people >15 years old (%)	15.7	10.6	27.4	21.8	18.0	23.4	29.3	19.6	9.4

especially those in care or with particular health problems (for example, dementia), are a particularly vulnerable group.

Additionally, there appears to be an absence of dental clinics or dentists across many local health centres in developing nations. There is also a lack of dental knowledge among the allied non-dental personnel who manage the local health centres. Across 120 district hospitals in Ghana, only half have dental clinics. This is a common occurrence shared by other countries.

WHO oral health country profiles 2022

On 18 November 2022, the WHO released their Global oral health status report. The report highlights the fact that neglect of oral health affects nearly half of the world’s population and emphasises the impact of oral disease on people’s health and wellbeing globally. It specifically highlights inequalities, especially the higher disease burden for the most vulnerable and disadvantaged population groups.¹³

In Table 1, we summarise data from oral health country profiles, reflecting the prevalence of oral diseases and the available workforce in selected countries around the world.²

Although several developed countries have a higher number of dentists *per capita*, the oral health of children and adults in these countries is still very disappointing. It is clear that not only are the numbers of dental professionals paramount for preserving oral health, but the availability within a country and throughout the population is an important feature too.

In developed countries, the mix of populations, such as the socially deprived, older and minority groups of people, is possibly the main reason for the high numbers of children

with caries and adults with periodontal disease on a national level. In developing countries, the most obvious reason, over and above the mix of populations, is likely to be the lack of dental professionals available in parts of the country, creating the necessity to travel long distances to access oral health services.

Opportunities that teledentistry can offer as a solution to overcome barriers to oral health care

Access to specialised workforce (dentists, dental nurses, dental hygienists, dental therapists)

Reduced access to health care services during the COVID-19 pandemic clearly highlighted the importance of health information and exchange and underlined a need to implement digital solutions.

Many dental practitioners were out of business, or operated limited services, throughout the pandemic and patients were happy to be connected with their dentist using digital solutions. With this, a new area in the digitalisation of dentistry opened up, perhaps starting with the provision of effective training in communication for optimal use of everything teledentistry can offer.

During this time, Indonesia published guidelines mandating teledentistry use due to COVID-19. As a consequence, dental schools now teach teledentistry to students as part of the curriculum.

The model of teledentistry is going to be of great importance for private practitioners who were out of business during COVID-19. Teledentistry is a new area that practitioners can fully embrace. Using teledentistry before the patient comes directly to the clinic or the hospital means it is so much easier to avoid infection of transmissible and infectious disease.

The internet has long been a source of countless opportunities for personal fulfilment, professional development and information. With the COVID-19 pandemic, it has become essential for working, learning, keeping in touch and accessing basic services, including health services.

The latest International Telecommunication Union data show that uptake of the internet accelerated during the pandemic. In 2020 – the first year of the pandemic – the number of internet users grew by 10.2%, the largest increase in a decade, driven by developing countries, where internet use went up 13.3%.¹⁴ Most of the world’s population nowadays is covered by a mobile-broadband signal, but blind spots remain. In most developing countries, mobile broadband (3G or above) is the main and often the only way to connect to the internet. In total, 95% of the world’s population now have access to a mobile broadband network. Between 2015–2021, 4G network coverage doubled to reach 88% of the world’s population. Those remaining without internet connection face multiple barriers, including a lack of access to necessary health information. Unfortunately, some 390 million people worldwide are still not covered by a mobile broadband signal.¹⁴ Mobile and internet access in the developing world is an exciting, emerging opportunity for health care providers, not just in teledentistry, but also in the realms of telemedicine.

Rural and remote areas present the biggest problem in terms of reachability and that is where teledentistry can make a difference. Older and disabled people are also groups that are suffering from lack of access to usual dental practices.

Teledentistry allows practitioners to connect with patients all over a particular country, giving them access to consultations, treatment and prescriptions.

Licensed dental professionals play an essential role in providing optimal advice, delivering treatment required as part of an overall oral care plan resulting in favourable oral health outcomes. The use of mobile technologies to link up patients or local health personnel with a specialised dental professional may help communication concerning a patient's health record and might include photographs of the patient's mouth or specific oral problem. From the world oral health profiles,² we know that many developing countries lack the necessary qualified dental professionals. Teledentistry models have shown that off-site allied personnel can make a difference and effectively select those patients that need urgent and specialised in-person care by a dentist. Preventive messages, early intervention procedures, recording of oral health status and selection of patients in terms of urgency for in-person treatment can be performed by trained personnel in health centres or even at home in remote areas. Practices therefore have a reduced number of non-urgent consultations, freeing up time for specialised care for those in need. Patients will benefit from lower costs as a result of reduced travel, less time off work and a decrease in the number of appointments needed to complete care. Education and preventive measures can effectively improve oral health in underserved regions or countries. Several teledentistry projects have shown results that are comparable to in-person consultations.

Address oral health inequalities

Health inequalities are one of the most worrying problems of social injustice worldwide. The persistence of inequalities in advanced, high-income societies suggests that existing strategies have not been successful in tackling important determinants, even in the most egalitarian states. Tackling these inequalities in oral health has increasingly become a goal of governments. Several teledentistry models, especially in the USA, have been shown to impact oral health of specific population groups that find it difficult to access existing dental centres or practices. Non-dental health personnel are usually closer to these people and therefore best placed to integrate oral care into general health care. Because of the known link between oral health and general health and the shared risk factors, teledentistry can offer a cost-effective means of delivering preventive measures and limit expensive visits to dental care units for these specific population groups.

One of the fundamental challenges teledentistry faces are the barriers around access to technology. Many people in rural communities in under-developed countries, and some in developed countries, are unable to access the technology needed to participate in teledentistry. Quite often, these can be high-risk individuals with limited access to dental care.

Improving digital literacy is a further issue. Digital literacy is highly prevalent among individuals who are of poorer oral health status. However, data shows the number of older people who can effectively use smartphones is growing. This will improve further in future years. Carers will play a key role in helping people with physical or mental limitations take part in teledentistry. Promisingly, there are teledentistry models that have shown some very good results with older people and those with disabilities.

Reduce financial constraints

Lack of access to health services due to cost, distance to travel, lost time from work etc results in unmet needs. Where these are socially grouped, they reflect inequalities in health care delivery. Several reasons have been proposed as to the reason a higher socioeconomic status may produce benefits in terms of accessing health services.

Financial constraints may contribute to the level of dental care that is delivered to people. Inequalities in level of financial burden for provision of dental care is highly variable and depends not only on the socioeconomic status but perhaps even more on the dental care system/regime in place in specific countries.

In many countries, the number of people not covered by health insurance is huge. Recent teledentistry models have shown that this form of provision can reduce not only travel costs but often limit the number of appointments, with a dental practice further reducing the costs.

To ensure proper health care and oral health care delivery, community clinics existing in many countries and especially in rural areas may be a good choice for teledentistry. Because of the logistic and financial implications of any teledentistry project, there is an urgent need for financial support from government, industry, dental associations, or others. In Indonesia, Vietnam and soon also in other countries, Unilever has funded projects using teledentistry in different forms. Initial results show that these efforts have achieved the goal of converting people from just having

the telecalls to visiting a dentist. It's just the beginning of a journey that Unilever would like to expand and learn more about.

Overcome other barriers for access to dental care

Other specific reasons for not visiting a dentist regularly could be due to the waiting time for appointments.

Fear of the dentist is another reason for not visiting a dentist. Teledentistry again can make a difference as this group of people may be more willing to send a picture of their mouth rather than visiting a dentist in person.

A regular examination of the mouth by a qualified and trusted person, for example, a health care professional at a local health centre, can reduce visits to a dentist and help to build the confidence of the patient. Regular examinations are part of a dental prevention routine that can be performed using teledentistry rather than an in-person visit.

Through teledentistry, dental professionals can collect information from patients and then decide if a visit to the practice is required, for example, suspected disease that requires in-person treatment. With teledentistry, patients can be made more confident because they already have spoken to the dentist and know what to expect.

Dental professionals are taught to see and treat patients in the chair. However, in the future, the profession has an opportunity to move to a model where they are supporting patients' oral health when it doesn't require a visit to a dental practice. This is quite a fundamental change in attitude for dental practitioners, but actually means their time is being used more valuably and effectively. Therefore, training is needed so that dentists and dental teams look at their patients in a different way.

Examples of teledentistry projects

Projects called 'teledentistry' cover very different aspects of telehealth. The link between patient and professional for improving oral health through digital solutions can help in the case of lack of local appropriate dental professionals, access for underserved and remote populations, financial or socioeconomic constraints of the patient, or emotional, physical or other barriers for visiting the dentist in person.

In posters and papers presented at recent National Oral Health Conferences in the USA

and from a few articles in the literature, we could find more detailed and specific projects addressing one of the barriers to access. However, because of the limited availability of scientific studies with sufficient participants addressing each specific barrier, we also included systematic reviews to get a broader picture of these barriers and provide the answers by using digital solutions.

The FDI World Dental Federation published the fact sheet *Evidence-based use of teledentistry in oral health services* to guide dentists on how they can use teledentistry in their practice.¹⁵ The FDI World Dental Federation gathered data from teledentistry intervention studies with high-level evidence from the past ten years with a focus on interventions to improve patient care.¹⁵ In 14 out of the 27 studies, patients were already pre-selected for orthodontic treatment and therefore had visited a dental clinic or hospital before being included in the study. Most common measures were oral hygiene, plaque and bleeding indices. The results revealed that in five studies the teledentistry model was significantly more favourable than the conventional method. When teledentistry, along with conventional methods by the professionals, was researched, an improvement was seen in 16 studies. Dr Hiroshi Ogawa and Dr Sophie Dartevelle, leaders of the FDI research team, concluded that the teledentistry model has enormous benefits and should be integrated into several levels of oral health services: interpersonal, organisational and national levels. They found teledentistry grants provided societal benefits to underserved populations, were timesaving and cost-reducing. Teledentistry can provide access to oral health services to those who cannot, or are unlikely to, come to the dentist, give oral health education to patients and connect oral health practitioners together to improve services.¹⁵

Other systematic reviews have reported that teledentistry methods were comparable to other clinical assessments for the detection of caries,¹⁶ oral lesions¹⁷ and oral screening.¹⁸ A 2011 literature review on applications of teledentistry by Jampani et al.¹⁹ specifically looked at the exchange of clinical information and images over remote distances for dental consultation, diagnosis, treatment planning, co-ordination and continuity of care. The authors concluded that teledentistry has the ability to improve access to oral health care, improve the delivery of oral health care and lower its costs. Furthermore, it holds the capability to bridge the gap in oral health care

access between rural and urban communities.

The specific role in, for example, oral medicine and diagnosis, was confirmed by a dental hygiene model developed by the Northern Arizona University dental hygiene department. The model allowed dental hygienists to provide oral health care to underserved populations by linking up with a distant oral health team.²⁰ Therefore, telecommunication can be an efficient and cost-effective mechanism to provide pre-operative evaluation in situations in which patient transport is difficult or costly.²¹

Favero *et al.* stated that telecommunications applied to dentistry are particularly useful in the orthodontic field as minor emergencies can be solved easily at home, reassuring patient and parents and limiting visits to the dental office to cases of real need.²² A study by Ignatius *et al.* revealed that videoconferencing for diagnosis and treatment planning for patients requiring prosthodontic or oral rehabilitation treatment has the potential to increase the total number of dental specialist services in sparsely populated areas.²³

The FDI World Dental Federation (on 24/06/2021) issued a webinar in which two different teledentistry models were presented.²⁴ One was from Chile, where a specific consultation for oral pathologies was carried out through distant communication between the primary health care provider (dentist) and the maxillofacial experts located in hospitals in main cities. The benefits of the programme were multiple: timely resolution of the problem, reduced waiting time (reply by the experts in maximum 53 hours) and increased access to specialist care.

The other programme was the 'Oralien' model, introduced by the Union Française pour la Santé Bucco-Dentaire in France. Its objective was to provide better access to good oral health for residents of care homes and facilities for disabled people. The model was based on artificial intelligence that used an algorithm to translate the gathered information about the individual patient through questionnaire and scans/photos into a recommendation for follow-up on oral hygiene measures, or referral to a dentist, specialist or another health care professional.

Both these models used teledentistry through different executions and confirmed the benefits of teledentistry for reaching out to distant patients or patients that have difficulties to visit a dental practice in-person because of existing disabilities.

Conclusions from additional and recent publications on teledentistry are summarised below.

- Teledentistry has enabled dental providers to manage dental emergencies during the COVID-19 pandemic. Patients, though, questioned the value of the teledentistry model²⁵
- Rates of treatment plan completion in a paediatric dentistry clinic were similar among children seen for a new patient exam via synchronous teledentistry or in person²⁶
- A study on teledentistry during the COVID-19 pandemic concluded that while it is unlikely to replace in-person visits, the modality demonstrated promising impacts on access to care, particularly for consultation, monitoring screening, triaging and pre- and post-operative care²⁷
- A recent (July 2022) systematic review endorses teledentistry as a proficient approach for dental referrals, treatment planning and ensuring treatment adherence and viability. The use of asynchronous communication and the integration of smartphones for image capture are both practical and user-friendly for the seamless implementation of teledentistry²⁸
- US-based research found that about 23% of the dentists included in the research used teledentistry or virtual platforms during the COVID-19 pandemic when access to care was limited. The study revealed that dentists who embraced teledentistry early saw its benefits outweighing drawbacks. Those who adopted it later had less awareness of its advantages and were more concerned about issues like initial expenses and the quality of care provided. The expansion of care access emerged as a significant benefit of teledentistry²⁹
- A study on the perception of the use of teledentistry by Indonesian professionals found that a large portion of dentists (87%) acknowledged the practicality of teledentistry in dental practice, particularly in terms of time savings over referral letters. The majority recognised its potential to enhance dental practice and benefit patients. However, certain dentists raised worries about digital forgery (74.2%) and technical compatibility issues (71.8%) associated with teledentistry³⁰
- The virtual dental home project in the USA used health centres to manage prevention, early intervention procedures, the existing dental case and integrated oral

health into educational, social and general health systems. A cloud-based electronic health record is shared between the allied personnel on-site and the off-site dentist, who finally decide on eventual treatment or referral back to the on-site personnel for follow-up. The project showcases a cost-effective care system that enhances oral health for underserved groups. It expands roles of dentists and allied personnel through telehealth-enabled collaboration^{31,32}

- Telehealth and teledentistry services are considered a value-based activity. The services provide access to speciality care and have also built professional relationships across provider systems and contributed to the quality of care in the comprehensive health home³³
- Teledentistry has shown to reduce patient travel, to decrease number of appointments needed to complete care, to provide quality care in underserved areas and the results are comparable to in-person treatment³⁴
- Teledentistry has gained popularity since the onset of the COVID-19 pandemic but may be underused, despite its potential to benefit a wider range of patients and applications than many believe. Education on the capabilities and benefits of teledentistry may help increase adoption and improve patient care.³⁵

From the above, it is clear that the most common uses of teledentistry interventions in the reviewed studies were for oral health education, early detection of disease, monitoring of treatments and reinforcement of oral hygiene measures. For the latter, there is evidence that teledentistry action steps can improve oral health outcomes if compared with conventional communication tools. Education on the capabilities and benefits of teledentistry should become part of the curriculum of future dental professionals and broadly leveraged in continuing education efforts.

For Indonesia and Vietnam specifically, we reviewed projects that are currently running with substantial support of an oral health company (Unilever):

- WhatsApp, Ask Pepsodent (Indonesia) – this project, supported by the Indonesian Dental Association and advertised on-pack (Pepsodent dentifrice) and in a 30 second TV commercial, allows people to consult a dentist synchronously via

WhatsApp. Eventually, the patient can share photos, enabling the caregiver to provide the best diagnosis. All calls include a recommendation for oral hygiene and regular dental check-ups. So far (May 2022 – December 2022) the project triggered 40,000 consultations. Many calls made a referral to a dental clinic and a free mild tartar cleaning treatment was offered. A total of 599 patients redeemed these free treatments. Post-consultation satisfaction scores were extremely high, confirming the value that the project was providing to the population included in the project

- Voice call, Telehealth Doctor Anywhere (Vietnam) – in partnership with Doctor Anywhere, patients were offered a synchronous call with a dentist. The project was announced on-pack (Pepsodent dentifrice) and in a 5 second TV tag on. Between April and December 2022, it resulted in more than 2,000 calls. In most cases, referral to a dental clinic was made, but all calls also included general oral hygiene recommendations. Again, high satisfaction numbers were recorded.

Throughout these studies, the IT-supported teledentistry model has proven to overcome barriers to care and therefore may help improve oral health in specific populations. Most projects have proven to reduce the need for urgent treatment and to improve oral health status of participants.

Teledentistry won't replace in-person visits but it shows potential for enhancing care access, referrals, planning and treatment compliance. Asynchronous communication and smartphone image capture ease its implementation. Certain projects are demonstrating a new system of care that is more likely to improve the oral health of underserved and vulnerable populations at a lower cost than other systems of care. Teledentistry has shown to reduce patient travel, decrease number of appointments needed to complete care and provide quality care in underserved areas. The results are comparable to in-person treatment.

A concern that needs to be managed properly is the patient's privacy. Without the proper technology, teledentistry may violate privacy laws. Hence, there is a need for dental boards to monitor teledentistry providers as they would any dental provider.

Expanding access to care was definitely recognised as one of the greater values of teledentistry.

Conclusions

During the pandemic, teledentistry has proven to be a useful tool in providing care to patients no matter where they are and this technology will remain a part of dental practice. From our review, we conclude that teledentistry can be an effective method for dental referral, early detection of disease, treatment planning and compliance, and treatment viability, especially where the dental workforce is limited or not well-distributed over a country or region.

Teledentistry allows instant emergency consultations, including live video exams. Dentists offer initial diagnoses, treatment recommendations and can prescribe medications if needed. A simple check-up or early diagnosis through video communication may limit worsening of disease and eventually reduce extra visits to the practice.

Teledentistry can play a key role in providing delivery of care to the underserved. It may decrease unnecessary emergency room visits and eventually limit or avoid unnecessary travel to health services while the patient can be re-assured about their oral health.

Communication and training on preventive measures, such as optimal toothbrushing, interdental cleaning and use of effective fluoridated dentifrices, can be done in a less time-consuming and costly way using teledentistry, saving time and money for the practitioner and most importantly, saving travel expenses and time for the patient.

Teledentistry is becoming part of modern dentistry and is considered a value-based activity, but further research is required, especially related to available IT, training of the workforce involved, the impact on oral care services delivered and finally, oral health outcomes. While data from existing teledentistry models suggest improved oral health with specific population groups and seems promising, there is a need to investigate further evidence-based data on longerterm implementation of teledentistry on a larger scale.

Ethics declaration

The authors declare no conflicts of interest.

Author contributions

Guy Goffin: conceptualisation, methodology, formal analysis, investigation, resources, data curation, writing – original draft, writing – review and editing, visualisation. Nigel Carter: conceptualisation,

methodology, writing – review and editing, visualisation, supervision, project administration, funding acquisition. Armelia Sari Widyarman, Tri Erri Astoeti, Humayun Kabir Bulbul, Paapa Puplambu, Latifa Berrezouga, Hoang Trong Hung: resources, data curation.

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