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Review Article

Teledentistry and Online Referral System in Indonesian Primary Health Care Center During the COVID-19 Pandemic: A Narrative Review

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ABSTRACT

Aims: This review aims to map the needs and challenges in the application of teledentistry and online referral system encountered by dental health care professionals in Indonesian primary health care centers (puskesmas) to provide safe dental health service to the population during the COVID-19 pandemic.**Materials and Methods:** Literature search was undertaken of both in Indonesian and overseas context related to teledentistry. Narrative review of the literature was written to present the challenges, solutions, and application of teledentistry at Puskesmas to optimize oral health services during the COVID-19 pandemic.**Results:** Online referral system and teledentistry are options to help dental health service delivery in the pandemic era. While it has been adopted in many private clinics, there are many challenges to adopt it at the puskesmas level due to a lack of infrastructure, human resources, and budget allocation. While the Indonesian government has plans to support the digitization in the education and health sector, this pandemic shall pose an opportunity for Indonesian health department to develop and facilitate the use of teledentistry and online referral system. During this situation, health cadres can bridge the relationship between Puskesmas and the poor community through the help of teledentistry.**Conclusions:** The government commitment in applying online referral system and teledentistry in Puskesmas is needed. Dental education institutions can help to supply human resources, who are capable of developing and carrying out the most suitable teledentistry application for all stakeholders.**KEYWORDS:** COVID-19, health system access, pandemic, referral system, teledentistry

INTRODUCTION

Indonesia is an archipelago country containing more than 17,000 islands.^[1] The physical and social developments in each island are varied with a sharply increased inequality in the last decade.^[2] This condition results in unequal access to dental services.^[3,4] Secondary data analysis of the 2013 Indonesian Basic Health Research 2013 showed that dental service utilization during the last 12 months in Indonesia is only 8.1%.^[5]

In early 2020, with the emergence of the COVID-19 pandemic, dental treatment procedures were categorized at high-risk due to the large amount of

aerosols generated during these procedures and close proximity of the dentist with patients.^[5] To reduce the risk of the dental professionals' exposure to the virus and to prevent of cross-infection between patients, dental care has been limited to only emergency cases while other aerosol generating procedures were / have been suspended.^[5]

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6 The global burden of disease study reported that Indonesia ranks in the top four countries with the highest normative treatment need associated with four oral conditions viz. untreated dental caries of deciduous and permanent teeth, severe periodontitis, and total tooth loss.⁶ Hence, providing safe dental care for the population is needed, and incorporation of online referral system and teledentistry could thus be an option. Furthermore, the Indonesian Ministry of Health has issued the regulation No.20/2019⁷ concerning the administration of telemedicine services, which could be a basis for teledentistry application.

17 In Indonesia, the use of teledentistry has been used in some private dental practices especially during the pandemic of covid-19. However, the use of teledentistry in primary health care centers (Puskesmas), which are governmentally funded health care centers provided for the majority of Indonesian population, is not started yet. Giraudeau⁸ has warned us that we need to ensure that the development of telemedicine does not lead to new inequalities, in terms of economic, geographic and usability. Considering the diversity and inequality that exist in the Indonesian context with regard to the oral health care supply and demand, there is a need to propose the use of teledentistry and online referral system and its implementation in the Indonesian dental health care system, especially in Puskesmas. This review aims to address these gaps. Narrative review of the literature was written to present the challenges and recommendations for implementation of teledentistry, as reported in other countries. Findings from various literatures were discussed to relate to situation within the Indonesian context. The article provides useful information that would be valuable for policy makers in Indonesia in planning for the development of teledentistry, a service which would be especially

beneficial during COVID-19 pandemic, to be applied in Puskesmas.

MATERIALS AND METHODS

This article was a narrative review. Literature search was undertaken of both in Indonesian and overseas context related to teledentistry. Search was conducted in PubMed and Dentistry and oral sciences source database. The search terms include teledentistry, online referral system, teledentistry challenge and pandemic situation as the key words. Key word search terms were established, and a Boolean search string (OR) was developed across key words [Table 1]. Using truncated words (in this case *), the researchers performed an extensive search that captured all terms with the same root word. Any duplicate articles and articles that were not relevant after title and abstract reading were removed. Further search for Indonesian context was conducted on Indonesian health local journals through Indonesian database as well as by contacting some university libraries to find grey and offline literatures in the field. Additional reference tracking was also conducted to further elaborate the need and challenges in Indonesia context. All references were read and synthesis by two authors independently. In case of disagreement, a third reviewer's opinion was sought for further discussion and a decision was made by consensus. Figure 1 shows the flow of the search. The summary of concept finding was synthesized in Table 2 and the narrative review in Indonesian context was presented and discussed.

RESULTS

TELEDENTISTRY: LESSON LEARNT FROM OTHER COUNTRIES

The potential use of teledentistry has been well recognized.⁹⁻¹³ It gains more recognition in the current

Table 1: Database search terms for PubMed and Dentistry and oral sciences source database

SEARCH TERMS FOR PUBMED			
"teledent*" [All Fields]	"teledent*" [All Fields] AND "challenge*" [All Fields]	5 ("teledent*" [All Fields] AND ("pandemic s" [All Fields] OR "pandemically" [All Fields] OR "pandemicity" [All Fields] OR "pandemics" [MeSH Terms] OR "pandemics" [All Fields] OR "pandemic" [All Fields]))	("online" [All Fields] AND ("referral and consultation" [MeSH Terms] OR ("referral" [All Fields] AND "consultation" [All Fields]) OR "referral and consultatio" [All Fields] OR "referral" [All Fields] OR "referrals" [All Fields] OR "referrer" [All Fields] OR "referrers" [All Fields]) AND ("drug delivery systems" [MeSH Terms] OR ("drug" [All Fields] AND "delivery" [All Fields] AND "systems" [All Fields]) OR "drug delivery systems" [All Fields] OR "system" [All Fields] OR "system s" [All Fields] OR "systems" [All Fields]) AND "dent*" [All Fields])
SEARCH TERMS FOR DENTISTRY AND ORAL SCIENCES SOURCE			
Teledent*	"teledent*" AND "challenge"	"teledent*" AND "pandem"	("online" AND ("referral " OR "consultation "

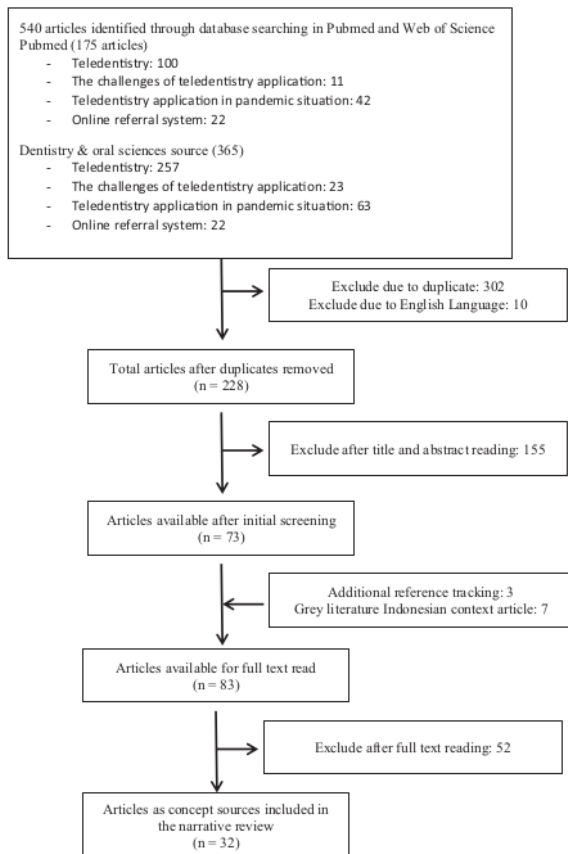


Figure 1: Flowchart of literature search

COVID-19 pandemic.^[5,11,14,17,25,29,31,32] Teledentistry could be delivered through real-time consultation as well as store and forward method.^[11-16] Teledentistry has been applied in many sectors including tediagnosis, teleconsultation, tele-treatment planning, sharing clinical and radiological photographs, teletriage, teleprescription and telemonitoring. There are many studies that assess the reliability of teledentistry using several devices such as intra oral camera,^[19] smartphone,^[20,21] WhatsApp images,^[21] email,^[22] as well as through virtual consultation.^[23] While the potential use of teledentistry is high, there are still many challenges for its application [Table 2].

INDONESIAN CONTEXT: THE ROLE OF PUSKESMAS IN MAINTAINING POPULATION HEALTH 14

Indonesia faced the unique challenge of providing health care across 900–1000 inhabited islands and 34 provinces with a mix of public and private providers. The Indonesian primary health care center (puskesmas) was introduced into the Indonesian primary health care system in 1960s.^[38] Puskesmas is a health service facility

that organizes public health efforts and first-level individual health efforts, emphasizing promotive and preventive measures. Puskesmas are at the forefront of health services in Indonesia and have a responsibility to look after all citizen's health in its area.^[39] There are close to around 10,134 Puskesmas spread across Indonesia in 2019.^[39] However, the facilities in each Puskesmas are also varied due to the inequality across areas. Health promotion and health education is conveyed to the population through the help of health cadres who are governed by Puskesmas. Health cadres consist of local people, who are willing to render their services and help puskesmas achieve its goals of improving community health through primary level of prevention.

The 2011 health facility research among 8,975 Puskesmas reported that 60.6% (5,439) of Puskesmas had the availability of a dentist while 39.4% (3,536) puskesmas did not report.^[40] The infrastructure and other facilities in each Puskesmas are also varied. 87.4% of the puskesmas have 24 hour electricity, 78.4% have access to computer, 17.1% have internet services, and only 15% have a local area network (LAN).^[34] Among 10,134 Puskesmas across Indonesia, only 6,168 Puskesmas have smooth internet availability, while 1,792 Puskesmas have interrupted internet access, while 1,090 Puskesmas do not have internet access at all.^[41] In addition to the inadequate state of the Puskesmas infrastructure, the availability of telecommunication devices in Indonesia is also limited. The infrastructure condition shows that 93.6% of public health facilities have telephone access, 27% have smartphones, and 82% have internet facilities.^[35]

INDONESIAN LOCAL CONDITION

Before the COVID-19 pandemic hit Indonesia and the rest of the world in 2020, the discussion on the use of telehealth in Indonesian health system had begun. Telehealth was planned to be used to provide better health services through Puskesmas for people in remote or isolated areas such as in the border and outer islands of Indonesia. In 2016, an economic analysis of the telehealth program was conducted.^[36] The results of the study concluded that even though the cost of telehealth implementation in Indonesia is going to be high, it was going to be very much affordable under the Indonesian health ministry's budget. If the program had to be started in 2016, about 660 Puskesmas would have been able to implement the telemedicine program by 2020.^[36]

However, the internet coverage in Indonesia is still 64.8%.^[42] Further, 35.2% of the population still does not use the internet.^[42] The internet speed in Indonesia is in the 110th position with a download speed of

Table 2: The summary of concept finding

No	Concept	Supported article	Main finding/possible solution
1	<p>Potential use of teledentistry</p> <ul style="list-style-type: none"> Method of delivering teledentistry: Real-time consultation vs. Store and forward Scope of teledentistry Patients' acceptance Tools used in teledentistry application The reliability Eliminate the disparities in oral health care between rural and urban communities 	<p>[9-13] [11-16] [5,11,17] [17,18] [5,11] [19-23] [24]</p>	<p>10 Real-time consultation involves a video conference in which dental professionals and the patient, at different locations, may see, hear, and communicate with one another using advanced telecommunication devices and 4 gh-speed internet connection. Store and forward involves the exchange of clinical information and static images collected and stored in the telecommunication equipment. telediagnosis, teleconsultation, tele-treatment planning, sharing clinical and radiological photographs, Teletriage, teleprescription, telemonitoring, 8 Teledentistry could occur through instant messaging applications (WhatsApp, Telegram, Instagram, SMS, Messenger) and video calling applications (Google Meet, Skype, Facetime, WhatsApp). Intraoral camera. Using intra oral camera,^[19] using smartphone,^[20,21] using WhatsApp images,^[21] using email,^[22]using virtual consultation^[23]</p>
2	The use of teledentistry in developing country or underserved population	[12,14,25-27]	
3	<p>The challenges of teledentistry application</p> <ul style="list-style-type: none"> Teledentistry helps only in the preventive and diagnostic procedures. Data security/patients' privacy/ ethical/legal issue Poor resolution of the images provided by the patient. Dentists' acceptance / knowledge / awareness Cost of the telemedicine equipment The payment of the teledental oral healthcare professional Infra-structure, Internet access, technology, Create new inequalities in healthcare access 	<p>[11] [10,11,13,15] [5,14] [10,17,29,30] [12,29] [12-15] [12-14,30] [8]</p>	<p>12 The patient's records should be safely stored, written or verbal consent obtained from the patient should be documented^[9] Intraoral Photography Recommendations^[28] require regular training Need strong political support^[15] Need strong political support^[15] Need strong political support^[15]</p>
4	Teledentistry application in pandemic situation	[5,11,14,17,25,29,31,32]	
5	<p>Online referral system</p> <ul style="list-style-type: none"> Develop relationships between dental practitioners and non-dental primary care providers in rural and remote population 	[33]	<p>11 Develop relationships between dental practitioners and non-dental primary care providers in rural and remote population^[33]</p>
6	Indonesian context	[7,14,30,34-37]	

22.34 Mbps among 174 countries.^[43] The distribution of telecommunication networks in Indonesia is still uneven i.e., eastern areas such as East Nusa Tenggara, Maluku, and Papua still do not have equal internet

access.^[44] The unevenness of the telecommunication network is certainly a challenge for teledentistry development because its access requires a stable speed. The internet speed in areas outside Java, the main island

in Indonesia, is low for implementing teledentistry activities.^[45] Teledentistry services will be successful only if there is a 24 hour uninterrupted electric supply and 3G/4G high speed internet access.

The prevailing pandemic situation makes Indonesian government more aware of the need for telecommunication technology to support education and health services and at the same time is currently committed to providing equal distribution of telecom infrastructure as needed.^[42]

THE NEED FOR ONLINE REFERRAL SYSTEM AND TELEDENTISTRY

The online referral system and teledentistry have been discussed as a solution to provide care in underdeveloped areas and the outreach even before the Pandemic. In the health sector, telemedicine can be used for screening, consultations between patients and dentists, doctors, and colleagues to simplify the dental referral system, as well as regular case studies. Teledentistry is a form of telemedicine specifically dedicated to dentistry that uses electronic medical records, information and communication technology, and the internet to provide consultation at a distance.^[26] Teledentistry refers to the use of information and communication technologies to improve dental care offered to distant or isolated people.^[46,47] Teledentistry can improve access to dental health services and quality of care, especially in rural areas where there are not enough specialist dentists. All of them aim to facilitate the transfer of knowledge and skills, with the help of sophisticated technology.^[30] In oral diseases, adequate images of oral lesions can be taken and sent to a specialist to diagnose and create a treatment plan for the on-site dentist to implement. Monitoring these patients after undergoing treatment can be done via telemonitoring, where the specialist can evaluate the patient and decide on the next treatment action.^[16]

During the pandemic, the use of teledentistry has been seen as a solution to provide care not only for the remote area but also in regular dental services thereby reducing the contact of dental personnel and patients. Several studies in the application of teledentistry showed promising results. A study on a telediagnosis service named EstomatoNet that was created to support primary care dentists and physicians in diagnosing and decision-making for oral lesions reveals that around 25% of cases ended up in the medication prescription or follow up.^[46] Thus, teledentistry might be useful and effective for pharmacological management related to several dental conditions. Further, a systematic review of the use of teledentistry as a tool of caries detection showed that teledentistry has an acceptable diagnostic performance in detecting dental caries.^[48]

The development of teledentistry has been applied in many countries. In Brazil, for example, the use of teledentistry has been used progressively by the development of a telehealth program by the Federal University of Rio Grande do Sul. This program uses innovative telehealth applications with actions that include teleconsultation, telediagnosis, and tele-education.^[27]

DISCUSSION

Pandemic COVID-19 has created a situation that has put dental practices as a high-risk place for COVID-19 transmission.^[5] Dental procedures usually need close face-to-face interaction with patients and create a large amount of aerosols, which are currently reported as a way of virus transmission.^[49] The majority of governments have implemented restrictions to dental treatment, as SARS-CoV-2, the virus causes the COVID-19, has been detected in saliva samples and infection typically spread through respiratory droplets.^[5] The use of paper-based medical records is also considered as a medium of transmission. Thus, the use of an online referral system, digital data management, and teledentistry has been shown as a solution to minimize the spread of infection while keeping the dental service running for the population.^[5]

Teledentistry awareness in several studies ranged from 37.4% to 88.6% in India, Rwanda, and Pakistan.^[29] Research conducted in Saudi Arabia showed that only 25.16% of students had previously used teledentistry.^[29] In Indonesia, there are no studies that yet that discuss the use of teledentistry by dentists. However, its use has seen in several private clinics and is starting to increase, especially during the COVID-19 pandemic. However, the implementation of teledentistry in Indonesian health care services is still hampered by unclear implementation rules or laws regulating telemedicine services. Thus, there is no guarantee of protection and legal certainty.^[37] Furthermore, it was reported that the lack of teledentistry acceptance by dentists was due to the low ability to use new technology, fears of data leakage, fear of making inaccurate diagnoses as a result of less contact with patients, as well as concern about increasing costs and expenses to provide supporting facilities and infrastructure.^[48]

To effectively use teledentistry, dental health personals as implementers need time to implement and practice teledentistry. Several efforts can be made, such as providing clear guidelines by related organizations, adequate internet and telecom technology training for dentists and promoting teledentistry as a tool to

prevent infection transmission in the curriculum for dental students so that they are accustomed and can accept it.^[50]

Community acceptance of teledentistry concepts is likely the key to the success of teledentistry.^[50] The existence of teledentistry facilitates patients and dentists to communicate indirectly causing anxiety among patients as they could feel that they do not get adequate information about their problem.^[50] However, a study about the satisfaction of teledentistry services during the pandemic in the UK context^[18] showed that 97% of patients were satisfied with the services provided. All respondents agreed that the application of teledentistry reduced the examination time and also agreed that during the teledentistry consultations, the patient can convey his complaints as clearly as face to face consultation.^[18] It is possibly because the internet access is fast in the UK, and its people are almost entirely tech-savvy.

For Indonesia, teledentistry could be used in terms of teleconsultation, telediscussion, telediagnosis, and referral between the community and dental service providers in Puskesmas, as well as from dental service providers to dental specialists in other governmental clinics or hospitals. Considering the local condition of each Puskesmas, and each area in Indonesia, the implementation of teledentistry in Puskesmas could be challenging. Here, the commitment of the Indonesian government to increase the infrastructure and internet access in all areas is really needed. However, for a relatively well-developed area, such as cities in Java, the main island in Indonesia, the teledentistry project in Puskesmas could be pilot tested. Moreover, as not all Indonesian population are well educated and equipped with technology and facilities, we need a system that could help the poor get access to their dental services with the help of teledentistry.

The culturally close social relationship among Indonesian keeps people locally socialized, even in the pandemic situation. We are advantage due to the presence of dental health cadres, both in school dental health service or community dental health service programs. The health cadres keep in touch with community within their areas routinely. These health cadres are educated and in a better socioeconomic condition than the rest of the population and could be trained in the use and application of teledentistry to help the poor. With this arrangement, it is possible to apply the teledentistry concept in Puskesmas with good coverage in all populations. With the teledentistry application, the management (data, referral, and pharmacological) will reduce the density of patients

visiting the puskesmas, and thereby reducing the risk of the COVID-19 transmission.

The application of an online referral system, digital data management, and teledentistry application in Indonesian primary health care centers is possible when the government supports this concept and plans its implementation at the earliest. Dental education institutions can help to supply human resources, who are capable of developing and carrying out the most suitable teledentistry application for all stakeholders. In the pandemic situation, health cadres can bridge the relationship between Puskesmas and the poor community by the use of teledentistry application.

This research provided new insight in the need and challenges of the use of teledentistry and online referral system in Indonesian primary health care center during the covid-19 pandemic. It will serve as a guideline for policy makers in reducing the risk of the COVID-19 transmission through the use of teledentistry in Indonesian primary health care center.

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CONFLICTS OF INTEREST

Authors declare that there is no conflict of interest.

AUTHORS CONTRIBUTIONS

Ninuk Hariyani: Conceptualization, data acquisition, funding acquisition, investigation, methodology, draft writing, review & editing; Namita Shanbhag: Review & editing; Ekawati Wasis Wijayati: Data acquisition, investigation, draft writing, review & editing; Arie Wahyu Prananta: Data acquisition, investigation, review & editing; Dini Setyowati: Methodology, data acquisition, funding acquisition, investigation, review & editing; Retno Palupi: Data acquisition, funding acquisition, investigation, review & editing.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

As this was a review of available literature, no ethic clearance was required.

PATIENT DECLARATION OF CONSENT

Not applicable.

DATA AVAILABILITY STATEMENT

All relevant data are within the manuscript.

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