

# Knowledge, Attitudes, and Practices Regarding Teledentistry Among Dentists in Jakarta During the Coronavirus Disease (Covid-19) Pandemic: A Cross-Sectional Study

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## ABSTRACT

**Objective:** To assess factors associated with knowledge, attitudes, and practices (KAP) related to teledentistry among dentists in Jakarta during the COVID-19 pandemic. **Material and Methods:** This cross-sectional study used a self-administered online questionnaire with a purposive sampling technique. Survey items comprised knowledge of, attitude toward, the practice of, and barriers to teledentistry. The Chi-square, Mann-Whitney, and Spearman correlation tests were used to determine factors associated with KAP of teledentistry. **Results:** A total of 183 dentists in Jakarta completed the questionnaire. The findings showed that 95.6% of the surveyed dentists had good knowledge, 83.1% expressed positive attitudes, and 60.7% practiced teledentistry during the COVID-19 pandemic. Most participants (86.3%) expressed a willingness to practice teledentistry in the future. The three most significant barriers that obstruct dentists from practicing teledentistry are patient compliance and satisfaction regarding the dentist's physical presence, a low population education level, and a lack of technological infrastructure. A statistically significant relationship was found between teledentistry practice and age, marital status, working experience, and training regarding teledentistry. A positive correlation was found between knowledge of and attitude toward teledentistry. **Conclusion:** Dentists in Jakarta have a high understanding of, positive attitudes toward, and good practices for teledentistry. Factors related to teledentistry practice were age, marital status, work experience, and training experience in the last two years.

**Keywords:** Attitude; Knowledge; COVID-19; Telemedicine.

## Introduction

At the end of 2019, the coronavirus (COVID-19) emerged in Wuhan, China. Research has indicated that the causative agent of the spread of COVID-19 may be airborne aerosols, such as those generated during medical treatment in an enclosed space, resulting in a high risk of transmission between dentists, dental nurses, and patients [1]. In response, countries worldwide declared a state of emergency that affected the delivery of dental services [2]. The first COVID-19 cases in Indonesia were confirmed in March 2020, and the disease quickly spread to all provinces. Jakarta, the capital city of Indonesia, accounted for more than half of all Indonesian cases in the first month of the emergence of COVID-19 [3]. A significant number of dentists in Indonesia are located in Jakarta and neighboring areas, 1.1% of whom contracted COVID-19 [4].

Teledentistry was introduced to help safely deliver dental services in Indonesia during the COVID-19 pandemic by providing access to and delivery of health services through communication technology [5]. Dentists had to update their knowledge and skills regarding infection control and follow recommended protocols to protect themselves and their patients [6]. In light of the pandemic, developing new protocols to increase biosecurity among dentists became necessary. Teledentistry provides dental and oral health services, advice, and treatment through remote communication and information technology, which reduces person-to-person contact between service providers and patients [7]. Teledentistry can also initially screen patients for COVID-19 symptoms before a dentist decides on the treatment [8].

Thus, it is essential to assess the extent to which dentists are professionally prepared to implement and provide teledentistry services. Previous studies have found a need for more knowledge and teledentistry practice among dentists before the COVID-19 pandemic. However, since then, there has been an increase in both [9-11]. Many factors, including sociodemographics, work-related characteristics, Internet use, and teledentistry course experience, have been associated with a dentist's knowledge of, attitudes toward, and practice of teledentistry [12,13]. However, barriers faced by dentists in using teledentistry include the following: patient satisfaction based on the physical presence of the dentist; individual patient's knowledge, attitudes, and practices; resource availability; violation of patient privacy; and quality of intraoral images [12,14].

Therefore, this study aimed to determine the factors associated with knowledge, attitudes, and practices (KAP) related to teledentistry among dentists in Jakarta. We also investigated the willingness and barriers to using teledentistry in dental practice.

## Material and Methods

### Study Design, Settings, and Participants

A cross-sectional study was conducted in Jakarta, Indonesia, in June 2022. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines per the Declaration of Helsinki [15]. The Dental Research Ethics Committee of the Faculty of Dentistry at Universitas Indonesia approved the research protocol (Protocol Number: 030980921). The latest version of the G-Power sample size calculator was used to estimate the sample size, which revealed a power of 0.9 (90%), a significance level of 0.05, and a correlation of 0.208 between skill level and telemedicine awareness [16]. The sample size invited to join this study was 238, and in case of drop-outs, an additional 10% was added, so the minimum sample size was 262 dentists. A purposive sampling technique was used to collect the participant data based on the eligibility criterion, which included registered dentists who were actively practicing during the COVID-19 pandemic in Jakarta. The result with incorrectly recorded information was excluded.

## Instruments

A self-administered online questionnaire was distributed. The Indonesian Dental Association (IDA) facilitated the questionnaire distribution to its members by contacting each branch head in five regions of Jakarta. The respondents were evenly distributed across all areas. A link to the Google form was shared through online media platforms, such as WhatsApp and Instagram. Participation was voluntary; informed consent was obtained from all study participants before enrollment, and their responses were kept confidential. The research instrument was adapted from those used in previous studies on KAP and barriers to teledentistry [9,11,12]. A cross-cultural adaptation process was applied according to the guidelines to finalize the Indonesian version of the questionnaire [17]. The final Indonesian version was pilot-tested with 25 dentists, whose results were not included in the main study.

Face validity was verified during the pilot study to ensure the clarity and comprehensiveness of the wording. In the finalized survey, the section that focused on independent variables was used to collect data on the following: 1) sociodemographics, 2) work-related characteristics, 3) daily Internet access, and 4) training in teledentistry. The section that focused on the dependent variables consisted of three domains. The first domain concerned the participants' knowledge of teledentistry and included 10 True/False questions scored as True = 1 and False = 0. As a result, each participant's total score ranged from 0 – 10 points. Higher scores represented good knowledge of teledentistry. The second domain concerned the participants' attitudes toward teledentistry. It consisted of 10 questions scored on a five-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree. Attitudes toward teledentistry that were being assessed: six questions about teledentistry usefulness, each question about a government initiative for teledentistry program, the accuracy of dental examination via computer and intraoral camera, patients' privacy by using teledentistry, and future use of teledentistry as a standard method of oral healthcare. The cumulative score ranged from 10-50 points for each participant. The higher scores indicated more favorable attitudes toward teledentistry. The third domain consisted of four questions about teledentistry practice, one about the need for further training, and one about willingness to practice teledentistry in the future. The final domain included eight potential barriers to teledentistry, answered by dentists who did not practice it with a yes or no response. The barriers were related to population education, patient compliance and satisfaction, technological infrastructure, cost of teledentistry infrastructure, fees for teledentistry charged, dentists' resistance to the new technology, patient privacy, and time to learn and apply teledentistry technology.

Pearson product-moment correlation was conducted to assess the instrument's validity [18], and the results are significantly higher compared to the critical value table ( $r > 0.396$ ,  $p < 0.05$ ). The internal consistency of the questionnaire was also assessed. A Cronbach's alpha of 0.833 was obtained, representing good internal consistency. A test-retest of the questionnaire using an interclass correlation coefficient (ICC) was performed at three-week intervals. The test-retest results were 0.937 and 0.878 for knowledge and attitude, respectively, indicating almost perfect agreement.

## Data Analysis

The collected data were entered into MS Excel and processed using IBM SPSS 25.0 for Windows statistical software (IBM Corp., Armonk, NY, USA). Descriptive statistics, including percentages, means, and standard deviations, were used to describe the characteristics of the study participants, KAP, and barriers to teledentistry. When the data distribution was not expected, a Mann-Whitney test was performed to assess differences in participants' characteristics regarding their knowledge and attitudes. Relationships between

teledentistry practices and all independent variables were assessed using chi-squared analysis. Finally, the Spearman correlation test was applied to evaluate the correlations between knowledge and attitudes toward teledentistry. All differences were assessed using the two-tailed test, and a significance level was set at  $p < 0.05$ .

## Results

A total of 183 respondents completed the questionnaire, with a response rate of 70%. More than half of the respondents (56.3%) were married, and the median age (min.-max) was 29 (23–72) years. Most participants were general dentists (63.9%) and worked in private practice (74.9%). Regarding teledentistry training, only 31.1% of the respondents had received the training in the last two years. The characteristics of the respondents are shown in Table 1. The mean knowledge score was 8.78 (maximum score = 10), indicating that most dentists understood teledentistry. The respondents were asked about the definition of teledentistry, and 97.3% chose the correct answer (Table 2).

**Table 1. Characteristics of study participants.**

Variables	N (%)
Age (Years) - Median (Min.-Max.)	29 (23–72)
Sex	
Male	38 (20.8)
Female	145 (79.2)
Marital Status	
Single	80 (43.7)
Married	103 (56.3)
Qualification	
General Dentist	117 (63.9)
Specialist	66 (36.1)
Work Experience (Years) - Median (Min.-Max.)	5 (1–45)
Type of Practice	
Private	137 (74.9)
Governmental	46 (25.1)
Daily Internet Use for General Purposes (Hours) - Median (Min.-Max.)	6 (1–18)
Teledentistry Training in the Last Two Years	
Yes	57 (31.1)
No	126 (68.9)
Knowledge - Mean $\pm$ SD	8.78 $\pm$ 1.57
Attitude - Median (Min.-Max.)	34 (15–40)

**Table 2. Participants correctly answered teledentistry knowledge items.**

Statement	N (%)
Teledentistry is the practice of using computers, the Internet, and technologies for dental consultation and treatment planning over a distance	178 (97.3)
It helps to monitor the patient's oral health	168 (91.8)
Helps to consult with an expert on a patient's problem	180 (98.4)
Helpful in early and easy consultation on oral disease with a specialist	175 (95.6)
Useful in the diagnosis and management of oral disease	132 (72.1)
Useful in improving access to oral health care	176 (96.2)
It can be applied in any branch of dentistry	103 (56.3)
Increases the number of dentists in areas where populations are scattered	161 (88.0)
A good tool for oral hygiene training	166 (90.7)
Decreasing the isolation of general practitioners apart from specialists	168 (91.8)

Table 3 presents respondents' attitudes toward teledentistry. The median score of the respondent's attitudes toward teledentistry was 34 (maximum score = 50). Most respondents agreed that teledentistry reduced patient flow during the COVID-19 pandemic by postponing non-urgent dental care (61.2%). Only 12% of respondents agreed that dental examinations conducted via computers and intraoral cameras were as accurate as those undertaken in dental clinics.

**Table 3. Participant's attitude toward teledentistry.**

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	N (%)	N (%)	N (%)	N (%)	N (%)
Teledentistry can reduce patient flow during pandemics by postponing non-urgent dental visits	52 (28.4)	112 (61.2)	15 (8.2)	4 (2.2)	0 (0.0)
There is a clear need for a government initiative for teledentistry programs where patients can receive advice on their treatment needs from a central facility	45 (24.6)	113 (61.7)	23 (12.6)	2 (1.1)	0 (0.0)
Dental examinations via computers and intraoral cameras are as accurate as dental clinic exam	9 (4.9)	22 (12.0)	46 (25.1)	77 (42.1)	29 (15.8)
Teledentistry is a convenient form of oral care delivery that makes dental examinations easier	12 (6.6)	63 (34.4)	65 (35.5)	37 (20.2)	6 (3.3)
Teledentistry can be in addition to regular dental care	24 (13.1)	102 (55.7)	46 (25.1)	9 (4.9)	2 (1.1)
Teledentistry helps in reducing the costs of dental practices	18 (9.8)	70 (38.3)	70 (38.3)	21 (11.5)	4 (2.2)
Teledentistry saves dentists time	20 (10.9)	95 (51.9)	44 (24.0)	19 (10.4)	5 (2.7)
Teledentistry can violate the patients' privacy	8 (4.4)	27 (14.8)	60 (32.8)	77 (42.1)	11 (6.0)
I think teledentistry is useful	40 (21.9)	115 (62.8)	24 (13.1)	3 (1.6)	1 (0.5)
In the future, teledentistry will be a standard method of oral healthcare delivery	27 (14.8)	70 (38.3)	56 (30.6)	21 (11.5)	9 (4.9)

Table 4 shows the results of the dental practices in teledentistry. Most respondents (60.7%) practiced teledentistry, and a little more than half had started since the COVID-19 pandemic emerged (53%). Most respondents agreed that teledentistry was helpful for patient education and planning appointments (87.4%). The results revealed that the most frequently used tools and subunits in teledentistry practice were mobile phones (71.4%) and teleconsultations (83.8%). Most respondents shared that they would like to practice teledentistry in the future (86.3%), and they needed continuous education regarding the use and application of teledentistry (84.7%).

**Table 4. Teledentistry practice among respondents.**

Questions	N (%)
Have you practiced teledentistry?	
Yes, before the COVID-19 pandemic	14 (7.7)
Yes, since the COVID-19 pandemic	97 (53.0)
No	72 (39.3)
In which cases do you consider teledentistry useful in your clinical practice?	
Dental hygiene education	160 (87.4)
Planning patient's appointments	160 (87.4)
Emergency advice	156 (85.2)
Clarification of patient's doubts about some dental procedures	150 (81.9)
Oral hygiene training	145 (79.2)
To monitor the patient's dental treatment	131 (71.6)
Do you need training/further training on the use and application of teledentistry?	
Yes	155 (84.7)
No	28 (15.3)
Would you practice teledentistry after COVID-19?	

Yes	158 (86.3)
No	25 (13.7)
If you have practiced teledentistry, what tools do you use most often to support your practice toward teledentistry?*	
Mobile phone	79 (71.4)
Computer Desktop / Laptop	28 (25.7)
Tablet	4 (2.9)
If you have practiced teledentistry, what subunit do you practice most frequently?*	
Teleconsultation	93 (83.8)
Telemonitoring	9 (8.1)
Telediagnosis	6 (5.4)
Teletriage	3 (2.7)

\*N = 111.

The several barriers among dentists who did not practice teledentistry are summarized in Table 5. The most common obstacles to the practice of teledentistry were people with lower education (90.2%), patient satisfaction related to the dentist's presence (88.5%), and lack of technological infrastructure (73.8%).

**Table 5. Barriers using teledentistry#.**

Barriers	N (%)
Population education is low	63 (90.2)
Patient compliance and satisfaction require the physical presence of a dentist	65 (88.5)
Lack of technological infrastructure	60 (73.8)
High cost of teledentistry infrastructure	43 (62.3)
Inappropriate fees for teledentistry charged to patients	47 (62.3)
Dentists' resistance to new technology	42 (55.7)
Fear of invading a patient's privacy	40 (55.2)
Time required for dentists to learn and apply the teledentistry technology	41 (48.6)

#N=72.

Associations between the characteristics of the responding dentists and the knowledge of, attitudes toward, and practice of teledentistry are shown in Table 6. There were statistically significant differences in age, marital status, work experience, and teledentistry training experience in the previous two years associated with practicing teledentistry ( $p < 0.05$ ). The Spearman correlation test showed a moderate positive correlation between knowledge of and attitudes toward teledentistry ( $r = 0.436$ ,  $p = 0.001$ ).

**Table 6. Factors associated with knowledge, attitude, and teledentistry practice among respondents.**

Variables	Knowledge		Attitude		Have you ever practiced teledentistry?		
	Mean (SD)	p-value <sup>†</sup>	Median (Min.-Max.)	p-value <sup>†</sup>	No	Yes	p-value <sup>‡</sup>
					N (%)	N (%)	
<b>Sex</b>							
Male	8.6 (1.9)	0.828	34 (14-50)	0.796	13 (34.2)	25 (65.8)	0.588
Female	8.8 (1.4)		35 (20-49)		50 (40.7)	86 (59.3)	
<b>Age (Years)</b>							
< 29	8.8 (1.8)		34 (21-48)		25 (27.8)	65 (72.2)	0.003*
≥ 29	8.7 (1.3)	0.282	34.5 (14-50)	0.967	47 (50.5)	46 (49.5)	
<b>Qualification</b>							
General Dentist	8.8 (1.5)	0.971	35 (21-48)	0.564	59 (41.8)	82 (58.2)	0.276
Specialist	8.7 (1.8)		34 (14-50)		13 (31.0)	29 (69.0)	
<b>Marital Status</b>							
Single	8.8 (1.3)	0.369	34.5 (21-49)	0.832	41 (51.3)	39 (48.8)	0.006*
Married	8.8 (1.7)		34 (14-50)		31 (30.1)	72 (69.9)	
<b>Type of Practice</b>							
Governmental	8.8 (1.5)	0.399	35 (21-50)	0.117	53 (38.7)	84 (61.3)	0.889

Private	8.6 (1.7)		34 (14-43)		19 (41.3)	27 (58.7)	
Work Experience							
≤ 5 Years	8.7 (1.4)	0.214	34 (21-48)	0.900	48 (49.5)	49 (50.5)	0.005*
> 5 Years	8.8 (1.7)		34.5 (14-50)		24 (27.9)	62 (72.1)	
Daily Use of the Internet for General Purposes							
< 8 Hours	8.9 (1.6)	0.123	35 (14-50)	0.688	42 (41.2)	60 (58.8)	0.677
≥ 8 Hours	8.6 (1.5)		34 (25-49)		30 (37.0)	51 (63.0)	
Teledentistry Training in the Last Two Years							
No	8.7 (1.6)	0.468	34 (28-45)	0.548	61 (48.4)	65 (51.6)	0.001*
Yes	8.9 (1.4)		34.5 (14-50)		11 (19.3)	46 (80.7)	

\*Mann Whitney test; †Chi-square test; SD = Standard deviation; \*significance,  $p < 0.05$ .

## Discussion

The emergence of COVID-19 brought attention to the potential use of teledentistry to provide a wide range of remote dental services without the risk of infection. Although teledentistry is not a new discipline, the emergence of the COVID-19 pandemic increased the dental community's awareness of its critical role [8,19]. Previous studies have focused on the KAP of teledentistry among dentists and have been widely documented [9,11,13]. However, few studies have been conducted in Indonesia, particularly during the COVID-19 pandemic. The present study aimed to determine the factors associated with KAP in teledentistry among dentists in Jakarta during the COVID-19 pandemic. Furthermore, this study also evaluated the willingness and barriers to using teledentistry in dental practice.

The study's findings showed that most respondents had good knowledge of teledentistry. These results are consistent with previous findings that dentists have understood teledentistry well since the emergence of COVID-19 [20]. However, in our study, many dentists (68.9%) reported not receiving teledentistry training in the last two years. Most respondents (84.7%) thought they needed further training in applying teledentistry in their practices. Such findings can be explained by the lack of didactic and practical (i.e., experiential) learning opportunities related to teledentistry in dental education curricula. Before COVID-19 emerged in Indonesia, a specific module on teledentistry had yet to be established in dental education curricula. Therefore, to overcome this problem, it is essential to include the topic of teledentistry as an integral part of dental education curricula [10,21].

The present study also found that almost all respondents had positive attitudes toward the benefits and application of teledentistry. One-third of the respondents agreed that teledentistry could be a future standard method for oral healthcare. This result aligns with the finding that only 12% of the respondents agreed that dental examinations via computers and intraoral cameras are as accurate as those conducted in dental clinics. Indeed, a previous study found that dental examinations via teledentistry without radiographs were not as precise and needed the same accuracy as clinical examinations [22,23]. It should be noted that further evidence is required to support or refute these findings. Nevertheless, a systematic review has provided evidence that supports teledentistry as an effective means of making dental referrals, planning treatment, identifying oral disease, and practicing teleconsultation [24]. Further studies should be conducted to increase the accuracy and reliability of teledentistry in performing these tasks.

More than half of the respondents (53.0%) had practiced teledentistry since the emergence of COVID-19. This result is higher than that observed in Saudi Arabia (23.2%) [11] and Brazil (10.5%) [13] in a previous KAP survey among dentists during the COVID-19 pandemic. The observed discrepancy may have been caused by a lack of knowledge, lack of facilities, and inadequate preparation for teledentistry among dentists since those

studies were conducted very early in the COVID-19 pandemic when the number of cases was increasing rapidly. More than two-thirds of the respondents were willing to practice teledentistry in the future. Previous studies conducted in Colombia [9] and France [25] reported similar findings. This result can be explained by the emergence of COVID-19 and an increase in the perceived need for teledentistry [9,11].

Moreover, teledentistry involves innovative technology that provides certain benefits and requires forward thinking, both of which foster positive attitudes and high levels of awareness among users [26]. Nonetheless, several potential barriers could occur in the future practice of teledentistry. In the present study, the barriers to applying teledentistry were as follows: a low level of education among the population, patient satisfaction related to the dentist's presence, and a lack of technological infrastructure. Studies conducted in Colombia [9] and Saudi Arabia [12] similarly identified the following barriers: dental treatment requires physical contact, limited available technology, and older dentists may need more technological skills.

When teledentistry is part of a nation's health system, human and financial resources, infrastructure, and regulations are required. Indonesia is a developing country, and several potential barriers to teledentistry may be due to a lack of adequate resources, such as Internet access throughout the country, the absence of teledentistry regulations, digital forgery, and the absence of teledentistry courses on the curriculum in undergraduate dental programs [27]. Therefore, it is necessary to have a policy on teledentistry development and expand continuing teledentistry education among the next generations in Indonesia.

Our findings showed that dentists with a significantly more excellent opportunity to practice teledentistry were more than 29 years old, married, had more than five years of work experience, and had received training in the last two years. A previous study revealed that dentists between 46 and 59 years old have had a significantly greater chance to practice teledentistry since COVID-19 [9]. Younger dentists had higher levels of preparedness for practicing teledentistry than older dentists. During the pandemic, teledentistry practices increased more frequently among younger and older dentists. These findings indicate that because younger dentists adapt more quickly to technology, age is an essential factor in the knowledge and practice of teledentistry [9,13].

Married dentists were found to have more significant opportunities to practice teledentistry than single dentists. Married dentists are likely to have children and an extended family. They thus may implement good practices for COVID-19 prevention and control because they fear the transmission of COVID-19 to their children and family [28]. Practicing teledentistry could minimize the need for face-to-face interactions between dentists and patients, thus reducing the potential risk of transmission of COVID-19. Dentists with more than five years of experience showed more preparedness to practice teledentistry than those with less clinical experience. Dentists with more work experience felt more prepared to perform teledentistry than those with less work experience. This could be because they were likelier to have greater knowledge of oral disease and greater confidence in diagnosing and treating patients [13].

The results showed a statistically significant difference between teledentistry practice and training. It was found that telemedicine training can prepare physicians to build relationships through telehealth technology and overcome technological difficulties, which provides opportunities to increase clinical competence and confidence [29]. The present study found a moderate positive correlation between knowledge of and attitudes toward teledentistry. The technology acceptance model (TAM) is widely used to predict health professionals' acceptance of remote care technologies. Perceived usefulness, perceived ease of use, attitude, and behavioral intention are predictors that motivate or inhibit people regarding the adoption of teledentistry services [30].

This study has several limitations. First, potential biases, such as response, order effect, and sampling bias, may be associated with the survey methodology. The small sample size is also one of the limitations of our study, and it may reduce the statistical power of the study [31]. However, the response rate in this study is quite similar to the previous systematic review [32], which revealed that the mean response rate of the dental questionnaire-based studies was 70.8%. Another limitation is that the data were collected when the COVID-19 outbreak was in a particular stage, which may have influenced the respondents' responses. Although we modified the questionnaire, recruited potential respondents using various survey distribution channels (invitations sent through WhatsApp messenger and Instagram), and guaranteed survey anonymity, some biases may still have occurred. Therefore, the results might not be generalizable to all dentists in Indonesia and might not represent dentists living in rural areas. Finally, further qualitative studies on potential barriers to teledentistry and increased response rates in urban regions should be conducted to improve the generalizability of the findings.

However, this study's findings prove that although most respondents expressed comprehensive knowledge about and positive attitudes toward practicing teledentistry, continuous education through workshops and training courses is still needed. Courses on teledentistry-related patient appointments, consultations using synchronous and asynchronous modalities, documenting, legal and ethical issues, and billing requirements should be integrated into undergraduate and postgraduate curricula. Despite the study's limitations, the results offer insights into areas that require further improvement, particularly the appropriate regulation of teledentistry services in Indonesia.

## Conclusion

Dentists in Jakarta have high knowledge of, positive attitudes toward, and good practices in teledentistry. Most respondents in our study had practiced teledentistry since the emergence of the COVID-19 pandemic. The factors related to promoting teledentistry practice were age, marital status, work experience, and training experience in the last two years. The main obstacles found to prevent dentists from implementing teledentistry were patient compliance and satisfaction regarding the physical presence of a dentist, the low level of education in the population, and the current lack of technological infrastructure.

## Authors' Contributions

SKP	 <a href="https://orcid.org/0000-0002-9428-2090">https://orcid.org/0000-0002-9428-2090</a>	Conceptualization, Methodology, Formal Analysis, Investigation and Writing - Original Draft.
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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

## References

- [1] Ge ZY, Yang LM, Xia JJ, Fu XH, Zhang YZ. Possible aerosol transmission of COVID-19 and special precautions in dentistry. *J Zhejiang Univ Sci B* 2020; 21(5):361-368. <https://doi.org/10.1631/jzus.B2010010>
- [2] Baghizadeh Fini M. What dentists need to know about COVID-19. *Oral Oncol* 2020; 105:104741. <https://doi.org/10.1016/j.oraloncology.2020.104741>
- [3] Das RK, Sudaryo MK. Epidemiological patterns and spatial distribution of COVID-19 cases in DKI Jakarta (March–December 2020). *Natl Public Health J* 2021; 16(1):17-22. <https://doi.org/10.21109/kesmas.v0i0.5074>
- [4] Soebandrio A, Kusumaningrum T, Yudhaputri FA, Oktavianthi S, Safari D, Malik SG, et al. COVID-19 prevalence among healthcare workers in Jakarta and neighbouring areas in Indonesia during early 2020 pandemic. *Ann Med* 2021; 53(1):1896-1904. <https://doi.org/10.1080/07853890.2021.1975309>
- [5] Ministry of Health of the Republic of Indonesia. Implementation of health services through the utilization of information technology and communities in the context of preventing the spread of coronavirus disease 2019. Regulation No. 20/2019. Ministry of Health of the Republic of Indonesia; 2019.
- [6] Mustafa RM, Alshali RZ, Bukhary DM. Dentists' knowledge, attitudes, and awareness of infection control measures during COVID-19 outbreak: A cross-sectional study in Saudi Arabia. *Int J Environ Res Public Health* 2020; 17(23):9016. <https://doi.org/10.3390/ijerph17239016>
- [7] Khan SA, Omar H. Teledentistry in practice: Literature review. *Telemed J E Health* 2013; 19(7):565-567. <https://doi.org/10.1089/tmj.2012.0200>
- [8] Ghai S. Teledentistry during COVID-19 pandemic. *Diabetes Metab Syndr* 2020; 14(5):933-935. <https://doi.org/10.1016/j.dsx.2020.06.029>
- [9] Plaza-Ruiz SP, Barbosa-Liz DM, Agudelo-Suárez AA. Impact of COVID-19 on the knowledge and attitudes of dentists toward teledentistry. *JDR Clin Trans Res* 2021; 6(3):268-278. <https://doi.org/10.1177/2380084421998632>
- [10] Pradhan D, Verma P, Sharma L, Khaitan T. Knowledge, awareness, and attitude regarding teledentistry among postgraduate dental students of Kanpur city, India: A questionnaire study. *J Educ Health Promot* 2019; 8:104. [https://doi.org/10.4103/jehp.jehp\\_363\\_18](https://doi.org/10.4103/jehp.jehp_363_18)
- [11] Nassani MZ, Al-Maweri SA, AlSheddi A, Alomran A, Aldawsari MN, Aljubarah A, et al. Teledentistry-knowledge, practice, and attitudes of dental practitioners in Saudi Arabia: A nationwide web-based survey. *Healthcare* 2021; 9(12):1682. <https://doi.org/10.3390/healthcare9121682>
- [12] Aboalshamat KT. Awareness of, beliefs about, practices of, and barriers to teledentistry among dental students and the implications for Saudi Arabia vision 2030 and coronavirus pandemic. *J Int Soc Prev Community Dent* 2020; 10(4):431-437. [https://doi.org/10.4103/jispcd.JISPCD\\_183\\_20](https://doi.org/10.4103/jispcd.JISPCD_183_20)
- [13] Raucci-Neto W, de Souza Pereira M, Cerqueira NM, Louzada VG, de Castro Raucci LMS, Leoni GB. Knowledge, perception, and experience of dentists about teledentistry. *Int Dent J* 2022; 72(4):456-462. <https://doi.org/10.1016/j.identj.2021.07.007>
- [14] Tan SHX, Lee CKJ, Yong CW, Ding YY. Scoping review: Facilitators and barriers in the adoption of teledentistry among older adults. *Gerodontology* 2021; 38(4):351-365. <https://doi.org/10.1111/ger.12588>
- [15] Vandembroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and elaboration. *PLoS Med* 2007; 4(10):e297. <https://doi.org/10.1371/journal.pmed.0040297>
- [16] Mutlu A, Kilinc A, Ozcan L, Tepetas M, Metintas S, Onsuz M. Evaluation of telemedicine awareness, knowledge, attitude, skill levels of physicians and students. *Eur J Public Health* 2022; 32(Suppl 3):ckac130.064. <https://doi.org/10.1093/eurpub/ckac130.064>
- [17] Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 2000; 25(24):3186-3191. <https://doi.org/10.1097/00007632-200012150-00014>
- [18] Souza AC, Alexandre NMC, Guirardello EB. Psychometric properties in instruments evaluation of reliability and validity. *Epidemiol Serv Saude* 2017; 26(3):649-659. <https://doi.org/10.5123/S1679-49742017000300022>
- [19] Jampani ND, Nutalapati R, Dontula BS, Boyapati R. Applications of teledentistry: A literature review and update. *J Int Soc Prev Community Dent* 2011; 1(2):37-44. <https://doi.org/10.4103/2231-0762.97695>
- [20] Subhan R, Ismail WA, Musharraf S, Khan M, Hafeez R, Alam MK. Teledentistry as a supportive tool for dentists in Pakistan. *Biomed Res Int* 2021; 2021:8757859. <https://doi.org/10.1155/2021/8757859>
- [21] Chaudhary FA, Ahmad B, Javed MQ, Mustafa S, Fazal A, Javaid MM, et al. Teledentistry awareness, its usefulness, and challenges among dental professionals in Pakistan and Saudi Arabia. *Digit Health* 2022; 8:20552076221089776. <https://doi.org/10.1177/20552076221089776>
- [22] AlShaya MS, Assery MK, Pani SC. Reliability of mobile phone teledentistry in dental diagnosis and treatment planning in mixed dentition. *J Telemed Telecare* 2020; 26(1-2):45-52. <https://doi.org/10.1177/1357633X18793767>
- [23] Steinmeier S, Wiedemeier D, Hämmerle CHF, Mühlemann S. Accuracy of remote diagnoses using intraoral scans captured in approximate true color: A pilot and validation study in teledentistry. *BMC Oral Health* 2020; 20(1):266. <https://doi.org/10.1186/s12903-020-01255-8>
- [24] Alabdullah JH, Daniel SJ. A systematic review on the validity of teledentistry. *Telemed J E Health* 2018; 24(8):639-648. <https://doi.org/10.1089/tmj.2017.0132>

- [25] Giraudeau N, Bauer M, Tramini P, Inquimbert C, Toupenay S. A national teledentistry study on the knowledge, attitudes, training and practices of private dentists. *Digit Health* 2022; 8:20552076221085069. <https://doi.org/10.1177/20552076221085069>
- [26] Lin GSS, Koh SH, Ter KZ, Lim CW, Sultana S, Tan WW. Awareness, knowledge, attitude, and practice of teledentistry among dental practitioners during COVID-19: A systematic review and meta-analysis. *Medicina* 2022; 58(1):130. <https://doi.org/10.3390/medicina58010130>
- [27] Rachmawati Y, Wardhani N, Rubiyanti S, Siregar N. Knowledge, practice, attitude, and barriers related to the use of telehealth in COVID-19 pandemic. *J Stoma* 2022; 75(2):93-98. <https://doi.org/10.5114/jos.2022.117342>
- [28] Bitew G, Sharew M, Belsti Y. Factors associated with knowledge, attitude, and practice of COVID-19 among health care professional's working in South Wollo Zone Hospitals, Northeast Ethiopia. *SAGE Open Med* 2021; 9:20503121211025147. <https://doi.org/10.1177/20503121211025147>
- [29] Yaghobian S, Ohannessian R, Iampetro T, Riom I, Salles N, de Bustos EM, et al. Knowledge, attitudes and practices of telemedicine education and training of French medical students and residents. *J Telemed Telecare* 2022; 28(4):248-257. <https://doi.org/10.1177/1357633X20926829>
- [30] Venkatesh V, Bala, H. Technology acceptance model 3 and a research agenda on interventions. *Decis Sci* 2008; 39(2):273-315. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
- [31] Button KS, Ioannidis JP, Mokrysz C, Nosek BA, Flint J, Robinson ES, et al. Power failure: Why small sample size undermines the reliability of neuroscience. *Nat Rev Neurosci* 2013; 14(5):365-376. <https://doi.org/10.1038/nrn3475>
- [32] Al Khalaf K, O'Dowling Keane S, da Mata C, McGillicuddy CT, Chadwick BL, Lynch CD. Response rates to questionnaire-based studies in the contemporary dental literature: A systematic review. *J Dent* 2022; 126:104284. <https://doi.org/10.1016/j.jdent.2022.104284>