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Original article

Mapping of health care facilities, dental visits and oral health problems in Indonesia to prevent COVID-19 transmission

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ABSTRACT

Background: *One of the goals of Indonesia's participation in sustainable development goals is to improve its health state. Efforts to achieve health improvement are increasing the availability of health care facilities so people can easily access and get treatment for dental and oral health. As we know, the first case of COVID-19 in Indonesia was found in March 2020 and all cases were spread over 34 provinces. During this pandemic situation, health care facilities and some dental treatments generating aerosols are one of the environments that can potentially transmit COVID-19 to the community. Dentists have the riskiest job because they must be less than two meters from patients.* ***Purpose:*** *This study aimed to evaluate the distribution of health care facilities, dental visits and oral health problems to prevent increased exposure to COVID-19 by using a geographic information system to explore the distribution of regional data.* ***Methods:*** *This study is a secondary data analysis and used data from Indonesia Basic Health Research 2018 and Health Facility Research 2019. Data of health care facilities, dental visits and oral health problems were tabulated using MS Excel version 16.45. Spatial mapping was done using Quantum Geographic Information System Desktop version 3.18.3 based on open-source software.* ***Results:*** *Java Island has the highest distribution of health care facilities and receives treatment from the dentist. COVID-19 reached a peak in June–July 2021, and Java Island became the region with the highest incidence rate.* ***Conclusion:*** *The distribution of health care facilities and dental visits was in line with the spread of the COVID-19 virus in 34 provinces. Almost all treatments of oral health problems need a highspeed rotary instrument, which can be a source of transmission of this virus.*

Keywords: *Health care facilities; dental visit; COVID-19; teledentistry*

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INTRODUCTION

Coronavirus or severe acute respiratory syndrome coronavirus 2 was first discovered in Wuhan, China in 2019. The increase in cases was due to human-to-human transmission, for which the origin is still unknown.[1] Hospitals and health facilities have challenges in dealing with pandemics, which showed in the handling of patients who needed treatment or referrals for COVID-19 cases by controlling virus contamination. In addition, strict protocols were implemented, such as monitoring the movement of people and hospital staff or health care facilities who could infect themselves while in hospital.[2] The study showed that there were 138 patients treated at the Wuhan Hospital and 40 of those patients (29%) were health care workers.[3]

The first case of COVID-19 in Indonesia was reported on March 2, 2020, and all cases are spread in 34 provinces. DKI Jakarta, DI Yogyakarta, West Java, Gorontalo, and North Sulawesi are provinces with a high risk for COVID-19 infection.[4] The total number of infected in May 2020 was 14.265 people and 214.746 people in September 2020. Fast and high transmission occurring among humans increases the risk to health care workers because they interact with COVID-19 patients daily and other patients without symptoms.[4,5]

Several world health organisations, such as the Center for Disease Control (CDC), the American Dental Association (ADA) and the National Health Service (NHS), have made regulations to regulate and provide guidance for dental practices. New dental service protocols aim to

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prevent the spread of this virus.[6] Dentists are at a high risk of being infected by COVID-19 as they must work closely with the patient at a distance of fewer than two meters.[7] Various media, such as patients' oral fluids, contamination of treatment tools and materials and some parts of the dental unit surface, are currently sources of increased transmission and contamination for dentists, assistants and patients.[8] One instrument used in dentistry is a high-speed handpiece that can produce large amounts of aerosols and droplets mixed with the patient's saliva or blood, and these particles will be airborne for a few moments before falling to the surface or being inhaled through the respiratory tract.[3,7,9] Basic knowledge regarding COVID-19 transmission is paramount in preventing transmission in dental practices.[10] To minimise contact, several world health organization recommend postponing non-emergency procedures except for uncontrolled bleeding, cellulitis and trauma to facial bones causing airway disruption. To accomplish this, the ADA advised dentists to use teledentistry to limit COVID-19 spread and contact as the initial stage of screening patients during pandemic situations.[11]

Epidemiology is the study of determining factors and distribution-related health states. There is a study regarding the development of technology and health information systems involving geographical conditions and epidemiology as health geographic information systems (GIS). Health GIS is a tool with an integrated system for managing, analysing and presenting health data spatially. According to Nykiforuk and Flaman,[12] one of primary uses of GIS in health informatics is disease surveillance, which is the collecting and tracking of data incidence, prevalence and spread of disease. It is a key element in mapping and modelling disease using GIS that helps us more easily understand where a disease is and how it can be minimised or stopped.[13]

This study aims to describe the distribution of health care facilities, dental visits to general dentists and specialists and oral health problems in 34 provinces to identify high-risk regions of COVID-19 transmission using secondary data analysis and GIS in presenting data.

MATERIALS AND METHODS

This study aimed to evaluate the distribution of health care facilities, dental visits to general dentists and specialists and oral health problems using secondary data analysis. Secondary data was obtained from July to August 2021 in Indonesia and is available from the 2019 Health Facilities Research and 2018 Basic Health Research through the Health Research and Development Agency (https://www.litbang.kemkes.go.id/).[14] Internal and external data validity was performed by Health Facilities and Basic Health Research teams. Ethics approval was obtained from the Dental Research Ethics Committee, Faculty of Dentistry, Universitas Indonesia (Protocol Number: 030750921).

The geographic map of Indonesia was captured from Indonesia Geospasial (https://www.indonesia-geospasial.com/2020/04/download-shapefile-shp-batas.html).[15] Secondary data and maps of provinces in Indonesia were mapped using Quantum Geographic Information System (a free and open-source cross-platform desktop and worldwide association users and developers but legally constituted in Swiss, https://www.qgis.org/) to identify the distribution of health care facilities, utilisation of dental health services and dental and oral health problems experienced by the Indonesian community.

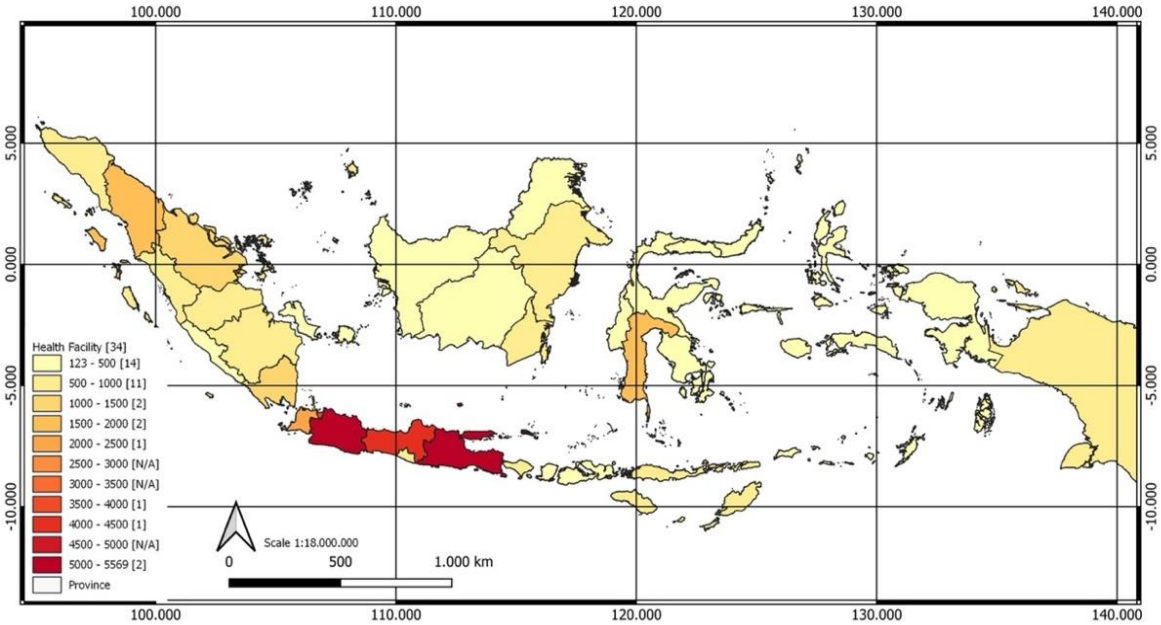

Figure 1. Distribution map of health care facilities in Indonesia.

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RESULTS

We can see the distribution of health care facilities, dental visits to general dentists and specialists and oral health problems in 34 provinces in Figures 1, 2 and 3. There are 38,840 health care facilities based on the types of dentists who practise in each province in Indonesia. From Figure 1, the highest number of health facilities are on Java Island with 21,826, while the lowest is in the Maluku Islands with 490 facilities. Figure 2 shows a map of the distribution of dental visits to general dentists and specialists.

Java Island is an area that has the highest number of dental visits to general dentists and specialists. General dentists and specialists have a broader level of competence and authority in practise compared to other dental practitioners. West Java has the highest number of visits to specialists (n=2,779) and general dentists (n=17,190), followed by East Java Province.

The primary dental problem was tooth cavities with 45.3%. On the other hand, the two main oral health problems with the most complaints were abscesses (14%) and gingival bleeding (13.9%). Gingival bleeding condition is closely related to periodontal tissue. Sulawesi Island shows the highest percentage of cavities, swollen gums or abscesses and bleeding gums among other provinces in Indonesia (Figures 3a, b and c).

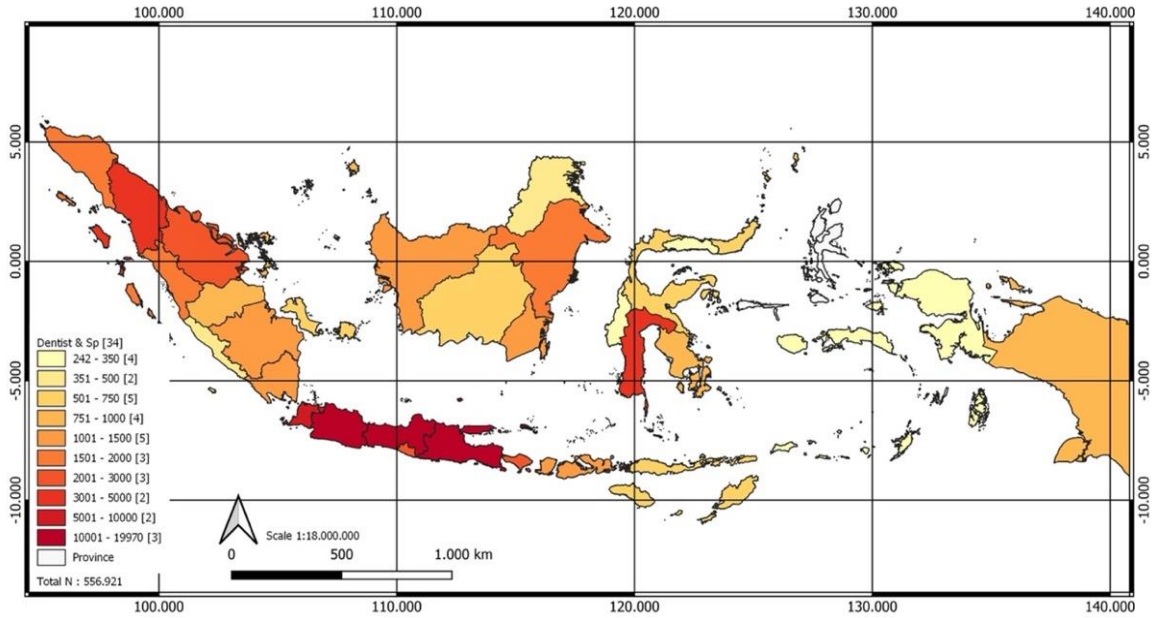

Figure 2. Distribution map of dental visits to the dentist and dental specialist.

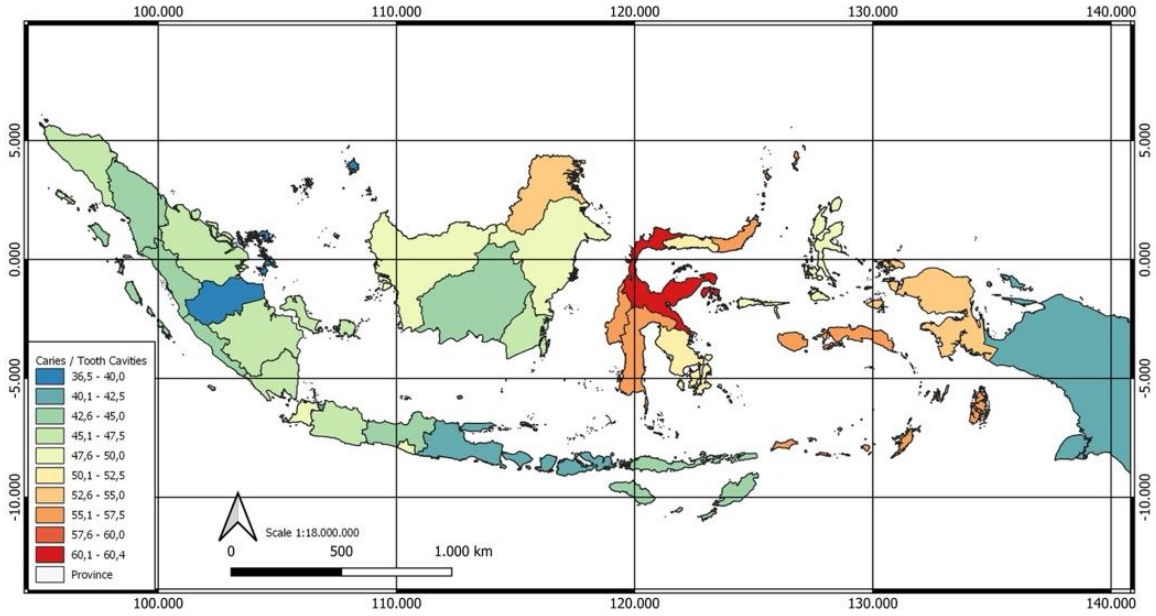

Figure 3a. Distribution of caries in Indonesia.

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DISCUSSION

Provinces in Java Island have more complete availability of health care facilities compared to other provinces. Java Island's five provinces were identified as the most high-risk provinces due to the high number of infected people.[4] Health care facilities in Indonesia are still not ready to face the pandemic regarding the availability of personal protective equipment (PPE), equipment and medicines.[16] The incidence of COVID-19 has increased in all countries; thus, lockdowns are an alternative to reduce the incidence by limiting people's mobility and provide an opportunity for health facilities to prepare for COVID-19 patients or prevent the viral spread to health care workers, inpatients and outpatients. Infection prevention in health care facilities is crucial but challenging to achieve.[17]

Health care facilities have contributed to the transmission of COVID-19 due to several factors, such as high mobility in health care facilities as a referral place for infected patients and inadequate PPE and hospital facility and infrastructure readiness in the face of a pandemic.[18] The potential for the spread of COVID-19 in health care

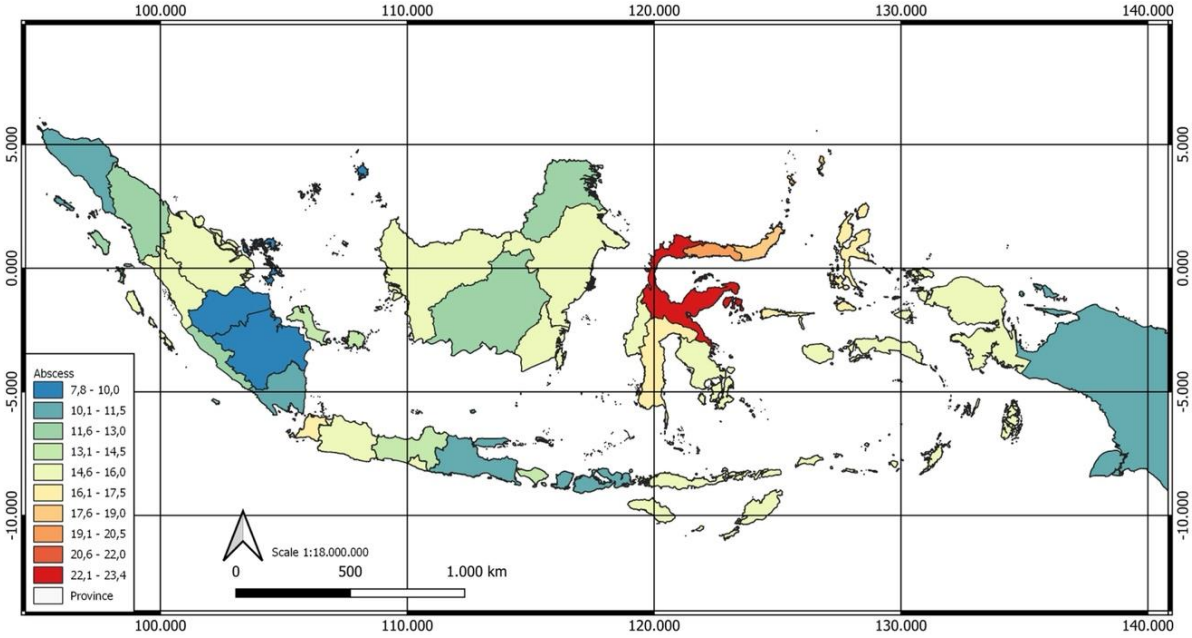

Figure 3b. Distribution of swollen gums or abscesses in Indonesia.

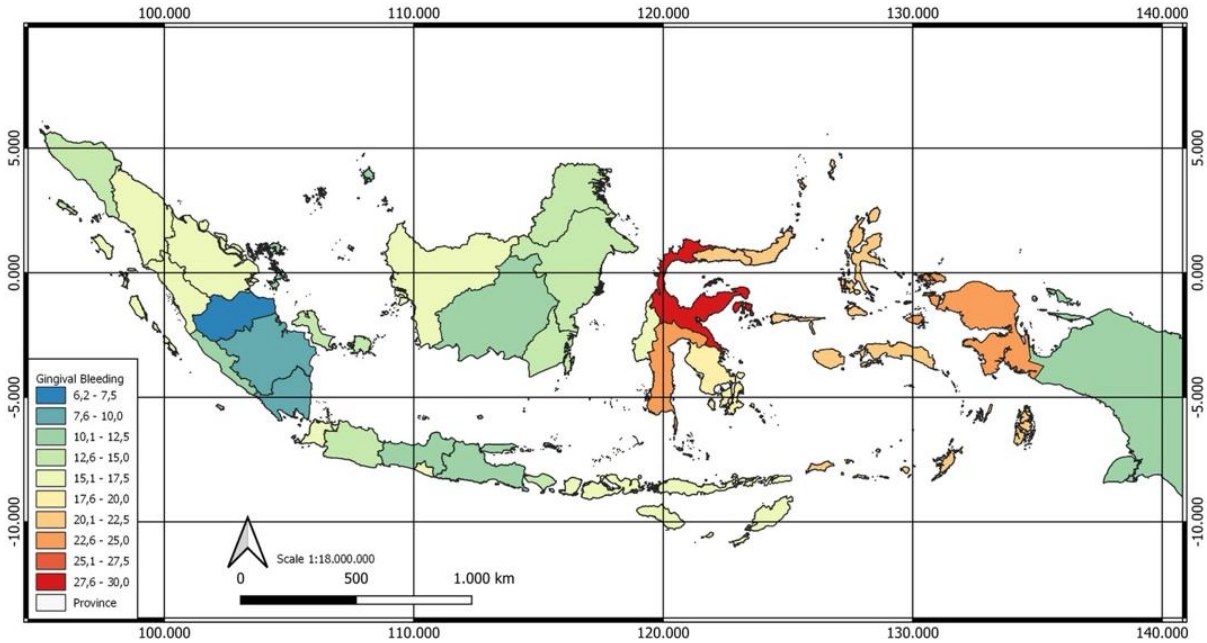

Figure 3c. Distribution of gingival bleeding in Indonesia.

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facilities can come in various forms, such as surfaces of objects that have direct contact with COVID-19 patients contaminated with droplets containing the virus and causing fomite transmission. A study showed that 202 surface samples in seven isolation rooms were positive. These samples were obtained from the patients' personal belongings, such as towels, toothbrushes and the walls of the patient's bedroom. Another sample was collected from the surface of the public bathroom flushing toilet, and the test result was positive.[19] The process of periodically spraying disinfectants on all rooms and surfaces in health care facilities must maintain a minimum distance of 1.5 meters, use appropriate masks and use hand sanitisers to reduce the risk of exposure.[17,19]

Asymptomatic patients who visit health care facilities are difficult to detect and can increase the risk of transmission, so the rules for limiting visits to health care facilities need to be implemented.[20,21] The health care facility zone is divided into three categories, namely the yellow zone, orange zone and blue zone, regarding the main principle that after the patient has carried out the screening process, the patient will not have direct contact with at-risk patients. The yellow zone (medium risk) is a gathering point where people enter through one door for initial screening, and this zone should be placed in an open room to provide good air circulation. The orange zone is for people confirmed positive, and the blue zone is for people confirmed negative.[17]

Indonesia Basic Health Research 2018 data shows that the number of visits to dentists on the island of Java is very high, which is closely related to the availability of health care facilities (Indonesia Health Facilities Research 2019) centralised on Java Island.[22,23] The total confirmed positives in Indonesia on October 31, 2021, was around 4 million people, and mortality cases were 143.405.[24] Among the total number of deaths, health care workers who died during the pandemic were 2,032 cases. The peak total mortality amount was 485 people in July 2021. Dentists rank seventh with 46 deaths. Based on the number of deaths of health care workers in each province in Indonesia, East Java was ranked first, followed by West Java, DKI Jakarta and Central Java.[25] The death of health care workers is one of the main problems during the COVID-19 pandemic. Indonesia can learn from the outbreak of the Ebola virus disease, which has caused a high number of deaths and workload level for health care workers.[16]

Dentists have a crucial role in reducing the spread of COVID-19 by ensuring adherence to practice activities that refer to the regulations set to protect themselves, patients and the nursing team.[6] Practicing dentists must ensure that all team members understand the forms of transmission and preventive measures from COVID-19. Dental procedures require air pressure to support the equipment used, which can produce aerosols and droplets from the patient's saliva. The dental procedures that commonly produce aerosols are cavity preparation, the use of rotary instruments in root canal treatment, scaling and polishing dental implants and surgery with complicated cases.[6,26] The significant impact of limitation in dental visit shows that only 38% of patients visiting the dentist with the most complaints were dental trauma and oral infections during this pandemic.[26] A study showed that 131 of the 285 respondents (46%) visited the dentist during the pandemic, and the majority of complaints were toothaches (55.7%), ulcers (31.3%), bleeding gums (24.4%) and complaints of bad breath (16%). During this pandemic to minimize infectious spreading, only 6.1% who visited dentist, received treatment for their complaints and remaining 13.7% did online consultation. Respondents who did not visit the dentist (93.9%) had personal reasons, namely not requiring treatment (34.1%), limited operational dental health services (27.6%) and fear of being exposed to COVID-19 during dental treatment.[27] In another study, there was a significant increase in emergency dentist visits during the pandemic from 51% to 71.9%. The most common emergency complaints were dental pulpal or periapical lesions and cellulitis. Dental injury cases decreased from 14.2% to 10.5%, which was influenced by the reduced number of people doing activities due to the lockdown period.[28] Cavities are the most common dental problems in Indonesia, and treatment requires a handpiece. Currently, dentists have a high risk of exposure to the COVID virus while practising as COVID-19 can spread through the air as droplets, aerosols and airborne particles. The ADA recommends postponing treatment if the availability of PPE is limited and only emergency dental treatments are allowed, such as uncontrolled bleeding, cellulitis or trauma to the face interfering with the airway.[11]

Dental clinics, hospitals and other health care facilities treating dental problems can potentially transmit COVID-19 and require strict protocols. There are various operational procedures for dental services during this pandemic, starting from the patient's arrival, while in health facilities and rooms, and after the procedure is complete.[29] In the COVID-19 situation, reducing contact with people is a preventive measure that can help to reduce exposure risk. Tele means 'far,' so teledentistry is an attempt to fulfil long-distance communication needs in dentistry.[30] Teledentistry is the initial stage before patients come to the clinic that has used remote communication technology to avoid direct contact during the pandemic.[11,29,30]

Teledentistry consists of several subunits, including teleconsultation, which is the most common form and the initial stage of teledentistry. Patients consult through telecommunications media, which is considered very useful, especially for patients with physical and mental limitations, the elderly and prisoners who have limitations to visit health care services. Studies have shown that teleconsultation can reduce the number of referrals from primary health services by more than 45%.[30,31]

Telediagnosis is the initial stage of determining a diagnosis by using technology in sending clinical images or photos and supporting examination data. Several studies show that smartphones are used in early diagnosis to detect dental caries and pre-malignant oral lesions.[11,30] Teletriage in teledentistry is commonly used to assess the needs

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of patients in receiving care in conditions with limited access to health services due to geographic location and socioeconomic conditions, such as the use of teleradiology in providing outcome information to the continuing health care level.[30] Telemonitoring can be used to evaluate treatment outcomes during a pandemic and reduce the frequency of visits, costs and the time required.[30,31]

The availability of the teledentistry system was well responded to by patients (97%), particularly in populations that have difficulty accessing dental health services.[32,33] In addition to assessing and improving oral cavity health status, it can also monitor patients after dental surgery.[34] In paediatric patients, this can reduce the anxiety felt by children when taking anamnesis. Some orthodontic cases, except fixed appliances, can still be performed using e-dentistry.[35] Teledentistry can be implemented in a virtual clinic and telephone with users aged 10–70 and 8–88 years. The virtual clinic is more widely used than over the phone. Paediatric patients are still accompanied by their parents during consultations.[33]

In its implementation as a supporting tool to limit face-to-face services, teledentistry has several limitations in the diagnostic accuracy level. The quality of clinical photos must have good resolution, and the target object must be taken properly.[30] Both methods require a supportive team and system in their implementation. Dentists need to have the ability to use e-dentistry technology. In addition, infrastructure factors, such as good signal quality, limited hardware components and support from technicians and operational experts, both software and hardware, that are qualified for this system need to be considered.[30,33] Another obstacle is the regulation of prescriptions, particularly in the use of antibiotics, when handling cases of acute oral infections to prevent drug resistance.[36]

From secondary data and using GIS as tools, we can visualise the highest number of health care facilities, dental visits and oral health problems easier than with graphics or tables on presenting data, and we can minimise and stop the spread of viruses based on pandemic distribution. The distribution of health care facilities and dental visits was in line with the spread of the COVID-19 virus in 34 provinces in Indonesia. Java Island had the highest distribution of health care facilities and dental visits and is also the COVID-19 hotspot province in Indonesia. As we know, almost all dental procedures need highspeed rotary instruments and produce droplets, aerosols and airborne particles, where these three things are a way of transmitting the COVID-19 virus at health care facilities. Teledentistry and postponed treatment are an effort to minimise contact with the patients for certain cases during the pandemic.

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