

BMJ Open Trends in dental visits during the state of emergency for COVID-19 in Japan: a retrospective observational study

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ABSTRACT

Objectives To determine national medium-term trends in dental visits during three COVID-19 emergency declaration periods in Japan and to analyse how these trends varied according to prefectural emergency measures and COVID-19 incidence.

Design and setting A retrospective observational study of Japan's dental claims from January 2017 to December 2021.

Data sources Data from a monthly report by the Health Insurance Claims Review and Reimbursement Services (HICRRS) in Japan. HICRRS handles the claims of employer-based health insurance.

Data analysis We determined the number of monthly dental claims nationwide from January 2017 to December 2021 and the percentage change in the number of monthly dental claims based on the difference in the COVID-19 alert level between the three emergency declaration periods in 2020–2021 and the corresponding periods in 2019. Results were analysed using descriptive statistics, multiple regression model, graphical figures, and narrative synthesis.

Outcome measures The main outcome was the change in the number of dental visits between the emergency declaration periods in 2020–2021 and the corresponding periods in 2019. We also assessed the difference in the number of dental visits based on the COVID-19 alert level.

Results The data set included a total of 736 946 088 dental claims. Until the end of 2021, the greatest decrease in monthly dental claims was in April 2020, which was 22.3% lower than that in April 2019. As indicated by the coefficient in the regression model, the percentage change in monthly dental claims decreased by 5.01% (95% CI –8.27 to –1.74) depending on the difference between the prefectures designated as being under special precautions and other prefectures.

Conclusions The decrease in dental visits was greater during the first state of emergency, ie, April–May 2020, and in prefectures designated as being under special precautions. Further efforts to promote appropriate dental visits at different alert levels are necessary.

INTRODUCTION

The WHO declared the novel coronavirus outbreak as a Public Health Emergency of International Concern on 30 January 2020.¹ WHO named the syndrome COVID-19 and declared it as a pandemic on 11 March

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Based on a large sample size, the study explored the medium-term trends in dental visits during the state of COVID-19 emergency in Japan.
- ⇒ Changes in dental insurance claims due to administrative district differences in the COVID-19 alert level were evaluated.
- ⇒ Data quality was assured because dental insurance claims are administrative data.
- ⇒ Our data only included employer-based health insurance claims, and most of the individuals were aged <65 years.
- ⇒ The emergency declarations were issued or lifted in the middle of the month, but dental claims were analysed on a monthly basis.

2020.² In Japan, the first COVID-19 case was reported on 14 January 2020, after which the number of patients with COVID-19 rapidly increased, prompting the Japanese government to declare the first state of emergency in seven urban prefectures on 7 April 2020.³ The emergency declaration was expanded to the entire country on 16 April 2020. Simultaneously, the government designated 13 of 47 prefectures as being under special precautions, which included major cities and their neighbouring prefectures.⁴ At the end of 2021, a total of three emergency declarations (April–May 2020, January–March 2021 and April–September 2021) were issued in Japan. Only the first emergency declaration was issued nationwide, whereas the second and third were issued in 11 and 21 prefectures, respectively.

The COVID-19 pandemic has evidently changed our behaviour. Many studies in Japan showed a decrease in the use of patient and medical services due to the pandemic.^{5–7} In particular, dental clinics experienced difficulties in providing treatment and care.^{8–10} This is because most dental procedures generate aerosols and droplets through the use of dental handpieces, which is a route of COVID-19 infection.^{11–13} To prevent the

spread of pathogens, the US Centers for Disease Control and Prevention recommended that dental treatment be provided in individual patient rooms whenever possible.¹⁴ In addition, the Ministry of Health, Labour and Welfare (MHLW) in Japan informed dentists of the need to postpone non-urgent dental treatment in April 2020.

A previous study showed that the number of dental visits during the COVID-19 pandemic in the USA decreased during the early phase of the pandemic, with areas with lower COVID-19 incidence showing less decrease.¹⁵ Following the resumption of dental services in the United Kingdom in 2020, activity was considerably lower than in 2019, with 67% fewer people using dental services in October 2020 than in October 2019.¹⁶ To prepare for the prolonged spread of COVID-19 and the outbreak of new emerging infectious diseases, the trend of dental visits during the pandemic needs to be verified. In Japan, insurance claims provide not only the number of claims but also the cost per day and the days per claim, which allowed us to identify the differences in trends according to the characteristics of dental treatment. Such data are large, and their quality is assured because dental insurance claims are administrative data. However, changes in dental insurance claims due to differences in COVID-19 incidence and administrative district policies are not clearly evident. Moreover, although previous studies reported trends for a short period, at most until 2020 or the first wave of COVID-19,^{15–17} long-term analyses are required to determine the impact on dental visits during the pandemic.

This study aimed to clarify medium-term trends in dental visits during the state of COVID-19 emergency in Japan and to examine how visit trends varied by alert level and COVID-19 incidence.

METHODS

Study design and data source

This retrospective observational study used open data on a monthly report basis from January 2017 to December 2021 provided by the Health Insurance Claims Review and Reimbursement Services (HICRRS).¹⁸ Japan has a National Health Insurance programme that includes dental treatment, and insurers can roughly be divided based on the three types of insurance that they offer: (1) employer-based health insurance, (2) residence-based national health insurance and (3) health insurance for people aged ≥ 75 years. HICRRS handles the claims of individuals with employer-based health insurance, for which we used aggregate data consisting of the number of dental claims, total costs and total days. We preliminarily found that these data covered 13 933 765 dental claims (61.1% of the nationwide claims) in December 2021. We also used prefectural branch-level data on claims and the COVID-19 case counts from January 2020 to December 2021 from the COVID-19 visualisation dashboard run by the MHLW. Then, we constructed a prefecture-level cumulative incidence of COVID-19 for 100 000

inhabitants using population estimates from the national census taken on 1 October 2020 and from the Statistics Bureau of Japan retrieved on 1 October 2021.

Variables for dental visits and related indicators

In this study, the number of dental insurance claims per month was used as a proxy indicator for monthly dental visits. In addition, we used cost per day and days per claim (both on a monthly basis) as supplementary variables that reflect the status of dental care.

Statistical analysis

We determined the percentage change in monthly dental claims nationally and by prefecture. We calculated the percentage change in the number of claims, cost per day and days per claim between the three emergency declaration periods in 2020–2021 and the corresponding periods in 2019. To illustrate the prefecture-level findings, we constructed a map of Japan reflecting the percentage change in the number of claims between April 2019 and April 2020.

Finally, we examined the percentage change in monthly dental claims in April 2020 between the prefectures under special precautions and the other ones. We used a multiple regression model to determine whether the percentage change in monthly dental claims from prefectures designated as being under special precautions differed significantly between April 2019 and April 2020. The dependent variable was the percentage change in monthly dental claims between April 2019 and April 2020, while the explanatory variable was the designation of prefectures under special precautions. The cumulative incidence of COVID-19 was added as a covariate. The model was estimated with robust SEs. All analyses were performed using Stata/MP V.16.1 (Stata Corp, Texas) and Tableau Desktop (Tableau Software, Washington).

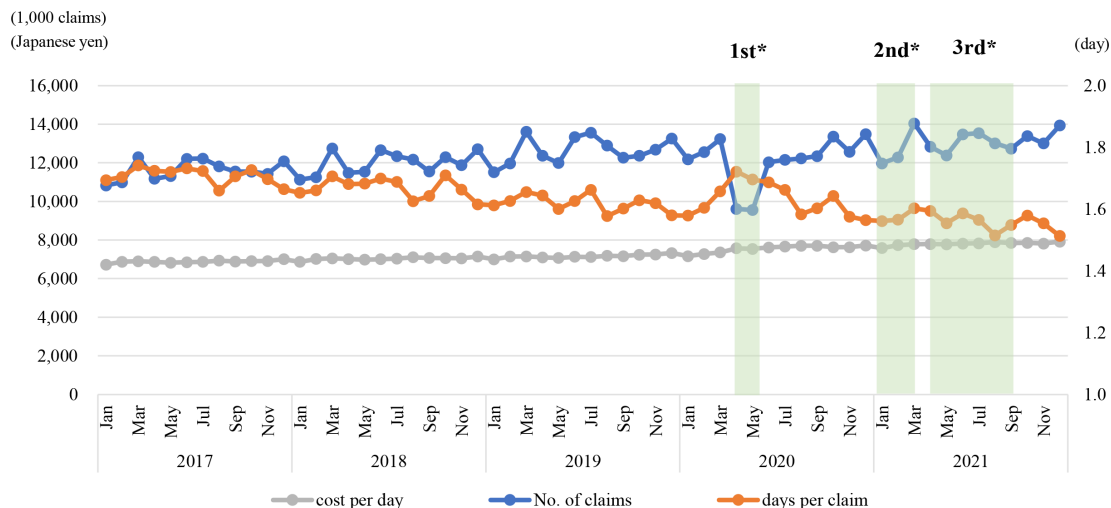
Patient and public involvement

None.

RESULTS

The data set included a total of 736 946 088 dental claims from January 2017 to December 2021. Until 2019, the number of monthly dental claims exhibited seasonality and an increase with time, where March had the highest number of claims every year (figure 1), particularly, in 2019.

During the first state of emergency from April to May 2020, the number of national monthly dental claims was lower than that in the corresponding months in 2019 by 22.3% and 20.3%, respectively (table 1). Both the cost per day and the days per claim in the same period were higher than those in the corresponding months in 2019. During the second state of emergency from January to March 2021, the number of monthly dental claims was higher than that in the corresponding months in 2019. During the third state of emergency from April to September



Left axis: No. of claims (1,000 claims), cost per day. Right axis: days per claim
 * State of emergency 1st (April 7 to May 25, 2020), 2nd (January 8 to March 21, 2021), and 3rd (April 25 to September 30, 2021)

Figure 1 Number of monthly dental claims, cost per day and days per claim from January 2017 to December 2021.

2021, the number of monthly dental claims was almost higher than that in the corresponding months in 2019, with the exception of July, where the number of monthly dental claims in July 2021 was 0.2% lower than that in July 2019.

The greatest decrease in the number of monthly dental claims after the declaration of the state of emergency compared with that in 2019 was observed in April 2020,

which was during the early phase of the pandemic in Japan (figure 2). A slight decrease in the number of monthly dental claims in July 2021 was confirmed before a rapid increase in the cumulative incidence of COVID-19.

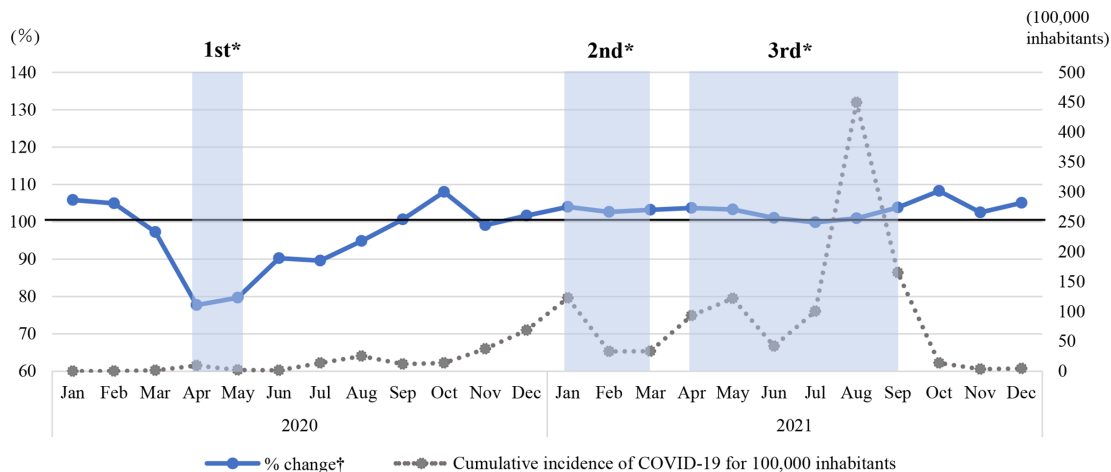
The percentage change in the number of monthly dental claims between April 2020 and April 2019, which exhibited the greatest decrease after the pandemic, was examined at the prefectural branch level (figure 3 and

Table 1 Number of monthly dental claims and its percentage change between the three emergency declaration periods in 2020–2021 and the corresponding periods in 2019

Emergency declarations	First state of emergency April 7–May 25, 2020			Second state of emergency January 8–March 21, 2021			
	Year	April	May	Year	January	February	March
	N (% change*)			N (% change*)			
Number of claims	2019	12 370 900	11 989 548	2019	11 512 284	11 969 166	13 606 207
	2020	9 614 252 (–22.3)	9 551 896 (–20.3)	2021	11 971 588 (4.0)	12 285 721 (2.6)	14 042 447 (3.2)
Cost per day	2019	7100	7069	2019	6998	7143	7152
	2020	7569 (6.6)	7542 (6.7)	2021	7583 (8.4)	7736 (8.3)	7785 (8.9)
Days per claim	2019	1.64	1.60	2019	1.61	1.63	1.66
	2020	1.72 (4.7)	1.70 (6.0)	2021	1.56 (–3.2)	1.57 (–3.7)	1.60 (–3.2)
Emergency declarations	Third state of emergency † April 25–September 30, 2021						
	Year	April	May	June	July	August	September
	N (% change*)						
Number of claims	2019	12 370 900	11 989 548	13 333 412	13 564 244	12 892 495	12 264 480
	2021	12 827 678 (3.7)	12 386 327 (3.3)	13 470 781 (1.0)	13 542 092 (–0.2)	13 011 979 (0.9)	12 734 323 (3.8)
Cost per day	2019	7100	7069	7130	7118	7185	7163
	2021	7790 (9.7)	7776 (10.0)	7817 (9.6)	7828 (10.0)	7891 (9.8)	7849 (9.6)
Days per claim	2019	1.64	1.60	1.63	1.66	1.58	1.60
	2021	1.59 (–3.0)	1.55 (–2.9)	1.59 (–2.5)	1.57 (–5.8)	1.52 (–3.9)	1.55 (–3.3)

*The percentage change was calculated as follows: (①–②)/② × 100, where ① is the number of claims in a month during the state of emergency and ② is that in the corresponding month in 2019.

†No prefecture was under a state of emergency for the entire period.



* State of emergency 1st (April 7 to May 25, 2020), 2nd (January 8 to March 21, 2021), and 3rd (April 25 to September 30, 2021)

† The percentage change was centered at 100 for ease of interpretation.

Figure 2 Percentage change in the number of monthly dental claims from January 2020 to December 2021 compared with that in the corresponding months in 2019.

online supplemental appendix table). The greatest decrease in the number of monthly dental claims occurred in Tokyo (−35.1%), followed by Kanagawa (−30.0%). The prefectures with the greatest decrease in the percentage change in monthly dental claims almost coincided with the prefectures designated as being under special precautions. In addition, the prefectures with a

large decrease in the percentage change in monthly dental claims coincided with the prefectures with high cumulative incidence of COVID-19. Only Miyazaki Prefecture showed an increase in the number of monthly dental claims in April 2020 compared with that in April 2019. The average decrease in the percentage change in the number of monthly dental claims among the prefectures

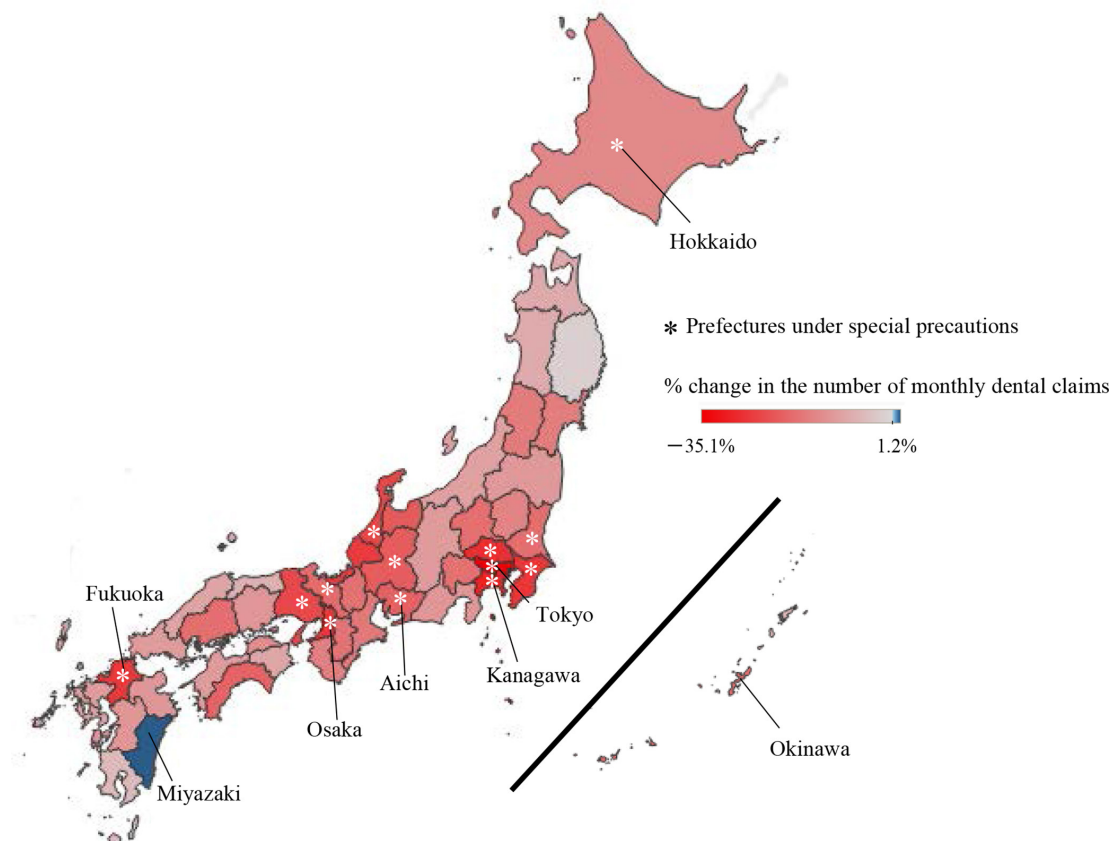


Figure 3 Prefecture-level percentage change in the number of monthly dental claims between April 2019 and April 2020.

Table 2 Percentage change in the number of monthly dental claims between the prefectures under special precautions and other prefectures in April 2019 and April 2020

	Average number of monthly dental claims		Difference (% change)	Coefficient*	95% CI
	April 2019	April 2020			
Prefectures under special precautions †	624 662	456 279	-168 382 (-24.4)	-5.01	-8.27 to 1.74
Other prefectures	125 009	108 312	-16 697 (-13.1)	Ref.	-

*Multiple regression analysis with robust standard errors was used to examine the percentage change in monthly visits to dental offices between April 2020 and April 2019. The cumulative incidence of COVID-19 for 100 000 inhabitants in April 2020 was added as a covariate (B -0.82, 95% CI -1.09 to -0.57).

†Prefectures under special precautions during the first state of emergency (Tokyo, Saitama, Chiba, Kanagawa, Osaka, Hyogo, Fukuoka, Hokkaido, Ibaraki, Ishikawa, Gifu, Aichi and Kyoto).

under special precautions was 24.4%, which was higher than the average decrease of 13.1% observed for other prefectures (table 2). Results from the regression model allowed us to compare the difference in the number of monthly dental claims between the prefectures under special precautions and other prefectures after the first state of emergency. As indicated through the coefficient obtained in the regression model, the percentage change in the number of monthly dental claims decreased by 5.01% (95% CI -8.27, -1.74) depending on the difference between the prefectures under special precautions and other prefectures.

DISCUSSION

This study aimed to clarify medium-term trends in dental visits during the state of COVID-19 emergency in Japan and to examine how visit trends varied by alert level and COVID-19 incidence. We found that the number of monthly dental claims during the first state of emergency decreased compared with that in the corresponding months in 2019. Moreover, the decrease in the percentage change in the number of monthly dental claims among the prefectures under special precautions was greater than that among other prefectures during the first state of emergency. However, after the second state of emergency, we did not observe a decrease in the number of dental claims in line with the cumulative incidence of COVID-19.

Among the three states of COVID-19 emergency in Japan, there was a great decrease in the number of monthly dental claims during the first state of emergency, with the largest decrease occurring in April 2020, a time when the Japanese government and most prefectural governments were encouraging individuals to stay home to ensure physical distancing. Simultaneously, the lack of personal protective equipment was also a serious problem in Japan. The possible reasons for the decrease during the first state of emergency can be discussed from two perspectives: dental staff and patients. From the first perspective, some dental offices may have closed during the early phase of the first state of emergency owing to the fear of COVID-19 infection.^{19 20} As from the second

perspective, patients who feared about contracting COVID-19 or stayed home may have avoided dental visits during this period.^{21 22}

In April–May 2020, the number of dental claims decreased compared with that in the corresponding months in 2019. However, the percentage change in cost per day and days per claim increased. Considering that dental insurance is used almost exclusively on an outpatient basis, the outcomes indicate that patients who did not require ongoing treatment might have refrained from dental visits during the first state of emergency. This is consistent with the results of a previous study, which showed that patients who usually had fewer dental visits refrained from visiting dental offices during the first state of emergency.²¹ Similarly, the decrease in the number of monthly dental claims and the increase in cost per day indicate that patients who underwent low-cost dental treatments may have refrained from dental visits. A study conducted in the USA showed that among adults who reported delaying dental care owing to the COVID-19 pandemic, nearly 74.7% reported delaying care for a check-up, examination or cleaning.²³ These dental treatments, including dental insurance, tend to be cheaper in Japan. Moreover, practical changes, such as limiting patient admission to those with urgent needs, reducing the number of patients per office hours, and abstaining from aerosol-generating procedures, might have affected the number of dental visits.^{24–27}

During the first state of emergency in April 2020, most prefectures exhibited a decrease in the number of dental claims compared with that in April 2019, and the decreases were larger in the prefectures designated as being under special precautions than in other prefectures. This finding may be attributed to the increase in COVID-19 fear among both dental staff and patients in prefectures affected by the alert level, which are likely designated as prefectures under special precautions. These prefectures comprised urban cities and their neighbouring prefectures that reported a high incidence of COVID-19 in April 2020. A previous study in the USA reported a decrease in the number of dental visits in areas with high COVID-19 incidence.¹⁵ Our results are

also consistent with those of a previous study, which showed that living in urban areas was associated with delayed dental care.²³

Until December 2021, COVID-19 incidence peaked in August 2021, although the number of monthly dental claims in August 2021 did not decrease markedly compared with that in August 2019. One possible reason for the increase in the number of monthly dental claims in 2021 compared with that in 2019 is that patients who postponed their visits in 2020 returned in 2021. We should also consider the fact that dental visits in Japan have been increasing in recent years, even before the pandemic outbreak.

We noted a slight change in the number of monthly dental claims during the third state of emergency in 2021 compared with that in 2019; it decreased in July and increased in October. The reason for the decrease could be COVID-19 vaccination. By 25 April, 2022, approximately 80.0% of the total population in Japan had been fully vaccinated against COVID-19, and the number of fully vaccinated individuals increased from July to September 2021.²⁸ Previous studies have reported that vaccination programmes can affect the behaviour of individuals; those who have been vaccinated tend not to follow infection protective behaviours because of the protection they received.^{29–31} Our results suggest that some patients delayed their dental visits until they were fully vaccinated.

On the other hand, we observed around a 10% increase in cost per day during the third state of emergency. This could be due to the decrease in days per claim and the implementation of multiple procedures and treatments in a single visit. Furthermore, a provisional insurance fee revision of ¥50 per visit for infection control practices from April to September 2021 could have contributed to this increase.

Our study results should be interpreted in the context of their limitations. First, we only used employer-based health insurance data, and most of the individuals were aged <65 years (91.5%, data obtained in December 2021). Second, we only had monthly data; the emergency declarations were issued or lifted in the middle of the month, but dental claims were analysed on a monthly basis. Third, our data did not consider the changes in the number of individuals insured; in fact, the used data were collected from many insurers and the exact number of insured individuals per month was unknown. According to MHLW data, compared with the number of insured individuals in March 2019, the number increased by approximately 0.4% in March 2020, while it decreased by <0.1% in March 2021. Finally, a state of emergency was not declared in some prefectures at the time of the second and/or third nationwide declaration; our national-level analysis included data on those prefectures as well. Therefore, the number of monthly visits to the dental offices might have been underestimated.

CONCLUSIONS

There was a great decrease in the number of monthly visits to dental offices from April to May 2020 during the first state of COVID-19 emergency in Japan. The decrease in the number of dental visits was greater during the early phase of the emergency declaration and in prefectures designated as being under special precautions. Despite the absence of strict restrictions on dental visits in Japan, patients might have refrained from necessary visits based on their own judgement in the early phase of the pandemic. To prepare for the continual spread of COVID-19 and the possible outbreak of other emerging infectious diseases, further efforts to promote appropriate dental visits are necessary. Dental healthcare providers and government officials must create an appropriate environment where patients feel comfortable in consultations during the early phase of an outbreak.

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Contributors AT contributed to conception and design, data acquisition and analysis, drafting the manuscript and critically revising the manuscript. JT contributed to design, analysis and interpretation of data, drafting the manuscript and critically revising the manuscript. HF contributed to interpretation of data, drafting the manuscript, and critically revising the manuscript. YA contributed to interpretation of data, drafting the manuscript, and critically revising the manuscript. TY contributed to conception and design, drafting the manuscript, and critically revising the manuscript. All authors gave their final approval and agreement to be accountable for all aspects of the study. AT is acting as guarantor.

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