

# Medical visits and health-care expenditures of patients attending orthopedic clinics during the COVID-19 pandemic in Japan: LIFE Study

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## Abstract

**Background:** The first state of emergency for coronavirus disease 2019 (COVID-19) in Japan was imposed from April to May 2020. During that period, people were urged to avoid non-essential outings, which may have reduced their access to health care.

**Methods:** Using health-care claims data from a city in Fukuoka prefecture, Japan, we conducted a retrospective cohort study of the state of emergency's impact on patients' medical visits to orthopedic clinics and their associated health-care expenditures. These measures were compared between 2019 and 2020 using a year-over-year analysis and unpaired *t*-tests.

**Results:** The analysis showed that medical visits in 2020 significantly decreased by 23.7% in April ( $P < 0.01$ ) and 17.6% in May ( $P < 0.01$ ) when compared with the previous year. Similarly, monthly outpatient health-care expenditure significantly decreased by 2.4% ( $P < 0.01$ ) in April 2020 when compared with April 2019. In contrast, the health-care expenditure per capita per visit significantly increased by 1.5% ( $P < 0.01$ ) in June 2020 (after the state of emergency was lifted) when compared with June 2019.

**Conclusion:** As orthopedic clinics in Japan are reimbursed using a fee-for-service system, the increases in per capita expenditures after the state of emergency may be indicative of physician-induced demand. However, we posit that it is more likely that a post-emergency increase in anti-inflammatory and analgesic treatments for spondylopathies, low back pain and sciatica induced a temporary rise in these expenditures.

**Key words:** COVID-19, National Health Insurance claims data, state of emergency, orthopedics, low back pain

## Introduction

Coronavirus disease 2019 (COVID-19), which was first identified in late 2019, rapidly developed into a global pandemic [1]. To limit the spread of infections, many countries adopted lockdowns to restrict the movement of people. A study estimated that >3 billion people worldwide were forced to stay at home during such lockdowns in 2020 [2]. The effects of lockdowns have been investigated from various perspectives, including reduced physical activity, changes in eating habits [3], shifting logistics due to adjustments in purchasing habits [4], changes in food purchasing and consumption behaviors [5] and issues related to waste disposal [6]. In addition, lockdowns have affected access to health-care facilities and treatments, leading to increases in telemedicine use [7] and rising mental stress among caregivers of people with dementia [8]. In this way, COVID-19 lockdowns have shown extensive and far-reaching effects on the lives of people and the state of medical care around the world.

In Japan, the COVID-19 pandemic spread quickly after the first positive case that was confirmed in January 2020, and the government issued a state of emergency in Saitama, Chiba, Tokyo, Kanagawa, Osaka, Hyogo and Fukuoka prefectures on 7 April to contain the rise in infections [9, 10]. Under this

state of emergency, people were urged to avoid social contact and refrain from non-essential outings for 1 month. As infections continued to spread throughout Japan, the state of emergency was expanded to all prefectures on 16 April 2020. This state was not lifted simultaneously nationwide in May 2020 but was lifted for each prefecture depending on its infection situation. While Japan's state of emergency differed from the lockdowns of other countries in that no penalties were imposed for non-compliance, this policy successfully resulted in temporary school closures [11], reduced domestic travel [12], increased teleworking and reduced human flow [13].

Studies have explored the impact of the COVID-19 pandemic on patients and health-care facilities worldwide. In the USA, the pandemic was associated with reductions in hospitalizations for stroke, myocardial infarction, heart failure, chronic obstructive pulmonary disease, appendicitis and pneumonia [14], as well as delays in cancer detection and increased mortality in children [15]. In Slovenia, a study reported a decrease in hospitalizations for pediatric asthma due to a lockdown [16]. In Saudi Arabia, a lockdown was associated with exacerbated low back pain that may have been caused by a reduction in physical activity [17]. In Japan, studies found that the state of emergency for COVID-19 was

associated with a decline in medical visits and patient numbers for pediatric asthma exacerbations [18], overall reductions in physician visits and outpatient expenditures [19], increased postponement of breast cancer screening appointments for women [20] and worsening HbA1c control in diabetes patients due to reduced physical activity and dietary changes [21].

The implementation of various movement restriction policies and increased avoidance of outings has resulted in fewer medical visits and lower health-care expenditures for a variety of diseases. However, there is a lack of reports on changes in patients' medical visit behavior and health-care expenditures for orthopedic care in Japan. This study was conducted to investigate the impact of Japan's first state of emergency for COVID-19 on medical visits and health-care expenditures among patients attending orthopedic clinics.

## Methods

### Study data and patients

This retrospective cohort study was conducted using a database produced by the Longevity Improvement & Fair Evidence (LIFE) Study [22]. The LIFE Study is a longitudinal cohort study that included information from National Health Insurance enrollees, Latter-Stage Elderly Healthcare system enrollees and Long-Term Care Insurance enrollees in Japan. We performed an analysis using a National Health Insurance claims database from a city in Fukuoka prefecture, Japan. The database contained health-care claims data from enrollees of the National Health Insurance System, which covers retirees, non-working people, self-employed people, non-regular workers and primary industry workers aged  $\leq 74$  years. Under the Japanese health insurance system, each medical treatment is assigned a predetermined number of fee points to calculate the corresponding fees (1 point = 10 yen). Through these recorded fee points, our study data included all medical fees for each insurance-covered health-care encounter.

For this study, we compared the number of outpatient visits to orthopedic clinics and their associated health-care expenditures before and after the first COVID-19 case was confirmed in Japan in January 2019. Accordingly, our analysis compared these measures between 2019 and 2020. In Fukuoka prefecture, the first state of emergency was imposed from 7 April to 14 May 2020.

The initial database comprised 22 808 patients with claims data from January 2019 to December 2020. We excluded patients without any claims data for orthopedic care, patients who had been hospitalized for orthopedic conditions and patients who had visited an orthopedic hospital between January 2019 and December 2020.

### Target diseases and outcome measures

The National Health Insurance claims database contains monthly claims data from each health-care facility that provides insurance-covered care. For this study, we focused on diseases of the musculoskeletal system and connective tissue (DMSCT), which were identified using International Statistical Classification of Diseases and Related Health Problems, 10th Revision codes [23]. Based on a previously described method [24], we classified these diseases into 12 categories: inflammatory polyarthropathies, arthrosis, deforming

dorsopathies, spondylopathies, low back pain and sciatica, other dorsopathies, shoulder lesions, other soft tissue disorders, disorders of bone density and structure, other disorders of the musculoskeletal system and connective tissue, fracture, and other injuries (Supplementary Table S1).

Using the recorded fee points in the claims data, we calculated DMSCT-associated expenditures as the total billed amounts (including the insurer-reimbursed amounts and patients' out-of-pocket payments) for the following four medical service categories [25]: (i) consultations, (ii) image diagnosis, (iii) physical therapy and (iv) anti-inflammatory and analgesic treatments provided on-site at each clinic. As this study focused on the visits and expenditures of patients attending orthopedic clinics (which do not have inpatient facilities), DMSCT-associated expenditures for hospitalizations and surgeries were not analyzed.

The outcome measures were DMSCT-associated outpatient health-care expenditure per month (OEM), health-care expenditure per capita per visit (ECV) and number of medical visits per month (MV). Expenditures were calculated from the perspective of the payers. OEM, ECV and MV were natural log-transformed for the statistical analysis.

### Statistical analysis

The patients' baseline characteristics were summarized using mean values with standard deviation (SD) for continuous variables and frequency with percentage for categorical variables. We also tallied the number of patients who visited an orthopedic clinic for each month from January to December 2020 according to age group (<25, 25–34, 35–44, 45–54, 55–64 and 65–74 years). Next, we compared the natural log-transformed OEM, ECV and MV values for each month between 2019 and 2020 using a year-over-year (YoY) analysis and unpaired *t*-tests. YoY values were calculated as (2020 value – 2019 value)/(2019 value). We also performed a subgroup analysis that compared YoY ECV values for each month between 2019 and 2020 according to the 12 DMSCT categories. For any DMSCT category that showed a significant difference in YoY ECV values between 2019 and 2020, we performed an additional subgroup analysis to further compare the ECV values between these years according to the four medical service categories.

All analyses were performed using R version 4.0.5 [26]. The significance level was set at  $P < 0.05$ .

## Results

From the database, we identified 6447 patients who attended orthopedic clinics between January 2019 and December 2020. As shown in Table 1, the mean values (SD) of outpatient health-care expenditure per capita, number of medical visits per capita and age of patients were 17 583.1 (35 710.4) yen, 13.1 (27.1) visits and 56.8 (18.4) years, respectively. The study population comprised more women (58.8%) than men (41.2%).

The numbers of patients attending orthopedic clinics in 2020 according to age group are presented in Figure 1A. From January to March 2020, there were no major fluctuations in patient numbers in any age group. However, there was an overall decrease in patient numbers from April to May during the state of emergency. Subsequently, patient numbers in

**Table 1** Patient characteristics

	<i>n</i>	%	Mean	SD	Min	Max
Outpatient health-care expenditure per capita (yen) from 2019 to 2020	6447		17 583.1	35,710.4	350	534 520
Number of medical visits per capita (times) from 2019 to 2020	6447		13.1	27.2	1	512
Age (years)	6447		56.8	18.39	1	74
Sex						
Women	3790	58.8				
Men	2657	41.2				

all age groups increased from May to June, and the numbers of patients aged  $\geq 55$  years in June had almost returned to the same levels as in March. In contrast, the numbers of patients aged  $< 55$  years were generally higher in June than in March. There were no large decreases in patient numbers after June for all age groups. Although not shown in the figure, there were no notable differences in these trends between men and women.

Figure 1B shows the YoY values in OEM, ECV and MV for each month in 2020 vs. 2019. MV demonstrated a significant decrease of 23.7% ( $P < 0.01$ ) in April 2020 and 17.6% ( $P < 0.01$ ) in May 2020 (during the state of emergency). Similarly, OEM showed a significant decrease of 2.4% ( $P < 0.01$ ) in April 2020 and a non-significant decrease of 1.1% ( $P = 0.09$ ) in May 2020 when compared with the same months in 2019. However, ECV showed a significant increase of 1.5% ( $P < 0.01$ ) in June 2020 and a non-significant increase of 1.0% ( $P = 0.051$ ) in October 2020 when compared with the same months in 2019.

Figure 2 presents the results of the subgroup analysis of YoY trends of ECV according to DMSCT category. The ECV for ‘spondylopathies’ and ‘low back pain and sciatica’ was significantly higher in June 2020 than in June 2019 ( $P < 0.05$ ), and the ECV for ‘low back pain and sciatica’ was significantly higher in October and December 2020 than in the same months in 2019 ( $P < 0.05$ ). Therefore, we performed an additional subgroup analysis for these diseases according to the medical service categories. No significant results were observed in the other DMSCT categories.

Figure 3 presents the results of the additional subgroup analysis comparing the ECV for ‘spondylopathies’ and ‘low back pain and sciatica’ between 2019 and 2020 according to the four medical service categories. For ‘spondylopathies,’ the ECV of anti-inflammatory and analgesic treatments was significantly higher in May to July 2020 than in the previous year ( $P < 0.05$ ). For ‘low back pain and sciatica,’ the ECV of consultations was significantly lower in April 2020 than in April 2019 ( $P < 0.05$ ), but the ECV of anti-inflammatory and analgesic treatments was significantly higher in May 2020 than in May 2019 ( $P < 0.05$ ).

## Discussion

### Statement of principal findings

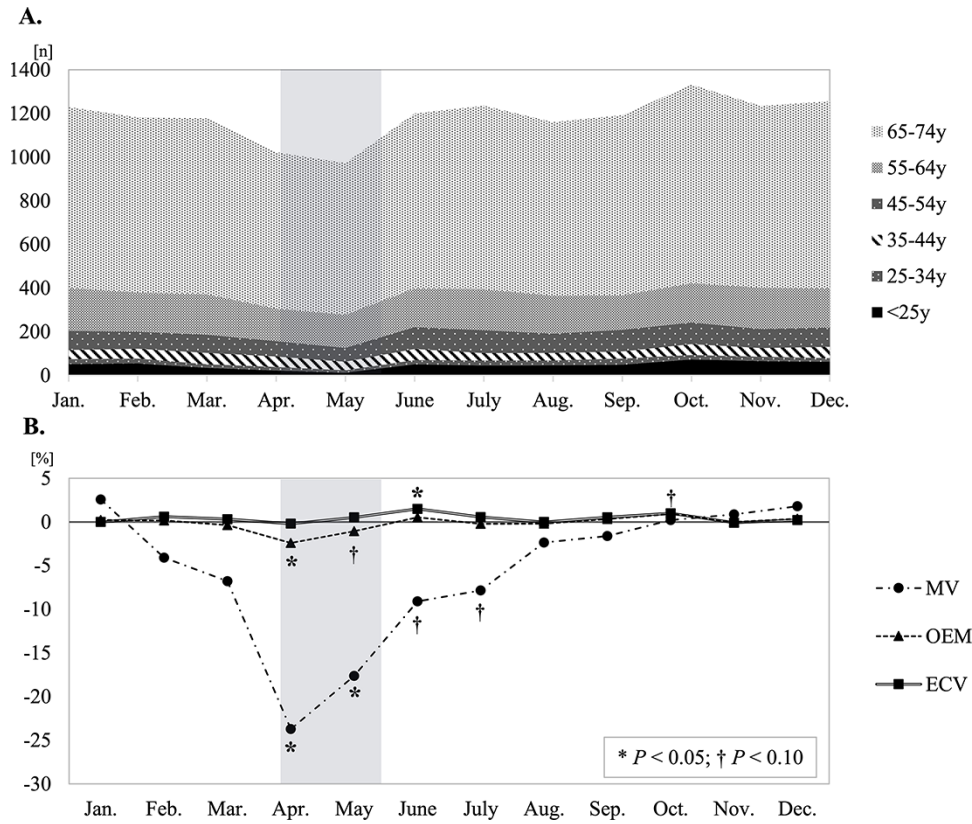
Using insurance claims data, this study investigated the impact of the first state of emergency for COVID-19 on medical visit behavior and health-care expenditures among patients attending orthopedic clinics in a Japanese city. The MV and OEM for orthopedic clinics during the state of emergency were found to be lower than in the previous year. However, the ECV was higher in June 2020 (after the state of emergency was lifted) than in June 2019. In the subgroup analysis, the ECV of on-site anti-inflammatory and analgesic treatments for ‘spondylopathies’ and ‘low back pain and sciatica’ was higher in June 2020 than in June 2019.

### Strengths and limitations

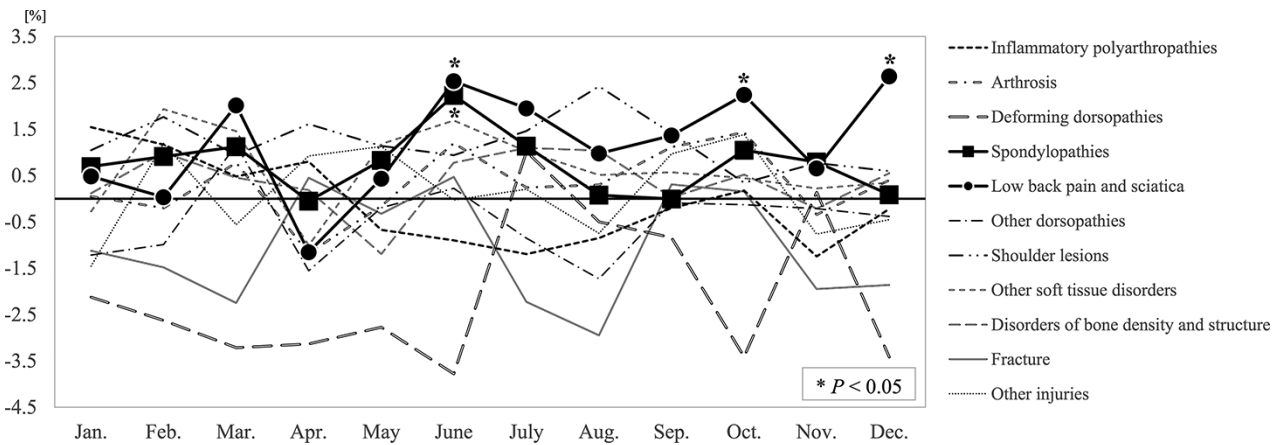
A strength of this study was the use of National Health Insurance claims data to determine changes in orthopedic clinic visit behavior and health-care expenditures during the state of emergency for COVID-19 in Japan. The study population encompassed all National Health Insurance enrollees residing in the participant city, which provided a large population-based sample for analysis. However, the study had the following limitations. (i) As the data were acquired from only one city, regional differences could not be considered. (ii) The study was conducted using claims data from Japan’s National Health Insurance System, which covers a large proportion of non-working individuals, part-time workers and self-employed workers. This may have led to biases in the types of work, socioeconomic status and income levels of our study population. Furthermore, there may be a lower proportion of persons who work from home and a higher proportion of persons in poor health when compared with the general population. (iii) National Health Insurance claims data do not include information on disease severity, which would have provided important context to the clinical indications for various medical services. (iv) The study focused on outpatients attending orthopedic clinics in Japan, and our findings may have limited generalizability outside of the study population.

### Interpretation within the context of the wider literature

Our study indicated that orthopedic clinics experienced reduced visits in April and May 2020 during the first state of emergency, which supported the findings of previous reports on other clinical departments in Japan [18, 19]. However, we observed significant increases in the ECV for both ‘spondylopathies’ and ‘low back pain and sciatica’ after the state of emergency was lifted, which could be explained by three hypotheses. The first hypothesis is that reduced physical activity during the state of emergency led to a rise in new-onset cases and/or the exacerbation of existing cases of ‘spondylopathies’ and ‘low back pain and sciatica,’ which manifested as an increased use of medical resources at orthopedic clinics (i.e. anti-inflammatory and analgesic treatments) after the state of emergency was lifted, and patients were more willing to seek care. In Saudi Arabia, Šagát and colleagues reported that a COVID-19 lockdown was associated with an increase in low back pain incidence and more intensive symptoms, especially in persons aged 35–49 years [17]. Moretti and colleagues noted an increase in neck pain among Italian workers



**Figure 1** Medical visits and health-care expenditures of patients attending orthopedic clinics. (A) Numbers of patients attending orthopedic clinics in 2020 according to age group, (B) year-over-year values of OEM, ECV and MV for each month in 2020 vs. 2019. Notes: The gray zone represents the period from 7 April to 14 May 2020 in which a state of emergency was declared in Fukuoka prefecture, Japan.



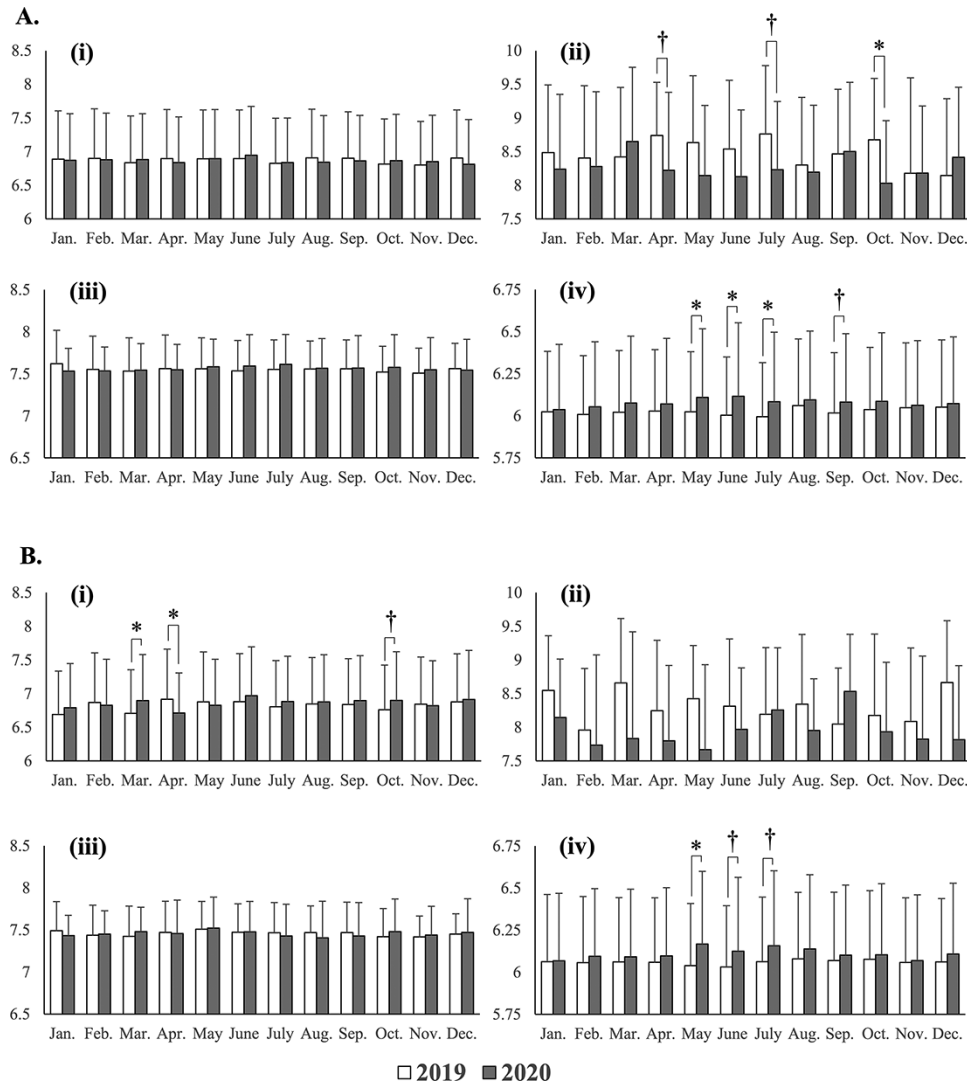
**Figure 2** Year-over-year values of health-care expenditure per capita per visit for each month in 2020 vs. 2019 according to DMSCT category. Notes: Does not include 'Other disorders of the musculoskeletal system and connective tissue' due to insufficient patient numbers.

who began teleworking during the COVID-19 pandemic, which could be attributed to reductions in physical activity, changes in work environment and telework-associated psychosocial factors [27]. Although the degree of physical activity and psychosocial stress of our study patients could not be quantified, we also observed increases in the ECV of 'low back pain and sciatica' and 'spondylopathies' (which include cervical symptoms) and in the number of patients aged <55 years (which represent the working generation)

attending orthopedic clinics. Our observed increase in the ECV for anti-inflammatory and analgesic treatments for 'spondylopathies' and 'low back pain and sciatica' after May 2020 also suggests that patients required more medical resources for these diseases after the state of emergency was lifted.

The second hypothesis to explain the increases in the ECV for both 'spondylopathies' and 'low back pain and sciatica' in June 2020 is that physician-induced demand





**Figure 3** Comparison of health-care expenditure per capita per visit for each month between 2019 and 2020 according to medical service category. (A) Spondylopathies, (B) low back pain and sciatica. Notes: \*  $P < 0.05$ ; †  $P < 0.10$  (i) consultations, (ii) image diagnosis, (iii) physical therapy and (iv) on-site anti-inflammatory and analgesic treatments.

rose after the state of emergency was lifted. Under Japan’s health insurance system, orthopedic clinics utilize a fee-for-service payment system, which can promote physician-induced demand [28, 29]. In addition, previous studies in Japan have found a relationship between hospital management practice and physician-induced demand, as high-cost procedures were more preferentially selected and per capita health-care expenditures increased after the revision of the medical payment system (an exogenous factor over which physicians have no control) [24, 30]. In March 2020, the Japanese government further revised the medical payment system, but this did not affect orthopedic clinics. However, orthopedic clinics likely experienced a decline in revenue due to a decrease in the number of patient visits during the state of emergency [31]. Therefore, physicians may have increased their medical services in June to offset the reduced profits in the preceding months. However, no significant increase was observed for the medical service categories of image diagnosis and physical therapy, which are high-cost services that can be controlled by physicians.

Finally, another hypothesis that should be considered is the potential influence of patient-induced demand. Given the situation in Japan after the state of emergency was lifted, the population was uncertain as to when the next state of emergency would be declared. It is possible that patients took the opportunity to visit orthopedic clinics to receive anti-inflammatory and analgesic treatments soon after restrictions were relaxed, resulting in a temporary increase in their health-care expenditures.

### Implications for policy, practice and research

Although Japan’s state of emergency did not prohibit all outings, many people shied away from seeking medical care. This may have caused a decrease in medical visits during the state of emergency, which was followed by a temporary surge in health-care expenditures after restrictions were lifted. In order to improve access to health care under movement restriction policies, there is a need to expand and promote the telemedicine system. Furthermore, the government should consider optimal insurance reimbursement strategies

for telemedicine in orthopedic clinics. The establishment of incentives for health-care providers could also help to facilitate their adoption of telemedicine services. Further research is needed to investigate the impact of repeated states of emergency.

## Conclusions

Japan's first state of emergency for COVID-19 reduced medical visits and health-care expenditures among patients attending orthopedic clinics. A decline in physical activity during this period may have induced new or exacerbated cases of 'spondylopathies' and 'low back pain and sciatica,' which increased the patients' need for medical resources and caused a temporary rise in per capita health-care expenditures after the state of emergency was lifted.

## Supplementary material

Supplementary material is available at *International Journal for Quality in Health Care* online.

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## Contributorship

NT: conceptualization, formal analysis, writing—original draft, writing—review and editing and visualization; HF: investigation, writing—review and editing, visualization and supervision.

## Ethics and other permissions

The study was approved by the Kyushu University Institutional Review Board for Clinical Research (Approval Number: 2020-622).

## Data sharing statement

The datasets generated and/or analyzed during the current study are not publicly available owing to restrictions.

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