



## HOSPITAL HYGIENE

# Impact of the state of emergency on trends in the care of three major diseases at Showa University Hospital, Japan: a retrospective and descriptive study

AKIRA MINOURA<sup>1</sup>, KOUZOU MURAKAMI<sup>2</sup>, MASAOKI MATOBA<sup>3</sup>, YOSHINORI ITO<sup>2</sup>,  
YUMI KAMIJO<sup>3</sup>, AKATSUKI KOKAZE<sup>1</sup>

<sup>1</sup> Department of Hygiene, Public Health and Preventive Medicine, Showa University School of Medicine, Tokyo, Japan;

<sup>2</sup> Department of Radiology, Division of Radiology, Showa University School of Medicine, Tokyo, Japan;

<sup>3</sup> Department of Health Management, Showa University Graduate School of Health Sciences, Tokyo, Japan

## Keywords

Hospital hygiene • COVID-19 pandemic • Infection control • State of emergency • Japanese patients

## Summary

**Introduction.** This study aimed to examine the trends in patient consultations for three major diseases (cancer, heart disease, and stroke) at Showa University Hospital, Japan during the state of emergency for the Coronavirus 2019 (COVID-19) pandemic.

**Methods.** The present study was a retrospective and descriptive study of Showa University Hospital in Tokyo, Japan. Subjects were patients who had received medical treatment at Showa University Hospital and were diagnosed from 2017 to 2020. To examine the impact of the state of emergency, the number visits to hospital by the top three causes of death or other diseases were summarised from 21 weeks of data, from week 8 to week 28, for each year.

**Results.** Compared to the average of the previous 3 years, a comparison of the three periods before and after the state of emergency showed a V-shaped curve in 2020, with a large drop in the number of cancer patients during the state of emergency, both from within Tokyo and from outside the city.

**Conclusions.** This study showed a long-term decrease in cancer patient visits to Showa University Hospital since the beginning of the COVID-19 pandemic compared to the previous 3 years. It is also possible that medical care that would have been available may not have been provided due to the state of emergency, so it is necessary to follow up patients while keeping a close eye on measures other than infectious diseases.

## Introduction

Coronavirus 2019 (COVID-19) caused a global public health emergency in 2020 [1]. During the COVID-19 pandemic, there was a shortage of medical staff and resources, intensive care units, ventilators, and personal protective equipment (especially medical masks) due to an urgent increase in the number of infected and severe patients. To deter the spread of COVID-19, many countries have imposed a lockdown with restrictions on outings and service closures. The lockdown in most of these countries has compelling force with penalties for violations. The lockdown can be expected to deter the spread of the infection, which would otherwise become destructive, resulting in not only economic damage, but also delays in treatment of patients [2]. In particular, cancer treatment delay is a problem in health systems worldwide. Hanna et al. demonstrated that a 4-week delay of cancer treatment is associated with increased mortality across surgical, systemic treatment, and radiotherapy indications for seven cancers [3].

Japan was in “mild lockdown,” which was not enforceable and non-punitive, during the state of emergency; nevertheless, the impact attracted attention [4]. On 7 April 2020, the Japanese government declared a state of emergency due to a COVID-19

outbreak in seven prefectures (Tokyo, Kanagawa, Osaka, Saitama, Chiba, Hyogo, and Fukuoka). Tokyo, host of the 2020 Olympics, had the highest number of infections among the 47 prefectures, and the Tokyo Metropolitan Government imposed its own transferal restrictions on citizens [5]. The state of emergency expanded nationwide on 16 April 2020, and was lifted in a phased manner beginning 14 May 2020. While many countries were in lockdown with penalties for violations, Japanese policy for COVID-19 was distinguished as the government “requesting” the public to refrain from going out except for emergencies and to temporarily close certain businesses without penalties for violations. This lockdown significantly transformed public activity as well as patients’ medical examination behaviours in Japan. For example, the number of monthly train users in April 2020 prominently decreased by 45.5% compared with the same month in 2019 [6]. The mild lockdown in Japan had a diverse range of influence on people’s lives, similar to other countries, including changes in domestic circumstances due to teleworking or school closure and economic damage due to decreased income or job loss. It has been suggested that patients with cancer are more likely to become severely ill due to COVID-19 infection, and it is possible that cancer

patients may have been discouraged from seeing a doctor [7]. The top three causes of death in Japan are cancer, heart disease, and stroke, but cancer has been number one since the 1980s [8]. Examining the impact of the COVID-19-related emergency on the behaviour of the top cause of death is a critical issue that directly affects the mortality rate in Japan.

This study hypothesised that the state of emergency suppressed patient visits to hospital for cancer, heart disease, and stroke in Japan. The aim of this study was to compare trends among cancer, heart disease, and stroke patient consultations at one university hospital in Tokyo before and after the issuance of the state of emergency. Moreover, we examined changes in patient consultations, including transfers between prefectures.

## Methods

The present study was a retrospective and descriptive study of Showa University Hospital in Tokyo, Japan. Subjects were patients who had received medical treatment at Showa University Hospital and were diagnosed from 2017 to 2020. To examine the impact of the state of emergency, the number of visits to Showa University Hospital for the top three causes of death or other diseases were summarised from 21 weeks of data, from week 8 to week 28, for each year (Tab. I). Showa University Hospital is located near the border between Tokyo (the

most populous prefecture in Japan) and Kanagawa (the second most populous prefecture). This is one of the areas most affected by the COVID-19 pandemic in Japan, because the number of COVID-19 infections has remained high since the early stages of the pandemic. In case of return to the hospital, subjects were defined only as patients with newly diagnosed diseases. The effectiveness of COVID-19 measures was assessed by calculating the 7-day moving average of the interval from symptom onset to isolation in hospital or quarantine. The trends of patient visits to hospital from Tokyo were divided into cancer, cardiovascular disease, stroke, and others (Fig. 1). The trends of patient visits to hospital from outside Tokyo were also divided into cancer, cardiovascular disease, stroke, and others (Fig. 2). For each disease, we examined the parallelism between 2020 and the average of the previous 3 years. As a secondary analysis, a difference-in-difference analysis was performed for diseases with parallelism. Table II shows parallel trends in both patients from within and outside Tokyo.

This study was approved by the Medical Ethics Committee of Showa University School of Medicine (Approval No. 2954).

All statistical analyses were conducted using JMP 15.0 (SAS Institute Inc. Cary, NC USA). All analyses were carried out at a 95% confidence interval. P-values less than 0.05 (two-tailed) were considered statistically significant.

**Tab. I.** Changes in the number of patient visits to Showa University Hospital before, during and after the COVID-19 state of emergency.

Targeted disease	All periods (21 weeks)	Before the state of emergency(7 weeks)	During the state of emergency(7 weeks)	After the state of emergency (7 weeks)	p-value*
<b>Patients from Tokyo (n = 47,136)</b>					
All disease (2020)	21.240	6.877	5.565	8.798	< 0.001
All disease (2017-2019)	25.896	8.746	8.210	8.940	
Cancer (2020)	1.396	502	328	566	< 0.001
Cancer (2017-2019)	1.848	629	577	642	
Cardiovascular disease (2020)	241	79	82	80	0,718
Cardiovascular disease (2017-2019)	249	83	80	86	
Stroke (2020)	285	85	78	122	0,004
Stroke (2017-2019)	262	88	83	91	
Others (2020)	19.318	6.211	5.077	8.030	< 0.001
Others (2017-2019)	23.537	7.946	7.470	8.121	
<b>Patients from outside Tokyo (n = 6,782)</b>					
All disease (2020)	2.831	941	696	1.194	< 0.001
All disease (2017-2019)	3.951	1.334	1.276	1.341	
Cancer (2020)	211	73	47	91	< 0.001
Cancer (2017-2019)	351	117	115	119	
Cardiovascular disease (2020)	22	9	5	8	0,370
Cardiovascular disease (2017-2019)	28	10	9	9	
Stroke (2020)	19	6	5	8	0,327
Stroke (2017-2019)	26	9	8	9	
Others (2020)	2.579	853	639	1.087	< 0.001
Others (2017-2019)	3.546	1.198	1.144	1.204	

\* Chi-square test.

The number of patients with the targeted diseases in 2020 was calculated data from weeks 8-28.

The number of patients with the targeted diseases from 2017 to 2019 was calculated as a 3-year average from data from weeks 8-28.

Fig. 1. Number of visits to hospital by patients from Tokyo by disease.

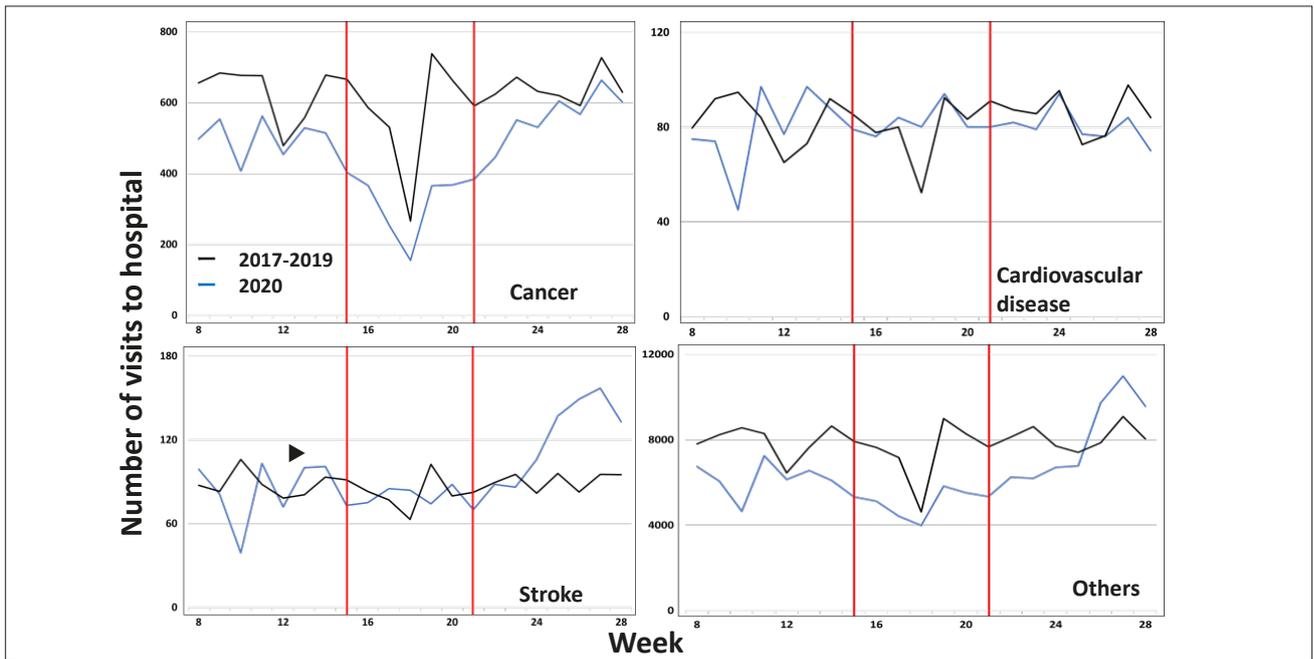
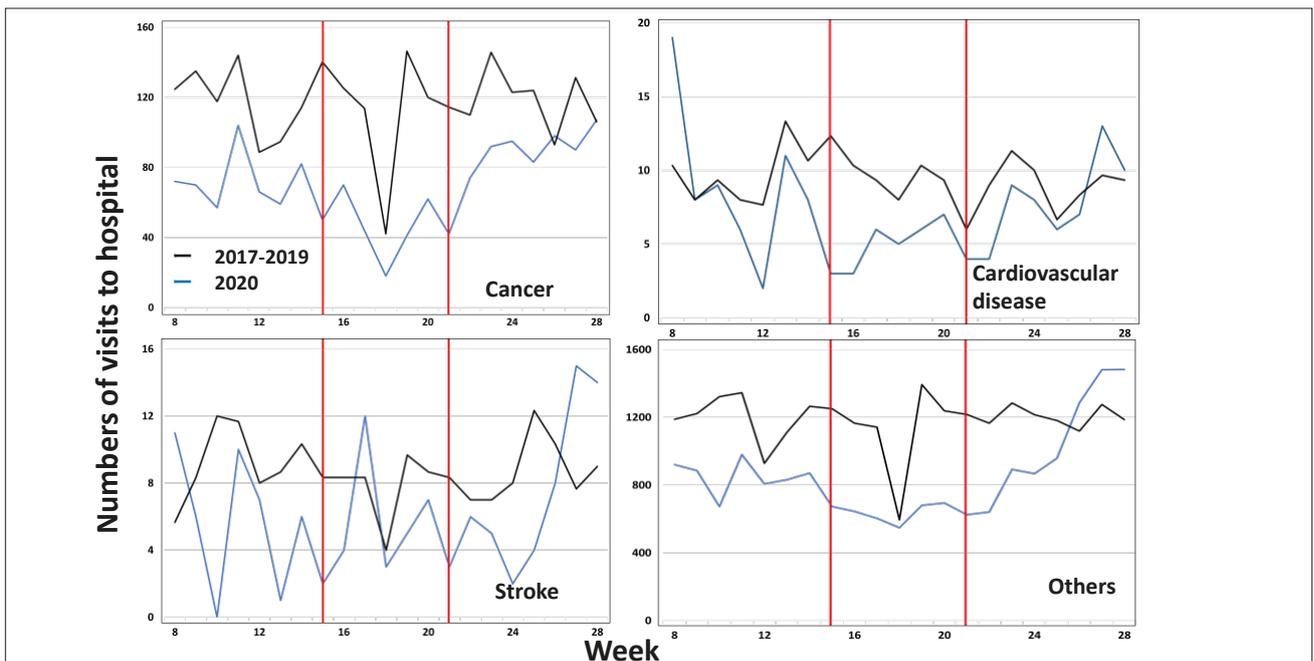


Fig. 2. Number of visits to hospital by patients from outside Tokyo by disease.



## Results

Table I summarises changes in the number of patient visits to Showa University Hospital before and after the state of emergency. Figures 1 and 2 summarise the weekly trends in visits to Showa University Hospital by patients from Tokyo and from outside Tokyo during the COVID-19 pandemic, respectively. In both figures, the start and end of the state of emergency are indicated by red lines. A comparison of the average number of

visits for the three periods before and after the state of emergency during the previous 3 years and 2020 shows a V-shaped curve in 2020, with a large drop in the number of visits by cancer patients during the state of emergency, both from within Tokyo and from outside the city. Trends in visits by cardiovascular disease patients showed no significant difference when comparing the average of the previous 3 years to 2020. Visits by stroke patients from Tokyo tended to increase after the state of emergency was lifted when comparing the average of the

**Tab. II.** Difference-in-differences analysis for cancer patient visits to Showa University Hospital before, during and after the COVID-19 state of emergency.

	Before to during state of emergency	During to after state of emergency
	OR (95%CI)	OR (95%CI)
Patients from Tokyo	0.98 (0.95-1.00)	0.99 (0.97-1.00)
Patients from outside Tokyo	0.89 (0.78-1.00)	0.93 (0.88-1.00)

OR: Odds ratio; CI: Confidence interval.

previous 3 years with 2020. Without including the top three disease causes of death, a comparison of the three periods before and after the state of emergency between the previous 3 years and 2020 shows a V-shaped curve in 2020, with a large drop in the number of visitors during the state of emergency, both from within Tokyo and from outside the city.

Among the three major diseases, only cancer showed parallelism between 2020 and the average of the previous 3 years. The results of the difference-in-difference analysis for cancer patients showed that the number of patients during the state of emergency was significantly lower than before (Tab. II). Furthermore, the number of visits by patients from outside Tokyo [odds ratio (OR): 0.89; 95% confidence interval (CI) (0.78-1.00)] decreased more than the number of visits by patients from Tokyo [0.98; (0.95-1.00)]. The number of patient visits after the state of emergency was significantly lower than during the state of emergency. The number of visits by patients from outside Tokyo [0.93; (0.88-1.00)] decreased more than the number of visits by patients from Tokyo [0.99 (0.97-1.00)].

## Discussion

The results of this study suggest that cancer patients at Showa University Hospital tended to refrain from seeing a doctor during the COVID-19 state of emergency, compared to before the state of emergency. Furthermore, compared to the situation during the state of emergency, there was a tendency to continue to refrain from seeing a doctor after the state of emergency was lifted. Among the top three disease causes of death, there was no significant difference in the trends of patients with cardiovascular disease and stroke between 2020 and the previous 3 years. The number of cancer patients decreased monotonically for 21 weeks, including the 7 weeks both before and after the state of emergency. The effect of public holidays and weekends should be noted. A study of emergency medical visits to a district general hospital in southwest Scotland admissions showed statistically higher mortality associated with admission on public holidays both on weekdays and weekends, but not with weekend admissions generally [9]. In Japan, holidays usually fall between 29 April and 5 May, and the number of hospital visits tends to decrease significantly during this period. It is

possible that the effects of this vacation (about a week) overlapped with the effects of the state of emergency. However, since the number of cancer patient visits continued to decrease even after the state of emergency was lifted, it is possible that COVID-19 is having a long-term effect on consultation behaviour regardless of the impact of the state of emergency.

A global survey elucidates the role of pancreatic surgery during the COVID-19 pandemic, regarding patient selection for the surgical and oncological treatment of pancreatic diseases to support clinical decision-making [10]. It has also been suggested that the response should be divided by cancer site.

Xiao et al. demonstrated that the lockdown in China due to the COVID-19 pandemic has had a significant psychological impact on cancer patients and their families and showed the importance of psychological support during the pandemic [11].

Emergency infection control measures are essential in hospitals. Although Japan was spared from the 2003 severe acute respiratory syndrome (SARS) epidemic, hospitals were placed on high alert. In 2003, substantial differences in emergency infection control measures, as perceived by health care workers, exist among hospitals in Japan, with differences across institutions exceeding those across disciplines. To achieve a higher level of preparedness for infectious diseases, institutions should designate and implement effective emergency infection control measures [12]. It is necessary to compare multiple medical institutions and examine regional differences because each region has its own universal health insurance system, and the health care system varies greatly depending on population density and the number of medical institutions in each municipality.

Lapointe-Shaw et al. demonstrated that patients discharged from hospital during the December holiday period were less likely to have prompt outpatient follow-up and were at higher risk of death or readmission within 30 days [13]. Collection of longitudinal data could help examine the effect of public holidays, weekends and the state of emergency among Japanese patients.

This study suggests that the COVID-19 state of emergency may have inhibited the movement of patients with three major diseases across prefectures in Japan. However, it is also possible that the medical care that would have been available may not have been provided due to the state of emergency, so it is necessary to follow up patients while keeping a close eye on measures other than those for infectious diseases. Moreover, Inoue et al. suggested that the lack of social capital was associated with refraining from seeking medical care among Japanese [14]. When examining regional differences in Japan, it will be necessary to show individual or regional social factors as well.

Our study has limitations. This study is based on the trend of consultation at a single hospital, and its generalizability is a challenge. In light of the COVID-19 epidemic, this study provides valuable information showing that patients refrained from attending medical

examinations due to the state of emergency using data from a single hospital; however, further study using data from multiple hospitals is necessary. Although this study was conducted in one hospital in Tokyo, which has the highest number of confirmed COVID-19 cases in Japan, it has the advantage of being geographically suitable for confirming the effectiveness of the state of emergency. Because the COVID-19 epidemic has continued worldwide, and this study is based only on data up to September 2020, a longer-term study is needed. It should also be noted that the number of patients for each disease varied. Compared to cancer, this study had a smaller number of patients with cardiac disease and stroke, and the trends for these conditions may not be readily detectable due to this smaller sample size.

## Conclusions

In conclusion, our study showed a long-term decrease in cancer patient visits to Showa University Hospital since the beginning of the COVID-19 pandemic compared to the same period in the previous 3 years. Among cardiovascular disease and stroke patients, there was no significant decrease in long-term visits at the beginning of the COVID-19 pandemic compared to the previous years. It is also possible that the medical care that would have been available may not have been provided due to the state of emergency, so it is necessary to follow up patients while keeping a close eye on measures other than infectious diseases.

## Acknowledgements

We would like to thank all the study participants.

## Funding

Not applicable.

## Conflict of interest statement

All authors declare that they have no conflicts of interest.

## Author contributions

AM and KM planned this study. YI, YK and AK contributed to improving this study in a meaningful way. AM drafted the manuscript. KM performed data collection. MM supervised data collection. KM supported the draft of this manuscript and data collection. AM contributed to the statistical analysis. AK made substantial contributions to the conception of this study and the revision of the manuscript. All authors read and approved the final manuscript.

## References

- [1] World Health Organization. Coronavirus disease (COVID-19) Weekly Epidemiological Update and Weekly Operational Update. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>
- [2] Wright A, Salazar A, Mirica M, Volk LA, Schiff GD. The Invisible Epidemic: Neglected Chronic Disease Management During COVID-19. *J Gen Intern Med* 2020;35:2816-7. <https://doi.org/10.1007/s11606-020-06025-4>
- [3] Hanna TP, King WD, Thibodeau S, Jalink M, Paulin GA, Harvey-Jones E, O'Sullivan DE, Booth CM, Sullivan R, Aggarwal A. Mortality due to cancer treatment delay: systematic review and meta-analysis. *BMJ* 2020;371:m4087. <https://doi.org/10.1136/bmj.m4087>
- [4] Yamamoto T, Uchiumi C, Suzuki N, Yoshimoto J, Murillo-Rodriguez E. The Psychological Impact of 'Mild Lockdown' in Japan during the COVID-19 Pandemic: A Nationwide Survey under a Declared State of Emergency. *Int J Environ Res Public Health* 2020;17:9382-400. <https://doi.org/10.3390/ijerph17249382>
- [5] Murakami M, Miura F, Kitajima M, Fujii K, Yasutaka T, Iwasaki Y, Ono K, Shimazu Y, Sorano S, Okuda T, Ozaki A, Katayama K, Nishikawa Y, Kobashi Y, Sawano T, Abe T, Saito MM, Tsubokura M, Naito W, Imoto S. COVID-19 risk assessment at the opening ceremony of the Tokyo 2020 Olympic Games. *Microb Risk Anal* 2021. <https://doi.org/10.1016/j.mran.2021.100162.100162>
- [6] Ministry of Land Infrastructure, Transport and Tourism. Monthly report of the Statistical Survey on Railway Transport in April 2020. Available at: [https://www.e-stat.go.jp/stat-search/files?page=1&layout=datalist&toukei=00600350&kikan=00600&tstata=000001011026&cycle=1&year=20200&month=12040604&result\\_back=1&result\\_page=1&tclass1val=0](https://www.e-stat.go.jp/stat-search/files?page=1&layout=datalist&toukei=00600350&kikan=00600&tstata=000001011026&cycle=1&year=20200&month=12040604&result_back=1&result_page=1&tclass1val=0). 2020 (Japanese).
- [7] Takahari D, Shinozaki E, Wakatsuki T, Ooki A, Ozaka M, Suzuki T, Nakayama I, Osumi H, Kamiimabeppu D, Sato T, Ogura M, Suenaga M, Chin K, Yamaguchi K. Managing a gastrointestinal oncology practice in Japan during the COVID-19 pandemic: single institutional experience in The Cancer Institute Hospital of Japanese Foundation for Cancer Research. *Int J Clin Oncol* 2021;26:335-44. <https://doi.org/10.1007/s10147-020-01806-7>
- [8] Ministry of Health, Labour and Welfare Japan. Vital Statistics of Japan, Statistics & Information Department, Minister's Secretariat 1975-2016; MHLW: Tokyo, Japan, 2016. <https://www.mhlw.go.jp/english/database/db-hw/populate/dl/E03.pdf>
- [9] Smith S, Allan A, Greenlaw N, Finlay S, Isles C. Emergency medical admissions, deaths at weekends and the public holiday effect. Cohort study. *Emerg Med J* 2014;31:30-4. <https://doi.org/10.1136/emmermed-2012-201881>
- [10] Oba A, Stoop TF, Lohr M, Hackert T, Zyromski N, Nealon WH, Unno M, Schulick RD, Al-Musawi MH, Wu W, Zhao Y, Satoi S, Wolfgang CL, Abu Hilal M, Besslink MG, Del Chiaro M, Pancreas Club EPCCPSAECOMIPSSGoPTPCSGoPDAw, International Study Group on Cystic Tumors of the P. Global Survey on Pancreatic Surgery During the COVID-19 Pandemic. *Ann Surg* 2020;272:e87-e93. <https://doi.org/10.1097/SLA.0000000000004006>
- [11] Xiao H, Zhang Y, Kong D, Li S, Yang N. Social Capital and Sleep Quality in Individuals Who Self-Isolated for 14 Days During the Coronavirus Disease 2019 (COVID-19) Outbreak in January 2020 in China. *Med Sci Monit* 2020;26:e923921. <https://doi.org/10.12659/MSM.923921>
- [12] Imai T, Takahashi K, Hoshuyama T, Hasegawa N, Chia SE, Koh D. Substantial differences in preparedness for emergency infection control measures among major hospitals in Japan: lessons from SARS. *J Infect Chemother* 2006;12:124-31. <https://doi.org/10.1007/s10156-006-0436-0>

- [13] Lapointe-Shaw L, Austin PC, Ivers NM, Luo J, Redelmeier DA, Bell CM. Death and readmissions after hospital discharge during the December holiday period: cohort study. *Bmj* 2018;363:k4481. <https://doi.org/10.1136/bmj.k4481>
- [14] Inoue A, Tsutsumi A, Eguchi H, Kachi Y, Shimazu A, Miyaki K, Takahashi M, Kurioka S, Enta K, Kosugi Y, Totsuzaki T, Kawakami N. Workplace social capital and refraining from seeking medical care in Japanese employees: a 1-year prospective cohort study. *BMJ Open* 2020;10:e036910. <https://doi.org/10.1136/bmjopen-2020-036910>

Received on June 10, 2021. Accepted on April 8, 2022.

**Correspondence:** A. Minoura, Department of Hygiene, Public Health and Preventive Medicine, Showa University School of Medicine, Tokyo, Japan. E-mail: [minoaki@med.showa-u.ac.jp](mailto:minoaki@med.showa-u.ac.jp)

**How to cite this article:** Minoura A, Murakami K, Matoba M, Ito Y, Kamijo Y, Kokaze A. Impact of the state of emergency on trends in the care of three major diseases at Showa University Hospital, Japan: a retrospective and descriptive study. *J Prev Med Hyg* 2022;63:E325-E330. <https://doi.org/10.15167/2421-4248/jpmh2022.63.2.2210>

© Copyright by Pacini Editore Srl, Pisa, Italy

*This is an open access article distributed in accordance with the CC-BY-NC-ND (Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International) license. The article can be used by giving appropriate credit and mentioning the license, but only for non-commercial purposes and only in the original version. For further information: <https://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>*