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How does the impact of the COVID-19 state of emergency change? An analysis of preventive behaviors and mental health using panel data in Japan

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ARTICLE INFO
JEL classification:
I12
I18
Keywords:
COVID-19
Preventive behavior
Mental health
State of emergency declaration

ABSTRACT
This study applies the difference-in-difference method on panel data collected from internet surveys to investigate changes in the preventive behaviors and mental health of individuals as influenced by the COVID-19 state of emergency declaration between March and June 2020. The key findings are: (1) The declaration led people to exhibit preventive behaviors but also generated negative emotions; (2) Such behaviors persisted even after deregulation of the state of emergency; (3) Making the declaration early (vs. late) had a larger effect on preventive behavior, with the gap between residents’ behaviors for areas that made early vs. late declarations persisting after the deregulation; and (4) The effects on mental health diminished during the state of emergency and disappeared after its deregulation.

1. Introduction

The COVID-19 pandemic has had a significant impact on social and economic conditions, resulting in drastic changes in lifestyle, even though only a few months have passed since the first person was infected in China in November 2019. Policymakers have been implementing various measures to mitigate the effects of the COVID-19 pandemic. On July 17, 2020, the death toll in the United States rose to 138,201, becoming the highest official figure worldwide, almost three to four times larger than those in the United Kingdom, France, Italy, and Spain. Meanwhile, Japan’s death toll was only at 985.1 This leads us to ask: Was the government’s policies for COVID-19 control more effective in Japan than in the United States and other countries? In this study, we examine this question by setting a quasi-natural experiment.

In various countries, including China, the United Kingdom, and the United States, governments have enforced strong lockdown measures in response to surging numbers of people infected by the virus.2 Countries that have implemented drastic measures (i.e. lockdowns) have seen reductions in the speed of the pandemic’s spread (e.g. Anderson et al., 2020; Fang et al., 2020; Tian et al., 2020; Viner et al., 2020). However, the lockdown severely affected mental health—increase in loneliness, worry, sadness (Brodeur et al., 2020b), and in incidences of domestic violence have been observed (WHO, 2020). However, government policies have not been sufficiently investigated, specifically, their positive and negative effects.

Fetzer et al. (2020) conducted a large-scale web survey from late March to early April (covering 58 countries) to investigate COVID-19 preventive behaviors and mental health within the population. Furthermore, they assessed the changes in the evaluations that people made during this period concerning government policies. However, their survey (for constructing panel data) did not involve the same respondents, and the sample comprised countries with different economic and social conditions. Therefore, they could not disentangle the effects of government policies on people’s perceptions and behaviors from other factors. Layard et al. (2020) analyzed the costs and benefits of the lockdown in the United Kingdom by considering not only traditional

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2 Existing works have considered various factors that influence preventive behaviours under the government’s stringent regulation. Social trust promoted preventive behaviours after the lockdown in the United States (e.g. Bargain and Aminjonov, 2020; Brodeur et al., 2020). The effects of political views on preventive behaviour were also examined in the United States (e.g. Allcott et al., 2020; Painter and Qiu, 2020). Briscese et al. (2020) considered how expectations about the duration of self-isolation is associated with following the government’s order.
economic indices such as income and unemployment, but also mental health. However, no study has evaluated by random assignment the effectiveness of policy measures in mitigating the COVID-19 epidemic, although a few studies have assessed this aspect using simulations. Haushofery and Metcalf (2020, p. 3) stated that, ‘One possible reason for the lack of systematic testing of mitigation measures in the COVID-19 pandemic is that it is both ethically and practically challenging: standard impact evaluation approaches typically require random assignment of some regions to an intervention and others to a control condition’. In Japan, similar to the United States and European countries, governments have asked the population to change hygiene and social behaviors to help contain the spread of the disease (e.g. washing hands more carefully and avoiding social gatherings). Later, a request for stricter and more costly measures, such as school closure and staying at home, were implemented. Differing from the lockdowns enforced in other countries, such as Italy, France, Germany, the United Kingdom, and the United States, the declaration of a state of emergency by the Japanese government could not substantially penalize by law those individuals who did not obey the government’s request. In other words, Japanese citizens could decide whether to carry out preventive behaviors to mitigate further spread of the COVID-19 pandemic. Therefore, it seems plausible that the reactions of Japanese citizens to COVID-19 may vary compared with countries that impose more rigorous lockdowns.

COVID-19 is often compared with the Spanish flu, which resulted in massive damage to human society. The Spanish flu pandemic lasted from January 1918 to December 1920, and it spread worldwide (Correia et al., 2020, p. 5). In China, the first Time of COVID-19 has been abated because of aggressive intervention; however, it is unknown whether COVID-19 was eradicated. As COVID-19 continues to spread globally, escalating cases of importation from overseas and/or resurgence of infection within China, coupled with the resumption of economic activities, make a second Time of COVID-19 probable (Leung et al., 2020, p. 1,383). Apart from China, this also holds true for the rest of the world. Therefore, it is possible that COVID-19 will persist for two or three years rather than several months. Existing works have compared the COVID-19 situation before and after the implementation of regulations (e.g. Allcott et al., 2020; Bargain and Aminjono, 2020; Brodeur et al., 2020a, 2020b; Engle et al., 2020; Painter and Qiu, 2020; Yamamura and Tsutsui, 2020). To sustain the society in the presence of COVID-19, we should evaluate mitigation policies from a long-term perspective. The seminal work of Agüero and Beleche (2017) found that in response to the 2009 influenza pandemic, information campaigns about hand-washing behaviors were promoted in Mexico, which triggered behavioral change. The behavior of washing hands persisted, thereby providing long-lasting effects on health outcomes. Historical evidence of coping with the Spanish flu in the United States indicated that cities that intervened earlier and more aggressively did not perform worse and grew faster after the pandemic was over (Correia et al., 2020). We independently collected data covering not only the period before and after the implementation of regulations, but also the period after deregulation. Existing works have explored changes in behaviors before and after the spread of COVID-19 by using aggregated level data (county-level), collected through Google and SafeGraph using mobile technology (Allcott et al., 2020; Bargain and Aminjono, 2020; Brodeur et al., 2020a, 2020b; Engle et al., 2020; Painter and Qiu, 2020). In comparison, one of the advantages of our data is the use of individual-level panel data collected by pursuing the same respondents at various phases and within one country. Using the data, we analyzed the changes in preventive behaviors and mental health of the same people to consider the effects of the COVID-19 policy in Japan and the persistence of these effects.

On April 7, 2020, the Japanese government declared a state of emergency for COVID-19 in the prefectures where the number of people infected with the virus was very large. Nine prefectures were clearly affected substantially by the COVID-19 epidemic. However, the declaration was made only for seven of these nine prefectures. Directly after the declaration, on April 16—when only nine days have passed—the declaration was extended to cover all parts of Japan. The state of emergency was subsequently deregulated on May 25. In this study, the seven prefectures for which the declaration was made earlier were taken as the treatment group and the two remaining prefectures that entered the state of emergency later, as the control group. Using the DID method based on data that cover the period before and after the state of emergency, we first examined the impact of declaring a state of emergency within a few days. Second, we further explored how the impact of the early declaration has changed after all of Japan was declared under a state of emergency, and then after its deregulation. The major findings are that preventive behaviors were promoted under the state of emergency, and the early timing of its declaration enhanced the effects, which persisted even after deregulation, whereas the effect of the state of emergency on mental health was observed directly only after the deregulation.

The situation in Japan can be considered as a natural experiment for examining how the government’s policy of appealing to the people’s conscience and morale generates changes in citizens’ behaviors, which in turn affect their mental health during the state of emergency. Furthermore, we examined whether the policy’s influence persisted when circumstances changed. This study contributes by assessing how early policy intervention (for COVID-19) affects preventive behaviors and mental health, and by determining whether the policy effects persist after its deregulation. To this end, the treatment and control groups were compared to explore, in a quasi-natural experimental setting, the effectiveness of policies that require preventive behaviors but do not impose any penalty.

The remainder of this article is organized as follows. In Section 2, we present an overview of the situation in Japan and explain the survey design and data. In Section 3, we describe the empirical method. In Section 4, we present and interpret the estimated results. Lastly, we provide some reflections and conclusions in the final section.

2. Setting and overview of the data

2.1. Setting

In Japan, the first person infected with COVID-19 was diagnosed on January 16, 2020. Similar to other countries, the number of infected people increased over time; however, the pace of increase was much slower than that in the United Kingdom, Italy, France, Spain, and the...
United States. To explore the effect of an exogenous shock, we conducted internet surveys to collect data concerning citizens’ preventive behaviors regarding COVID-19, as well as their mental health. We commissioned INTAGE, a company with abundant experience in academic research, to conduct the internet survey. The sampling method used was designed to gather a representative sample of the Japanese population with regard to gender, age, and prefecture of residence. In the internet survey, questionnaires were sent to selected Japanese citizens aged 16–79 years throughout Japan. As illustrated in Fig. 1, the surveys were conducted five times to pursue the same individuals for nearly three months from March to June. COVID-19 had hardly influenced daily life in Japan when we started the surveys. As shown in Fig. 1, the number of people infected daily was only 40 on March 13, when the first time of surveys was conducted. Subsequently, this number increased to around 150, and then 700, in the second and third times, respectively. After a state of emergency was declared, this number decreased to below 100, which was similar to the level of the first time.

**Fig. 1.** March 1 to June 30, 2020: Timing of surveys and state of emergency declaration, and daily changes in the number of people infected by COVID-19 for each group. **Note:** The long dash lines indicate the date the surveys were conducted. The first, second, third, fourth, and fifth times were conducted on March 10, March 27, April 10, May 8, and June 12, respectively. The thick solid line between the second and third times of the survey indicate the date of the emergency declaration for seven prefectures on April 7, and the long, thick dash line indicates the date of the declaration throughout Japan (47 prefectures) on April 16. The thick solid line between the fourth and fifth times of the survey indicates the date of deregulation of the state of emergency throughout Japan on May 25. Source: Data on the daily number of people infected by COVID 19 were sourced from the official website of the Ministry of Health, Labour and Welfare [https://www.mhlw.go.jp/stf/covid-19/open-data.html](https://www.mhlw.go.jp/stf/covid-19/open-data.html) (on July 4, 2020).

**Fig. 2.** Comparison of the mean values of COVID-19 infection case per 100,000 for each group. **Note:** We use the number of COVID-19 infection cases per 100,000 as the proxy for the degree of spread of COVID-19. We illustrated Fig. 2 using proxy values from April 1 to April 7, 2020. Error bars represent 95% confidence intervals. The treatment group consisted of Tokyo, Kanagawa, Saitama, Chiba, Osaka, Hyogo, and Fukuoka prefectures. Control group consists of Hokkaido, Aichi prefectures.
time of surveys was conducted on March 13. We gathered 4,359 observations, and the response rate was 54.7%. The second, third, fourth, and fifth times were conducted on March 27, April 10, May 8, and June 12, respectively. The response rates reached 80.2% (second time), 92.2% (third time), 91.9% (fourth time), and 89.4% (fifth time). The total number of observations was 19,740. Further, we limited the sample to prefectures where COVID-19 had spread to similar degrees when the first survey was conducted. Hence, the sample size decreased to 8,463.

As illustrated in Fig. 1, on April 7, between the second and third times, the Government of Japan declared a state of emergency for seven prefectures that had heavily suffered from COVID-19, including Tokyo and Osaka. The declaration requested people to avoid leaving their home unnecessarily, and also requested for the closure of various public places, including schools, museums, theatres, and bars, among others. At the time of the declaration, the request was planned to last for one month. Therefore, immediately after the declaration, the third time of the survey was carried out, after which the state of emergency declaration was promulgated throughout Japan, covering 47 prefectures. Immediately after the third time, on April 16, the state of emergency was declared throughout Japan. On May 25, 2020, the state of emergency was deregulated because the number of people infected daily decreased to around 20–30. Therefore, the advantage of our dataset is that it covers three phases: the period before the first declaration for only seven prefectures, that after extending the declaration to the rest of the 40 prefectures, and that after deregulation.

During the study period, the nine prefectures were remarkably affected by the COVID-19 epidemic, as the total number of people infected by COVID-19 in these prefectures was far larger than that for the other prefectures. In this study, the treatment group comprised respondents living in seven prefectures where on April 7, 2020, the Japanese government declared a state of emergency because of COVID-19. The two remaining prefectures were taken as the control group. The prefectures of Hokkaido and Aichi (the control group) were excluded from the declaration without a clear explanation from the Japanese government. Apart from the treatment and control groups, the remaining 38 prefectures were classified into other groups. However, only six days later, a state of emergency was declared for the control and other groups. The classification is based on infection cases per 100,000 in each prefecture because the per capita values reflect the degree of COVID-19 spread. As shown in Fig. 2, infection cases per 100,000 in the treatment group were almost the same, and there was no statistically significant difference. However, per capita infected individuals were distinctly larger than other groups, and there was a statistically significant difference. This type of setting can be considered quasi-randomization.

Japanese prefectures are closely related to their neighbors, especially to megacities, such as Tokyo and Osaka. The treatment group consisted of seven prefectures. These prefectures can be roughly divided into three geographical groups: Tokyo and its surrounding prefectures (Kanagawa, Chiba, Saitama), Osaka and its surrounding prefecture (Hyogo), and Fukuoka prefecture. Compared to Tokyo and Osaka, Fukuoka city included in Fukuoka prefectures is far less populated, so its effect on the surrounding prefecture is smaller. In Fig. 3, prefectures of the treatment group and the control group are shown in the map of Japan. Many people commute from one prefecture to another and spend time there. For instance, workers in Tokyo during the daytime return to the surrounding residential prefectures, such as Kanagawa, Saitama, and Chiba. In this study, Tokyo, Kanagawa, Saitama, and Chiba were included in the treatment group. However, in the case of Osaka Prefecture, many workers commuted from Koto to Osaka, but Kyoto was not included in the treatment group, although Hyogo was included in the treatment group. Therefore, the spillover effects of the declaration of the state of emergency in Kyoto were not examined. Apart from Kyoto, there is a possibility of spillover effects, which has not been examined in this study. It should be noted that spillover effects generate some biases. Turning to the control group, in Hokkaido (northern island), the spillover is unlikely to influence the results because there is a sea between Hokkaido and neighboring prefectures. Aichi includes Nagoya city, and its population size is over 2.3 million people. However, in comparison with Tokyo (9.5 million people) and Osaka (2.7 million people), its size is smaller, and thus the spillover effect is considered to be smaller.

In this study, we used data from respondents who live in the corresponding prefectures of the control and treatment groups. The population of the nine prefectures included in the treatment and control groups was about 53.1% of the total population of Japan. Specifically, the seven prefectures of the treatment group comprised 43.1% of the Japanese population. In the sample used in this survey, eight prefectures had megacities of over one million people, except for Chiba prefecture.

Using our novel dataset, first, we examined the effects of the declaration on citizens’ behaviors and mental health by comparing these two aspects before and after the declaration. Second, we investigated how the timing of the declaration (early vs. late) affected the persistence of the declaration’s effects after the state of emergency was extended to the control group. Third, we examined the effects after its deregulation.

2.2. Features of the data

The observations for the treatment and control groups totaled 6,877 and 1,586, respectively, making the total number of observations 8,463. The survey questionnaire contained basic questions about demographics such as age, gender, educational background, household income, job status, marital status, and number of children. These data were constant in the first, second, third, fourth, and fifth times because the five times were conducted only within three months. In addition, the respondents were asked questions concerning preventive behaviors as follows:

‘Within a week, to what degree have you practiced the following behaviors? Please answer based on a scale of 1 (I have not practiced this behavior at all) to 5 (I have completely practiced this behavior).’

8 Besides Tokyo and Osaka, the following prefectures were included in the survey: Kanagawa, Chiba, Saitama, Hyogo, and Fukuoka.

9 Official site of Statistics Bureau of Japan. https://www.stat.go.jp/data/nihon/02.html (accessed on November 29, 2021).

10 Chiba prefecture included Chiba City, which has 0.97 million people.
The answers to these questions served as proxies for the following variables for preventive behaviors: Staying indoors, Wearing a mask, and Washing hands. In addition, the mean value of these proxy variables, Preventive behaviors, was used to capture overall preventive behaviors. Larger values indicate that respondents are more likely to take preventive behaviors.

Regarding mental health, the respondents were asked the following question: ‘How much have you felt the emotions of anger, fear, and anxiety? Please answer based on a scale of 1 (I have not felt this emotion at all) to 5 (I have felt this emotion strongly)’.

The answers to these questions served as proxies for mental health, denoting: (1) Anger, (2) Fear, and (3) Anxiety. Furthermore, the mean value of these proxy variables, mental health, was used to assess overall mental health. Larger values indicate that the respondents’ mental health was worse.

By comparing the treatment and control groups, Figs. 4 and 5 illustrate the changes in the mean values of preventive behavior variables and mental health variables over time.
demonstrate the changes in the mean values of preventive behaviors and mental health of respondents from March 13 to June 12. In the next section, we explain the DID method used to examine the effects of the declaration. In applying this method, the key assumption was that the trends of variables were the same for the treatment and control groups before the declaration was announced (Angrist and Pschke, 2009). This is also called the parallel trend assumption. In most cases, Figs. 4 and 5 show that the common trends assumption is confirmed—that is, the trends regarding preventive behaviors and mental health were almost the same in the control and treatment groups from March 13 to 27—before the declaration of a state of emergency. However, there were some exceptional cases. In Fig. 4, “Wearing a mask” does not show a common trend. In Fig. 5, “Anger” does not show a common trend. Overall, in mental health variables, trends between groups differed slightly. Therefore, estimation results about “Wearing a mask” and “Anger” are less reliable than other results. Careful attention should be paid when the results for mental health are interpreted. Figs. 4 and 5 show that from March 13 to 27, except for Washing hands, the levels of the variables in the treatment group are lower than those in the control group. From March 27 to April 10, the figures show changes before and after the declaration of the state of emergency for the treatment group when the state of emergency has not been declared for...
Table 1
Dependent variables: preventive behaviors (Fixed-effects model) Data for males and females.

| Before the state of emergency | (1) Preventive behaviors | With dummies | (2) Staying indoors | (3) Wearing a mask | (4) Washing hands |
|-----------------------------|-------------------------|--------------|---------------------|-------------------|------------------|
| Time 3                     | 0.24***                 | (0.04)       | 0.35***             | 0.28***           | 0.10***          |
| Treatment                  | (0.07)                  | (0.09)       | (0.06)              | (0.06)            |
| Time 4                     | 0.25***                 | (0.05)       | 0.35***             | 0.24***           | 0.14***          |
| Treatment                  | (0.08)                  | (0.08)       | (0.08)              | (0.06)            |
| Time 5                     | 0.19***                 | (0.05)       | 0.31***             | 0.17***           | 0.08             |
| Treatment                  | (0.08)                  | (0.08)       | (0.06)              | (0.06)            |
| Time 3                     | 0.18***                 | (0.03)       | 0.23**              | 0.23**            | 0.09**           |
| Treatment                  | (0.06)                  | (0.05)       | (0.05)              | (0.04)            |
| Time 4                     | 0.49***                 | (0.04)       | 0.57***             | 0.68***           | 0.21***          |
| Treatment                  | (0.07)                  | (0.07)       | (0.07)              | (0.05)            |
| Time 5                     | 0.38***                 | (0.04)       | 0.15**              | 0.74**            | 0.26***          |
| Treatment                  | (0.07)                  | (0.07)       | (0.07)              | (0.05)            |
| Infected with COVID-19     | -0.001                  | -0.001       | -0.001              | -0.01             |
| Within R-Square            | 0.25                    | 0.14         | 0.19                | 0.05              |
| Obs. Groups                | 8,463                   | 8,463        | 8,463               | 8,463             |
|                           | 1,699                   | 1,699        | 1,699               | 1,699             |

3. The econometric model

Following Brodeur et al. (2020b), the DID method was used to examine the effects of the state of emergency declaration on preventive behaviors and mental health. Data were limited to nine prefectures and divided into the control and treatment groups, which included residents from two and seven prefectures, respectively. As discussed in the previous section, the DID method was considered valid. The estimated function takes the following form:

\[ Y_{itg} = \alpha_{1} \text{Time } 3_{i} \times \text{Treatment}_{g} + \alpha_{2} \text{Time } 4_{i} \times \text{Treatment}_{g} + \alpha_{3} \text{Time } 5_{i} \times \text{Treatment}_{g} + \alpha_{4} \text{Infected COVID-19}_{ig} + \beta_{1} + \epsilon_{itg} \]

In this formula, \( Y_{itg} \) represents the dependent variable for individual \( i \), Time \( t \), and group \( g \). For the estimation of preventive behaviors, \( Y \) denotes variables for preventive behaviors such as Staying indoors, Wearing a mask, and Washing hands. Regarding the estimation of mental health, \( Y \) denotes Anger, Fear and Anxiety, and. Second (Time 2), third (Time 3), fourth (Time 4), and fifth (Time 5) time dummies were included, with the first time as their reference group to determine the degree of change in the dependent variables as compared with the first time. Treatment is a dummy variable for the treatment group.

The key variables are Time 3 \( \times \text{Treatment} \), Time 4 \( \times \text{Treatment} \) and Time 5 \( \times \text{Treatment} \); the cross terms for Time 3, Time 4, Time 5, and Treatment. A key variable, \( \text{Time 3} \times \text{Treatment} \), was considered to reflect the effect of the declaration of the state of emergency. Time 4 \( \times \text{Treatment} \) and Time 5 \( \times \text{Treatment} \) (when both the treatment and control groups were under the same conditions) were included to investigate the effect of the timing of the declaration. When taking the preventive behaviors as dependent variables, the coefficients of Time 3 \( \times \text{Treatment} \) are expected to be positive if the declaration promoted citizens to achieve preventive behaviors. Meanwhile, when taking the variables for mental health as dependent variables, the coefficients of Time 3 \( \times \text{Treatment} \) are predicted to be positive if the declaration of the state of emergency worsened the mental health of the population. Moreover, Time 4 \( \times \text{Treatment} \) and Time 5 \( \times \text{Treatment} \) would be significant if the difference in the timing of declaration had an influence on the dependent variables.

The time-invariant, individual-level fixed effects are represented by \( k_{i} \). Because the panel data are of short term, most of the individual-level demographic variables were considered as time-invariant features completely described by \( k_{i} \). The regression parameters are denoted as \( \alpha \). The number of people infected with COVID-19 increased drastically in the residential areas during the study period; thus, this information was included as a control variable. The error term is denoted as \( \epsilon \). In addition to full-sample estimations, we conducted estimations using a sub-sample of males and females to consider how the effects of the timing of the declaration differed between genders.

In this specification, we considered how the effects of the state of the emergency changed according to different situations. Existing studies on pandemics have used aggregated-level data to indicate that earlier intervention resulted in faster growth after the pandemic was over (Correia et al., 2020). In comparison, the advantage of our study is that it more closely examined changes in behaviors and mental health by pursuing the same individuals. This way, we also were able to explore the difference in the effect between genders. Agüero and Beleche (2017) provided evidence that information campaigns about hand washing against the 2009 influenza pandemic promoted behavioral change to improve health conditions, and this behavior persisted even after the pandemic was eradicated. The present study considered not only preventive behaviors, including washing hands, but also mental health.
### 4. Results

#### 4.1. Main results

The results shown in Tables 1–4 are based on the sub-sample comprised of the treatment and control groups, as shown in Fig. 2. Tables 1–4 report the baseline specifications. Its upper part exhibits results that include only time dummies and infected people for considering the changes in the dependent variables according to different situations. Its lower part presents the results of cross terms between time dummies and Treatment for scrutinizing whether the declaration influenced the outcome and how the effects of the timing of the declaration changed according to changes in the situation.

The upper part of Table 1 shows positive signs for Time 3, Time 4, and Time 5 and their statistical significance at the 1% level. A significant positive sign for Time 4 indicates that the extension of the state of emergency through Japan generally triggered preventive behaviors. A significant positive sign for Time 5 signifies that the degree of preventive behaviors after deregulation of the state of emergency was higher than before the state of emergency. The absolute value of the coefficient of Time 5 is almost equivalent to that of Time 4 when the dependent variable is Wearing a mask and Washing hands. The results mean that the state of emergency continued to enhance these preventive behaviors even after the state of emergency was deregulated. Meanwhile, the absolute value of the coefficient of Time 5 is distinctly smaller than that of Time 4 when the dependent variables are Staying indoors. Therefore, the effects of declaring the state of emergency remained after deregulation, although such effects diminished. These results are further illustrated in Fig. 4. In particular, people are considered to have acquired the habits of washing hands and wearing a mask, which is in line with Agüero and

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**Table 2** Dependent variables: Mental health (Fixed-effects model) Data for males and females.

|                  | With dummies |  
|------------------|--------------|
| **Before the state of emergency** |              |
| Time 3           | 0.31***      |
| (1) Mental health| 0.22***      |
| (2) Anger        | 0.36***      |
| (3) Fear         | 0.11***      |
| (4) Anxiety      | 0.13***      |
| Time 4           | 0.07***      |
| Time 5           | 0.03***      |
| Infected with COVID-19 | 0.001 |
| Within R-Square  | 0.02          |

**Note:** Numbers in parentheses indicate robust standard errors clustered by individual levels, respectively.

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**Table 3** Dependent variables: Preventive behaviors (Fixed-effects model).

|                  | With dummies |              |
|------------------|--------------|
| **Before the state of emergency** |              |
| Time 3 × Treatment | 0.17***      |
| Time 4 × Treatment | 0.10***      |
| Time 5 × Treatment | 0.12***      |
| Time 3            | 0.22***      |
| Time 4            | 0.11***      |
| Time 5            | 0.13***      |
| Infected with COVID-19 | 0.07          |
| Within R-Square  | 0.06          |
| Obs.              | 4,693        |

**Panel A. Male sample**

|                  | With dummies |              |
|------------------|--------------|
| **Before the state of emergency** |              |
| Time 3 × Treatment | 0.30***      |
| Time 4 × Treatment | 0.28***      |
| Time 5 × Treatment | 0.31***      |
| Time 3            | 0.30***      |
| Time 4            | 0.27***      |
| Time 5            | 0.27***      |
| Infected with COVID-19 | 0.13          |
| Within R-Square  | 0.13          |
| Obs.              | 4,197        |

**Panel B. Female sample**

|                  | With dummies |              |
|------------------|--------------|
| **Before the state of emergency** |              |
| Time 3 × Treatment | 0.40***      |
| Time 4 × Treatment | 0.28***      |
| Time 5 × Treatment | 0.27***      |
| Time 3            | 0.40***      |
| Time 4            | 0.07***      |
| Time 5            | 0.07***      |
| Infected with COVID-19 | 0.00         |
| Within R-Square  | 0.15          |
| Obs.              | 4,197        |

Note: Numbers in parentheses indicate robust standard errors clustered by individual levels, respectively.
Panel A. Male sample

| Time | Mental health (1) | Anger (2) | Fear (3) | Anxiety (4) |
|------|-------------------|-----------|----------|------------|
| Before the state of emergency | <default> | | | |
| Time 2 | 0.30*** | 0.22*** | 0.36*** | 0.34*** |
| Time 4 | 0.13*** | 0.14*** | 0.14*** | 0.10*** |
| Time 5 | -0.03 | 0.06 | -0.05 | -0.10*** |
| Infected with COVID-19 | 0.01 | 0.004 | 0.02 | 0.02 |
| Within R-Square | 0.05 | 0.01 | 0.04 | 0.04 |

Panel B. Female sample

| Time | Mental health (1) | Anger (2) | Fear (3) | Anxiety (4) |
|------|-------------------|-----------|----------|------------|
| Before the state of emergency | <default> | | | |
| Time 2 | 0.16** | 0.26** | 0.10 | 0.13 |
| Time 4 × Treatment | 0.10 | 0.14 | 0.02 | 0.12 |
| Time 5 × Treatment | 0.14* | 0.18* | 0.10 | 0.13 |
| Time 3 | 0.23*** | 0.04 | 0.36*** | 0.29*** |
| Time 4 | 0.12 | 0.07 | 0.21*** | 0.07 |
| Time 5 | -0.07 | -0.04 | -0.04 | -0.13* |
| Infected with COVID-19 | 0.01 | -0.01 | 0.02 | 0.01 |
| Within R-Square | 0.26 | 0.14 | 0.11 | 0.21 |
| Obs. | 4,197 | 4,197 | 4,197 | 4,197 |
| Groups | 843 | 843 | 843 | 843 |

Note: Numbers in parentheses indicate robust standard errors clustered by individuals. ***, ***, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Beleche (2017). Turning to the lower part of Table 1, Time 3 × Treatment displays a positive coefficient and statistical significance for all the results. This signifies that for the treatment group, declaring the state of emergency improved preventive behaviors. Interestingly, Time 4 × Treatment exhibits a significant positive sign in all columns, suggesting that the early declaration of the state of emergency continued to have a larger effect even after the state of emergency was extended to the control group. We also observe that the coefficient of Time 5 × Treatment has a significant positive sign, except when Washing hands is the dependent variable. For the results of Preventive behaviors, the absolute values of the coefficients of the cross terms Time 3 × Treatment, Time 4 × Treatment, and Time 5 × Treatment were 0.29, 0.27, and 0.20, respectively. This implies that the effects of the early declaration persisted, although such effects diminished gradually. This is consistent with Correa et al. (2020). Overall, preventive behaviors were promoted under the state of emergency, and the early timing of its declaration enhanced the effects, which persisted even after deregulation.

We now turn to Table 2. Its upper part exhibits positive signs for Time 3 and Time 4, with statistical significance at the 1% level for all columns. Surprisingly, Time 5 has a negative sign with statistical significance, except when Anger is the dependent variable. This implies that the state of emergency had a detrimental effect on mental health. However, mental health remarkably improved once the state of emergency was deregulated, suggesting that the detrimental effect on mental health was temporary. The lower part of Table 2 shows a negative sign for Time 3 × Treatment that is statistically significant at the 1% level. Meanwhile, Time 4 × Treatment exhibits a positive sign that has no statistical significance in three of the four results. Time 5 × Treatment exhibits a positive sign, where two of the three results have statistical significance at the 10% level. These findings reveal that the state of emergency worsened mental health, while the timing of declaration was unlikely to influence mental health. The combined results of Tables 1 and 2 indicate that the early declaration of the state of emergency had a persistent effect of promoting preventive behaviors and only a temporary worsening effect on mental health.

We look at Tables 3 and 4 to examine how and to what extent the effects of the state of emergency differed between genders. Table 3 presents the estimated results for preventive behaviors, and Panels A and B show the results for males and females, respectively. In Panels A and B of Table 3, the upper part exhibits results similar to those in Table 1. In the lower part, Panels A and B show that Time 3 × Treatment, Time 4 × Treatment, and Time 5 × Treatment have significant positive signs in most cases. In particular, in the estimated results where preventive behaviors is the dependent variable, Time 3 × Treatment, Time 4 × Treatment, and Time 5 × Treatment show positive signs with statistical significance at the 1% level, which is consistent with the results in Table 1. The absolute values of Time 3 × Treatment for females are larger than those for males. Hence, as a whole, the declaration had more significant effects on females than on males. Washing hands for males is different from the other preventive behaviors in that it is less likely to be observed by other people. This seems to reduce the incentive for males to wash their hands. In other words, the statistical significance that is observed in females could mean that women may have an incentive to wash their hands even if other people are not observing their behavior. As Agiero and Beleche (2017) indicated, an exogenous health shock, such as a pandemic, facilitates the adoption of low-cost health behaviors, such as handwashing, which provides long-lasting effects on health outcomes. Therefore, it appears that for women, achieving the long-term effects of a general acceptance of handwashing in a society is important.

Table 4 presents the estimated results for mental health. The upper parts of Panels A and B of Table 3 exhibit results similar to those in Table 2. The lower part of Panel A shows significant positive signs for Time 3 × Treatment only when Mental health and Anger are the dependent variables. By contrast, Panel B shows a significant positive sign for Time 3 × Treatment except when Anger is the dependent variable. Similar to Table 2, the results for Time 4 × Treatment and Time 5 × Treatment are not...
statistically significant in most cases, which signify that the early declaration of the state of emergency did not influence mental health. We may interpret this as suggesting that an increase in anger in husbands could result in an increase in domestic violence against their wives, which was widely observed in various countries (WHO, 2020). Meanwhile, females were more likely to feel anxiety and fear than males, and this seemed to lead to mental illness. This could possibly cause social agitation. However, these negative effects on mental health did not persist. It should be noted that within R-square is around 0.01-0.02 in most cases in Tables 2 and 3 when “Anger” is the dependent variable. As shown earlier in Fig. 5, the comment trend assumption is not valid for “Anger.” Overall, the results of “Anger” are not reliable.

Overall, the declaration of a state of emergency not only had positive effects on preventive behaviors for mitigating the pandemic, but also negative effects on mental health, which could increase domestic violence and social unrest. However, the effects on preventive behaviors persisted and improved health conditions, whereas the effects on mental health were temporary.

Government regulation policies were observed to vary according to the culture and trust level in a country (Aghion et al., 2010; 2011; Alesina et al., 2015).11 That is, cultural differences between Japan and other countries might be the reason that Japan did not adopt a lockdown, which is more stringent than the state of emergency. We should consider such differences when evaluating the effectiveness of government policies in Japan.

4.2. Results using alternative control group

There were several prefectures in which the infection was serious, such as Kyoto. On April 16, 2020, six prefectures, Hokkaido, Aichi, Ibaragi, Ishikawa, Gifu, and Kyoto, were added to special alert prefectures in addition to the seven prefectures. The state of emergency was not declared on April 7, 2020, in these six prefectures. As an alternative specification, in addition to Hokkaido and Aichi, we include Ibaragi, Ishikawa, Gifu, and the control group.

As shown in the Appendix, Fig. A1 demonstrates a remarkable difference in infection cases per 100,000 between treatment and control groups, despite being statistically insignificant. Hence, it was not appropriate to compare the two groups. However, for the robustness check, we indicate Figs. A2 and A3, Tables A1 and A2. Here, we focus on preventive behaviors and mental health to consider overall preventive behaviors and mental health. Cursory examination of Figs. A2 and A3 shows the validity of the common trend assumption. These results are consistent with the main results. In Tables A1 and A2, we exhibit results when dependent variables are “Preventive behaviors” and “Mental health,” respectively. These results are similar to those of the main results. Overall, the estimation results of the main results are robust when an alternative control group is used.

4.3. Discussion

We found that the declaration of the state of emergency led people to practice preventive behaviors. In addition, an earlier declaration had a greater effect on preventive behaviors. There is a possibility that the rising number of people infected with COVID-19 leads people to practice preventive behaviors regardless of the declaration of the state of emergency because people could obtain information about its case from TV and website news. We have included Infected with COVID-19 as independent variables. In most cases, we did not observe a statistical significance of COVID-19 infections. This indicates that the rising number of people infected with COVID-19 hardly influences preventive behaviors. In our interpretation, the measurement error of Infected with COVID-19 leads to statistical significance partly due to the short supply for the polymerase chain reaction (PCR) test. In particular, during the study period, the PCR test was not sufficiently supplied Yomiuri News 2020a, Yomiuri News 2020b. It should be noted that the measurement error caused estimation biases.

It is critical to consider how the results of this study should be interpreted if the declarations were implemented simultaneously, as was the case with the second and third declarations in Japan. In fact, we do not have the data to answer this question. Our argument holds true only at the early stage when COVID-19 has not diffused throughout the country. China adopted strict regulations to prevent the spread of COVID-19, although mental health care is required to mitigate its negative effects (Xiang et al., 2020a). The optimal strategy changes as the situation changes.

After the period of this study, the Japanese government declared a state of emergency several times. It seems appropriate that the government implement the declarations in order of severity, then stagger the timing of the second and third places, if the marginal effect of the declaration differs according to the severity.

5. Conclusion

Government policies should be analyzed and evaluated considering their costs and benefits. This study examined how the declaration of a state of emergency for COVID-19 changed preventive behaviors and mental health in Japan. While Japan was experiencing the COVID-19 pandemic from March to June 2020, this study conducted Internet surveys for constructing panel data to investigate changes in individuals’ practice of preventive behaviors and their mental health. The same respondents were surveyed at different times. The DID method was used to explore the impact of the COVID-19 state of emergency declared by the government. The key findings are: (1) The declaration led people to practice preventive behaviors such as staying at home, wearing masks, and washing hands but also generated anger, fear, and anxiety. (2) The effect of the state of emergency on the promotion of preventive behaviors persisted even after its deregulation. (3) An early (vs. late) declaration of the state of emergency had a larger effect on preventive behavior, and the gap in people’s behaviors when comparing early vs. late declaration persisted not only during the state of emergency but also after its deregulation. Lastly, (4) the effect of the state of emergency on mental health diminished during the state of emergency and disappeared after its deregulation.

An increase in anger from staying indoors is thought to increase depression and worsen mental health, which eventually causes domestic violence. However, the deterioration of mental health was temporary, while the practice of preventive behaviors, especially washing hands and wearing masks, lasted even after deregulation of the state of emergency. Our findings suggest that the state of emergency is beneficial, considering the effects on mental health and preventive behaviors. However, undergoing a state of emergency has caused the economy to enter a period of stagnation. Thus, it is necessary to evaluate government policies based on a cost–benefit analysis with a long-term perspective. We argue that an early declaration of a state of emergency is more likely to cause citizens to acquire the habits of washing hands and wearing masks. The findings of this study are consistent with the case of long-lasting preventive behaviors that resulted from the 2009 H1N1 influenza outbreak in Mexico, which improved people’s health status after 2009 (Agüero and Beleche, 2017). Our findings suggest that early intervention plays a key role in facilitating preventive behaviors to take a firm hold in society, which may improve economic efficiency by promoting public health. Accordingly, earlier intervention is likely to

11 A key implication of the model is that individuals in low-trust countries want more government intervention even though they know the government is corrupt (Aghion et al., 2010). State regulation of labour markets is negatively correlated with the degree of cooperation in the economy (Aghion et al., 2010). Individuals with strong family ties support more stringent labour market regulations, even though regulations generate higher unemployment and lower income (Alesina et al., 2015).
promote growth more expeditiously after the pandemic is over (Agüero and Beleche, 2017).

Due to the lack of a long-term panel dataset, we cannot explore whether our inference, as discussed above, holds true. To consider in depth the effects of undergoing a state of emergency, we should continue to collect data. Further research should investigate these aspects to scrutinize whether the Japanese government’s policy is more effective and efficient than policies adopted by the United States, the United Kingdom, France, Italy, and Spain. In addition, it is necessary to explore why Japan did not adopt more stringent measures, such as a lockdown, by considering differences in the culture and the level of social trust in Japan and other countries. This is a remaining issue to be addressed in future studies.

Appendix

![Fig. A1. Comparison of the mean values of COVID-19 infection case per 100,000 for each group. Alternative control group is used. Note: We use the number of COVID-19 infection cases per 100,000 people as a proxy for the degree of spread of COVID-19. We illustrated Fig. A1 using proxy values from April 1 to April 7, 2020. Error bars represent 95% confidence intervals. Comparison of the mean number of people infected with COVID-19 in each group Treatment group consists of Tokyo, Kanagawa, Saitama, Chiba, Osaka, Hyogo, Fukuoka. The control group consisted of Hokkaido, Aichi, Kyoto, Gifu, Ishikawa, and Ibaragi. The Fig. A2 correspond to Mental health in Fig. 5.](image)

![Fig. A2. Changes in the mean values of proxy variables for mental health. Note: The solid line indicates the treatment group, whereas the dashed line denotes the control group. The control group consisted of Hokkaido, Aichi, Kyoto, Gifu, Ishikawa, and Ibaragi. The Fig. A2 correspond to Mental health in Fig. 5.](image)

![Table A1](image)

| With dummies | (1) Male and Female | (2) Male | (3) Female |
|--------------|-------------------|---------|-----------|
| Before the state of emergency | 0.34*** | 0.33*** | 0.35*** |
| Time 3 | (0.02) | (0.02) | (0.02) |
| Time 4 | 0.63*** | 0.67*** | 0.60*** |
| Time 5 | (0.02) | (0.03) | (0.03) |
| Infected with COVID-19 | 0.01 | 0.003 | 0.02* |
| Within R-Square | 0.24 | 0.25 | 0.24 |

Note: Numbers in parentheses indicate robust standard errors clustered by individual. ***, ***, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The results of column (1) correspond to column (1) in Table 1. The results of columns (2) and (3) correspond to column (1) in Panels A and B of Table 3, respectively. The control group consisted of Hokkaido, Aichi, Kyoto, Gifu, Ishikawa, and Ibaragi.
Table A2
Results using alternative control groups. Dependent variables: Mental health (Fixed-effects model).

|                             | With dummies (1) Male and Female | With dummies and its cross term |
|-----------------------------|----------------------------------|---------------------------------|
| Before the state of emergency |                                  |                                 |
| Time 3                      | 0.31***                          |                                 |
|                             | (0.02)                           |                                 |
| Time 4                      | 0.12***                          |                                 |
|                             | (0.03)                           |                                 |
| Time 5                      | −0.11***                         |                                 |
|                             | (0.03)                           |                                 |
| Infected with COVID-19      | 0.01                             |                                 |
|                             | (0.01)                           |                                 |
| Within R-Square             | 0.06                             | 0.05                             |
|                             | (0.01)                           | (0.01)                          |
| Before the state of emergency |                                  |                                 |
| Time 3 × Treatment          | 0.12**                           | 0.10*                           |
|                             | (0.04)                           | (0.05)                          |
| Time 4 × Treatment          | 0.05                             | 0.04                             |
|                             | (0.04)                           | (0.06)                          |
| Time 5 × Treatment          | 0.05                             | 0.08                             |
|                             | (0.05)                           | (0.06)                          |
| Time 3                      | 0.28***                          | 0.29***                         |
|                             | (0.04)                           | (0.05)                          |
| Time 4                      | 0.14***                          | 0.17***                         |
|                             | (0.04)                           | (0.05)                          |
| Time 5                      | −0.09**                          | −0.003                          |
|                             | (0.04)                           | (0.05)                          |
| Infected with COVID-19      | 0.002                            | 0.006                           |
|                             | (0.01)                           | (0.01)                          |
| Within R-Square             | 0.06                             | 0.05                             |
|                             | (0.01)                           | (0.01)                          |
| Obs.                        | 1,893                            | 940                             |
| Groups                      | 9,437                            | 4,486                           |
|                             |                                   | 4,751                           |

Note: Numbers in parentheses indicate robust standard errors clustered by individual. *** and ** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The results of column (1) correspond to column (1) in Table 2. The results of columns (2) and (3) correspond to column (1) in Panels A and B of Table 4, respectively. The control group consisted of Hokkaido, Aichi, Kyoto, Gifu, Ishikawa, and Ibaragi.

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