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Sociodemographic factors and self-restraint from social behaviors during the COVID-19 pandemic in Japan: A cross-sectional study

Takahiro Mori [a], Tomohisa Nagata [a], Kazunori Ikegami [b], Ayako Hino [c], Seiichiro Tateishi [d], Mayumi Tsuji [e], Shinya Matsuda [f], Yoshihisa Fujino [g], Koji Mori [a,*], for the CORoNaWork project

[a] Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan
[b] Department of Work Systems and Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan
[c] Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan
[d] Disaster Occupational Health Center, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan
[e] Department of Environmental Health, School of Medicine, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan
[f] Department of Public Health, School of Medicine, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan
[g] Department of Environmental Epidemiology, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan

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ABSTRACT

The control of human flow has led to better control of COVID-19 infections. Japan's state of emergency, unlike other countries, is not legally binding but is rather a request for individual self-restraint; thus, factors must be identified that do not respond to self-restraint, and countermeasures considered for those factors to enhance its efficacy. We examined the relationship between sociodemographic factors and self-restraint toward social behaviors during a pandemic in Japan. This cross-sectional study used data for February 18–19, 2021, obtained from an internet survey; 19,560 participants aged 20–65 were included in the analysis. We identified five relevant behaviors: (1) taking a day trip; (2) eating out with five people or more; (3) gathering with friends and colleagues; (4) shopping for other than daily necessities; (5) shopping for daily necessities. Multilevel logistic regression analyses were used to examine the relationship between sociodemographic factors and self-restraint for each of the behaviors. Results showed that for behaviors other than shopping for daily necessities, women, those aged 60–65, married people, highly educated people, high-income earners, desk workers and those who mainly work with interpersonal communication, and those with underlying disease reported more self-restraint. Older people had less self-restraint than younger people toward shopping for daily necessities; an underlying disease had no effect on the identified behavior. Specialized interventions for these groups that include recommendations for greater self-restraint may improve the efficacy of the implementing measures that request self-restraint.

1. Introduction

Legally binding lockdown policies have been implemented in many countries in response to the spread of coronavirus disease 2019 (COVID-19) infections, which has led to the control of human flow and thus to improved control of infection transmission. In China, the first lockdown reduced inflows to the city of Wuhan by 76%, outflows by 56%, and movement within Wuhan by 54% (Fang et al., 2020). In Italy, lockdown

Abbreviations: COVID-19, Coronavirus disease 2019; CORoNaWork, Collaborative Online Research on the Novel-coronavirus and Work; JPY, Japanese yen; OR, Odds ratio.

* Corresponding author.
E-mail address: kmori@med.uoeh-u.ac.jp (K. Mori).

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reduced interstate travel by 40% and the radius of action in daily life by 49% (Pepe et al., 2020); in France, the overall movement of people decreased by 65% (Pullano et al., 2020). Using longitudinal data from 202 countries, Aflano and Ercolano showed that controlling human flow via lockdowns reduced the number of newly infected people (Alfano and Ercolano, 2020).

Japan's state of emergency is not legally binding, unlike many other countries' measures, but is rather a request for self-restraint. Therefore, infection control is left to the discretion of the individual. Japan's state of emergency has been declared four times since the beginning of the COVID-19 pandemic: from April to May 2020, from January to March 2021, from April to June 2021, and from July to September 2021 (Minister, 2022). In addition; Japan has a unique measure called a quasi-state of emergency, which is issued before a state of emergency for the purpose of preventing the spread from a specific area where infection has tended to worsen or after a state of emergency to prevent the rebound of infection situation. Regarding the request for self-restraint, there is almost no difference between a quasi-state of emergency and a state of emergency (Secretariat, 2022). When Japan's government declares a state of emergency; the citizens are required to refrain from unnecessary and nonurgent social behaviors, including traveling, eating and drinking at a restaurant for extended periods of time, and socializing with groups of more than five people (Secretariat, 2022). However; in the first state of emergency, when sufficient information about COVID-19 was not available, the government sought to forestall an emergency by prohibiting at least 70% of all people from going out of their homes (Minister, 2022). As a result; movement across prefectures was suppressed by about 50% to 70% throughout Japan (Secretariat, 2022).

The impact of sociodemographic factors on social behaviors—specifically the act of leaving one's home to visit public spaces—during lockdowns has been investigated mainly in Western countries. It has been reported that women (Caselli, 2019; Andersen et al., 2020; Barari et al., 2021; Gouin et al., 2021; Coroiu et al., 2020; Gualda et al., 2021; Turk et al., 2021; Park et al., 2020; Clark et al., 2020; Smith et al., 2020), highly educated people, and high-income individuals (Barari et al., 2021; Al Zabadi et al., 2021; Papageorge et al., 2021; Iio et al., 2021) are more likely to refrain from going out during a lockdown. Whether a person is married or lives with their family (Gouin et al., 2021; Smith et al., 2020; Al Zabadi et al., 2021), and whether or not they have a pre-existing condition (Coroiu et al., 2020; Papageorge et al., 2021), are reportedly not associated with social behaviors during a lockdown. Reports implicating age vary: many show that older people refrain from going out more than younger people (Coroiu et al., 2020; Gouin et al., 2021; Gualda et al., 2021; Pullano et al., 2020; Barari et al., 2021), while others indicate the reverse (Caselli, 2019; Andersen et al., 2020).

During the first state of emergency in Japan, reports noted that women and young people, lower-income individuals, people living with two or more others, unemployed people, and those with a chronic disease were the least likely to leave their homes (Hanibuchi et al., 2021; Watanabe and Yabu, 2021). However, to our knowledge, the relationship between sociodemographic factors and self-restraint from social behaviors has not been investigated in Japan since the second and subsequent emergency declarations.

We hypothesized that the sociodemographic factors that affect the self-restraint of social behaviors in the second and subsequent states of emergency would be similar to the studies during the first state of emergency in Japan (Hanibuchi et al., 2021; Watanabe and Yabu, 2021). However, valid information on COVID-19 has been available over time and the public's response to the second and subsequent states of emergency has gradually declined (Secretariat, 2022). It is therefore necessary to investigate whether the factors that do not respond to the request have changed from the first states of emergency to the second to enhance the efficacy of those measures. The purpose of this study was to examine the relationship between sociodemographic factors and the self-restraint of social behaviors during the second state of emergency in Japan.

2. Methods

2.1. Study design and participants

We conducted a cross-sectional study using data from the Collaborative Online Research on the Novel-coronavirus and Work (CORoNaWork) that was collected on February 18 and 19, 2021. This survey was conducted as a self-administrated questionnaire via the Internet. The CORoNaWork study started in December 2020 and recruited participants aged 20–65 years old who had employment contracts. Respondents were sampled considering region, occupation, and gender. The region divided 47 prefectures into five levels according to the level of COVID-19 infection. Occupations were divided into office workers and non-office workers. The participants were collected equal numbers from across 20 collection units of five regions. Out of a total of 33,302 people who participated in December 2020, 19,560 were included in our analysis, after excluding non-responders, those who gave invalid or incorrect answers, and unemployed people at the time of our survey. Invalid or incorrect answers included response time < 6 min, answers not in the range of 20–65 years old, body weight < 30 kg, height < 140 cm, inconsistent answers to similar questions, and wrong answers to a question used solely to identify unreliable responses. Details of the study protocol have been previously reported (Fujino et al., 2021).

The first state of emergency was declared in all prefectures, whereas the second and subsequent declarations were given only in those prefectures where the infection situation was worsening. Importantly, instances of citizens going out of their homes were considerably suppressed not only in those prefectures in which a state of emergency was declared, but also in prefectures in which no declaration was made (Watanabe and Yabu, 2021; Cabinet Secretariat, 2022). Therefore, the second declaration was given in 11 of 47 prefectures, but this survey targeted respondents from all prefectures.

The present study was approved by the Ethics Committee of the University of Occupational and Environmental Health, Japan (Approval numbers: R2-079 and R3-006). Informed consent was obtained in the form of the website from all participants.

2.2. Assessment of social behaviors

We identified five distinct types of social behavior during a state of emergency; these reflect the Japanese government's request for self-restraint (Secretariat, 2022): (1) taking a day trip; (2) eating out with five people or more; (3) gathering with friends and colleagues; (4) shopping for other than daily necessities; (5) shopping for daily necessities. We asked the participants about the changes in each of the five behaviors before and after the second state of emergency as follows. "Has your self-restraint changed in response to the second state of emergency in January 2021?" Respondents chose one of the following five options: "greatly increased," "increased a little," "no change," "decreased a little," or "greatly decreased." We created a binary variable by defining "decreased a little" or "greatly decreased" as having self-restraint, and the other options as not having self-restraint.

2.3. Assessment of sociodemographic factors

We investigated gender, age, education, marital status, household income, job type, and underlying disease. Age was classified into five groups: 20–29, 30–39, 40–49, 50–59, and 60–65 years old. Education was classified into three categories: junior high or high school, vocational school or college, and university or graduate school. Marital status was classified into three categories: married, divorced or widowed, and never married. Annual household income was classified into four groups: $<$4.00 million Japanese yen (JPY); 4.00–5.99 million JPY; 6.00–8.99 million JPY; and $\geq$9.00 million JPY (1 USD was equal to 109.75 JPY in 2021 conversion rates) (OECD, 2022). Job type was classified into three categories: mainly desk work, jobs mainly involving

interpersonal communication, mainly physical work. Regarding underlying disease, we asked the question, "Do you have any disease that requires regular visits to the hospital or treatment?" Participants selected one of the following: "I do not have such a disease," "I have such a disease," or "I have such a disease, but refrained from going to the hospital following the second state of emergency." We rated the participants who answered, "I do not have such a disease" as "No" and the remaining two answers as "Yes.".

2.4. Statistical analyses

We examined the relationship between sociodemographic factors and self-restraint in each of the five identified social behaviors after the second state of emergency. Odds ratios (ORs) of crude model and multivariate model were estimated with a multilevel logistic model nested in the prefecture of residence because of the influence of regional differences in the infection status of COVID-19. The multivariate model was adjusted for age, gender and prefectures with and without the second state of emergency. We also conducted a trend test with age and household income as continuous variables. A p-value of less than 0.05 was considered statistically significant. All analyses were conducted using Stata Statistical Software (Release 16; StataCorp LLC, College Station, TX, USA).

3. Results

Table 1 shows the characteristics of participants. A total of 19,560 people (10,978 men and 8,582 women) were analyzed. The proportion of those who refrained from going out during the state of emergency were: taking a day trip (11,661: 59.6%), eating out with five people or more (11,447: 58.5%), gathering with friends and colleagues (12,936: 66.1%), shopping for other than daily necessities (8,668: 44.3%), and shopping for daily necessities (5,392: 27.6%).

Table1
Characteristics of participants.

	Total (n = 19560)	
	n	%
Gender		
Men	10,978	56.1
Age (years)		
20–29	989	5.1
30–39	3111	15.9
40–49	5776	29.5
50–59	7041	36.0
60–65	2643	13.5
Marital status		
Never married	6561	33.5
Divorced or widowed	2001	10.2
Married	10,998	56.2
Education		
Junior high or high school	5247	26.8
Vocational school or college	4495	23.0
University or graduate school	9818	50.2
Annual household income (JPY)		
<4.00 million	4219	26.1
4.00–5.99 million	4688	24.0
6.00–8.99 million	5295	27.1
≥9.00 million	4467	22.8
Job type		
Mainly desk work	10,379	53.1
Jobs mainly involving interpersonal communication	4562	23.3
Mainly physical labor	4619	23.6
Underlying disease		
Yes	6465	33.1
Self-restraint from taking a day trip		
Yes	11,661	59.6
Self-restraint from eating out with five people or more		
Yes	11,447	58.5
Self-restraint from gathering with friends and colleagues		
Yes	12,936	66.1
Self-restraint from shopping for other than daily necessities		
Yes	8668	44.3
Self-restraint from shopping for daily necessities		
Yes	5392	27.6

JPY, Japanese yen.

Table 2 and Table 3 show the relationship between sociodemographic factors and self-restraint from social behaviors during a state of emergency. In a multivariate model (Table 3), women had higher ORs than men for self-restraint from taking a day trip (OR 1.42), eating out with five people or more (OR 1.31), gathering with friends and colleagues (OR 1.54), shopping for other than daily necessities (OR 1.79), and shopping for daily necessities (OR 1.51). Compared with those aged 20–29, those aged 50–59 had a higher OR for self-restraint from gathering with friends and colleagues (OR 1.22), and those aged 60–65 had higher ORs for self-restraint from eating out with five people or more (OR 1.26), gathering with friends and colleagues (OR 1.61), and shopping for other than daily necessities (OR 1.18). However, regarding shopping for daily necessities, those aged 50–59 had a lower OR than those aged 20–29 (OR 0.83), and the trend test was significant. Married people had higher ORs for self-restraint from all behaviors than people who had never been married. Highly educated people and high-income earners considerably refrained from going out except for shopping for daily necessities. Compared with those whose job entailed mainly desk work, people with jobs mainly involving interpersonal communication had a higher OR for self-restraint from taking day trips (OR 1.09), while people whose jobs entailed mainly physical work had lower ORs for self-restraint from going out, except for shopping for daily necessities. People who had an underlying disease had higher ORs for self-restraint from going out, except for shopping for daily necessities.

4. Discussion

We investigated the relationship between sociodemographic factors and self-restraint from social behaviors after the second state of emergency in Japan. The results showed that the most self-restraint was reported with respect to going out aside from shopping for daily necessities, which are regarded as unnecessary and nonurgent social behaviors, by the following groups: women, those aged 60–65, married people, highly educated people, high-income earners, desk workers and those who mainly work with interpersonal communication, and those with an underlying disease. By contrast, women, older people, married people, and high-income earners reported substantial self-restraint from shopping for daily necessities (as much as that for other types of outings). No difference was observed for educational background, job type, or presence of underlying disease. Our findings suggest that it is necessary to consider measures to increase individuals' self-restraint during states of emergency toward both unnecessary and nonurgent social behaviors and shopping for daily necessities which is unavoidable to some extent.

Our hypothesis that the results would be similar to the studies during the first state of emergency in Japan was partly correct; that women, married people, people living with others, and those with a chronic disease refrained the most from going out. However, our results differed in terms of age and income class (Hanibuchi et al., 2021; Watanabe and Yabu, 2021). Our study was conducted approximately one year after a COVID-19 infection was first reported in Japan (Amengual and Atsumi, 2021); and since then, a lot more information on COVID-19 has been accumulated. Thus, it was possible for people to judge whether to refrain from social behaviors, a situation unlike the investigations during the first state of emergency (Hanibuchi et al., 2021; Watanabe and Yabu, 2021).

Our findings are also consistent with other countries' reports with respect to gender, age, educational background, and income, but differ slightly with respect to marriage and underlying diseases. According to the COVID-19 Stringency Index, which indexes the strength of each country's infection control, Japan ranks considerably lower than China,

Table 2
Odds ratio for the relationship between sociodemographic factors and self-restraint from social behaviors during a state of emergency in a crude model.

	Self-restraint from taking a day trip			Self-restraint from eating out with five people or more			Self-restraint from gathering with friends and colleagues			Self-restraint from shopping for other than daily necessities			Self-restraint from shopping for daily necessities		
	OR	95% CI	*P* value	OR	95% CI	*P* value	OR	95% CI	*P* value	OR	95% CI	*P* value	OR	95% CI	*P* value
Gender															
Men	1.00			1.00			1.00			1.00			1.00		
Women	1.40	1.32–1.48	<0.001	1.25	1.18–1.32	<0.001	1.40	1.32–1.49	<0.001	1.76	1.67–1.87	<0.001	1.58	1.48–1.68	<0.001
Age (years)															
20–29	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†
30–39	0.97	0.83–1.12	0.647	0.95	0.82–1.10	0.476	1.00	0.86–1.16	0.997	0.99	0.86–1.14	0.870	0.92	0.79–1.07	0.270
40–49	0.83	0.72–0.96	0.011	0.88	0.76–1.01	0.061	0.94	0.82–1.09	0.406	0.86	0.75–0.98	0.023	0.79	0.69–0.91	0.002
50–59	0.77	0.67–0.88	<0.001	0.86	0.75–0.99	0.035	0.96	0.83–1.11	0.576	0.74	0.65–0.85	<0.001	0.66	0.57–0.77	<0.001
60–65	0.92	0.79–1.07	0.258	1.05	0.91–1.22	0.508	1.20	1.02–1.40	0.025	0.79	0.68–0.92	0.002	0.65	0.55–0.76	<0.001
Marital status															
Never married	1.00			1.00			1.00			1.00			1.00		
Divorced or widowed	1.11	1.01–1.23	0.036	1.16	1.05–1.28	0.004	1.22	1.10–1.35	<0.001	0.98	0.89–1.08	0.700	1.04	0.93–1.16	0.502
Married	1.34	1.25–1.42	<0.001	1.41	1.32–1.50	<0.001	1.38	1.29–1.47	<0.001	1.07	1.01–1.14	0.024	1.04	0.97–1.11	0.274
Education															
Junior high or high school	1.00			1.00			1.00			1.00			1.00		
Vocational school or college	1.46	1.35–1.58	<0.001	1.44	1.33–1.56	<0.001	1.46	1.34–1.59	<0.001	1.42	1.31–1.54	<0.001	1.18	1.08–1.29	<0.001
University or graduate school	1.38	1.29–1.48	<0.001	1.51	1.41–1.61	<0.001	1.44	1.34–1.54	<0.001	1.29	1.20–1.38	<0.001	1.03	0.95–1.11	0.436
Annually household income (JPY)															
<4.00 million	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		0.003†
4.00–5.99 million	1.24	1.15–1.35	<0.001	1.26	1.16–1.36	<0.001	1.30	1.20–1.41	<0.001	1.14	1.05–1.23	0.002	1.09	1.00–1.19	0.063
6.00–8.99 million	1.60	1.48–1.73	<0.001	1.63	1.50–1.76	<0.001	1.60	1.48–1.74	<0.001	1.27	1.17–1.37	<0.001	1.18	1.08–1.28	<0.001
≥9.00 million	1.71	1.57–1.86	<0.001	1.89	1.73–2.05	<0.001	1.82	1.67–1.98	<0.001	1.29	1.19–1.40	<0.001	1.09	0.99–1.19	0.075
Job type															
Mainly desk work	1.00			1.00			1.00			1.00			1.00		
Jobs mainly involving interpersonal communication	1.10	1.02–1.18	0.009	1.04	0.97–1.12	0.269	1.07	0.99–1.15	0.087	1.02	0.95–1.09	0.675	1.00	0.92–1.08	0.958
Mainly physical labor	0.78	0.73–0.83	<0.001	0.70	0.65–0.75	<0.001	0.73	0.68–0.78	<0.001	0.80	0.74–0.85	<0.001	0.93	0.86–1.01	0.086
Underlying disease															
No	1.00			1.00			1.00			1.00			1.00		
Yes	1.08	1.02–1.15	0.013	1.11	1.05–1.18	0.001	1.14	1.07–1.21	<0.001	1.00	0.94–1.06	0.969	0.90	0.84–0.96	0.003

OR, odds ratio; CI, confidence interval; JPY, Japanese yen.

Table 3
Odds ratio for the relationship between sociodemographic factors and self-restraint from social behaviors during a state of emergency in a multivariate model.

	Self-restraint from taking a day trip			Self-restraint from eating out with five people or more			Self-restraint from gathering with friends and colleagues			Self-restraint from shopping for other than daily necessities			Self-restraint from shopping for daily necessities		
	OR*	95% CI	*P* value	OR*	95% CI	*P* value	OR*	95% CI	*P* value	OR*	95% CI	*P* value	OR*	95% CI	*P* value
Gender															
Men	1.00			1.00			1.00			1.00			1.00		
Women	1.42	1.34–1.52	<0.001	1.31	1.23–1.39	<0.001	1.54	1.44–1.65	<0.001	1.79	1.68–1.91	<0.001	1.51	1.41–1.61	<0.001
Age (years)															
20–29	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		0.049	1.00		0.007
30–39	1.01	0.87–1.18	0.865	0.98	0.85–1.14	0.807	1.06	0.91–1.24	0.435	1.07	0.92–1.23	0.372	0.97	0.83–1.13	0.669
40–49	0.95	0.82–1.09	0.457	0.96	0.84–1.11	0.616	1.11	0.96–1.28	0.171	1.06	0.92–1.21	0.427	0.92	0.79–1.06	0.241
50–59	0.93	0.81–1.07	0.324	1.00	0.87–1.15	0.977	1.22	1.06–1.42	0.007	1.02	0.89–1.18	0.730	0.83	0.71–0.96	0.012
60–65	1.16	0.99–1.36	0.066	1.26	1.07–1.47	0.004	1.61	1.36–1.89	<0.001	1.18	1.01–1.37	0.038	0.85	0.72–1.01	0.060
Marital status															
Never married	1.00			1.00			1.00			1.00			1.00		
Divorced or widowed	1.12	1.01–1.24	0.035	1.14	1.03–1.26	0.015	1.14	1.02–1.27	0.019	0.96	0.86–1.07	0.457	1.09	0.97–1.22	0.155
Married	1.53	1.43–1.63	<0.001	1.53	1.43–1.64	<0.001	1.51	1.41–1.62	<0.001	1.28	1.20–1.37	<0.001	1.24	1.15–1.34	<0.001
Education															
Junior high or high school	1.00			1.00			1.00			1.00			1.00		
Vocational school or college	1.35	1.24–1.47	<0.001	1.37	1.26–1.48	<0.001	1.35	1.24–1.47	<0.001	1.25	1.15–1.36	<0.001	1.07	0.97–1.17	0.168
University or graduate school	1.42	1.32–1.52	<0.001	1.55	1.44–1.66	<0.001	1.50	1.40–1.61	<0.001	1.35	1.26–1.45	<0.001	1.05	0.97–1.14	0.200
Annually household income (JPY)															
<4.00 million	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†	1.00		<0.001†
4.00–5.99 million	1.30	1.20–1.41	<0.001	1.30	1.20–1.41	<0.001	1.37	1.26–1.49	<0.001	1.21	1.12–1.31	<0.001	1.14	1.04–1.25	0.004
6.00–8.99 million	1.69	1.56–1.83	<0.001	1.70	1.57–1.84	<0.001	1.71	1.57–1.85	<0.001	1.38	1.27–1.49	<0.001	1.25	1.15–1.37	<0.001
≥9.00 million	1.84	1.69–2.00	<0.001	1.98	1.82–2.15	<0.001	1.94	1.77–2.12	<0.001	1.44	1.33–1.57	<0.001	1.19	1.08–1.31	<0.001
Job type															
Mainly desk work	1.00			1.00			1.00			1.00			1.00		
Jobs mainly involving interpersonal communication	1.09	1.01–1.17	0.023	1.04	0.96–1.11	0.331	1.06	0.99–1.15	0.111	0.99	0.92–1.06	0.814	0.97	0.90–1.05	0.486
Mainly physical labor	0.80	0.74–0.86	<0.001	0.71	0.67–0.77	<0.001	0.76	0.70–0.81	<0.001	0.83	0.77–0.89	<0.001	0.96	0.89–1.04	0.297
Underlying disease															
No	1.00			1.00			1.00			1.00			1.00		
Yes	1.13	1.06–1.20	<0.001	1.13	1.06–1.20	<0.001	1.15	1.08–1.23	<0.001	1.08	1.01–1.15	0.021	0.98	0.91–1.05	0.525

*Adjusted for age, gender and prefectures with and without the second state of emergency.
OR, odds ratio; CI, confidence interval; JPY, Japanese yen.

European countries, and the United States (Blavatnik school of school of government, 2022). Japan's state of emergency is not legally binding, so it is up to the individual to respond to requests for self-restraint, a factor that may help explain the differences between Japan's and other countries' in some aspects of their respective reports.

Self-restraint from social behaviors is influenced by the risk perception regarding infectious diseases (Brewer et al., 2004, 2007; Weston et al., 2018), including an awareness of the possibility and severity of infection (Brewer et al., 2007). More specifically, it has been reported that awareness of potential severity easily leads to self-restraint in socializing behaviors (Farooq et al., 2020; Okuhara et al., 2020). Concerns about not only one's own health but also the health of family and friends reportedly affect this self-restraint (Turk et al., 2021).

4.1. Unnecessary and nonurgent social behaviors

One of the reasons women refrained from social behaviors more than men was likely the influence of risk perception. It is reported that women have a higher risk perception for various hazards (Brug et al., 2009; Flynn et al., 1994). Furthermore, women are more likely to actively collect information on COVID-19 (Muto et al., 2020), and generally spend more time raising children and caring elderly family than men, especially during the COVID-19 pandemic (Sakuragi et al., 2021). Therefore, they may concern not only about being infected themselves but also about their children and elderly family being infected, which may increase their risk-avoidance.

The fact that those aged 60–65 years old refrained from going out is arguably also an indication of risk perception, given the data that show elderly people are more likely to become severely ill if they contract COVID-19 (Centers for Disease Control and Prevention, 2022). Indeed, the government and the media reported on this daily, emphasizing that many serious illnesses and deaths were experienced largely by elderly people, which may have contributed to the increased risk perception among the elderly population. For example, the substantial self-restraint in this group toward eating out with five or more people and gathering with friends and colleagues, may reflect their concern about being infected and transmitting the virus to their peers, who might then become seriously ill.

Other groups who evidenced higher risk perception (in the form of self-restraint) were: married people, highly educated and high-income earners, desk workers and those who mainly work with interpersonal communication, and those with an underlying disease. Married people are likely aware of their domestic situation as an infection route (Koh et al., 2020; Miyahara et al., 2021) and thus pay more attention to the possible ways in which their family members may become infected, in addition to their own infection risk, which may have contributed to their self-restraint. The self-restraint behaviors of the highly educated and the high-income earners may be explained by their generally high health literacy, which conceivably stems from their ability and desire to actively collect and select valid information (Lastrucci et al., 2019; Lee et al., 2010; Tokuda et al., 2009), resulting in increased risk perception and the adoption of behaviors that protect them from COVID-19 (Flynn et al., 1994). For many people whose jobs involve mainly desk work, they are often able to work from home, which is part of the recommended infection control measures and may therefore raise their risk perception. Even in workplaces where people engage in interpersonal communication, measures against infection have been strengthened to avoid infecting customers as well as employees. One report showed that infection control measures in the workplace cause individuals to strengthen their own protective measures (Kawasumi et al., 2021); thus, such workplace measures may naturally raise an individual worker's risk perception. Finally, people with an underlying disease are at an increased risk of becoming more severely ill if they contract COVID-19 (Centers for Disease Control and Prevention, 2022), information that is, at least in Japan, repeatedly disseminated by the government and experts, which may have raised their risk perception.

4.2. Shopping for daily necessities

Our results showed that, in contrast to younger people, older people did not refrain from shopping for daily necessities, and we observed no difference in this behavior between those with and those without an underlying disease; this was unlike all other self-restraint scenarios in this study. One of the reasons for this may have been that they are not as aware of the risk of getting infected while shopping as other social behaviors. One study reported that young people adhered more closely to the set shopping time (Turk et al., 2021), which indicates that young people may be more aware that shopping areas can be crowded and thus the risk of infection may be high. Another reason is that older people are less likely to use online shopping for those items or to use a food delivery service (Statistics Bureau of Japan, 2022). Furthermore, it is possible that shopping provided a community place for those older participants.

Women, married people, and high-income earners may be more aware of the risk of infection associated with shopping like other social behaviors. Furthermore, high-income groups and people living with family were more likely to shop online (Turk et al., 2021; Statistics Bureau of Japan, 2022), which helps explain how they can refrain from go shopping.

4.3. Implementation

During states of emergency in Japan, interventions to improve self-restraint behaviors to the groups lacking self-restraint toward unnecessary and nonurgent outings, such as men, young to middle-aged people, the less-educated, and those who do mainly physical work, are required. More specifically, interventions should draw on reports showing that trust in government and media influences risk perception (Ye and Lyu, 2020), and especially, information about the infection situation, including measures by the government, daily reports on the number of infected people and deaths, has a great impact on self-restraint behaviors (Watanabe and Yabu, 2021). Therefore, it is important to take the group characteristics into account when considering the content and distribution channels of the information that is shared with the public.

For example, men are at higher risk of becoming more severely ill with COVID-19 than women (Gebhard et al., 2020; Kragholm et al., 2021), and those aged 40–59 are at higher risk of becoming more severely ill than younger people (Centers for Disease Control and Prevention, 2022); thus it is necessary, to actively communicate these specific risks for certain groups of becoming more severely ill. People with less education and lower incomes have lower health literacy (Lastrucci et al., 2019; Lee et al., 2010; Tokuda et al., 2009), so it is important to send out simple, easy-to-understand information. Furthermore, because so much incorrect information continues to circulate, it is important to show how to identify correct information and thus avoid hindering effective responses and creating confusion and mistrust (World Health Organization).

As examples of the routes to be considered for the dissemination of information, middle-aged and older people tend to obtain and trust information about COVID-19 from television and newspapers, while younger people tend to obtain and trust information from the Internet and social networking services (Muto et al., 2020). For people who mainly do physical work, it is important to actively disseminate information in the workplace.

With respect to shopping for daily necessities, we think it is necessary to recommend online shopping for elderly people and for people with an underlying disease, and to consider service methods that can be easily used even by people who are not familiar with information technology. We also think that it is necessary to disseminate information that encourages healthy people to do the necessary shopping rather than those whose health is compromised. However, because shopping for daily necessities entails an unavoidable outing to some extent, finding ways to avoid crowded places is also important; this could be accomplished by

dividing shopping time by age and limiting the number of people who go shopping.

4.4. Limitations

This study had some limitations. First, we conducted an internet survey, which includes the possibility of selection bias. To reduce the potential bias, sampling was balanced by gender, occupation, and area of residence. Second, self-restraint from social behaviors was measured via subjective evaluations; moreover, the specific degree of self-restraint was not investigated. In addition, we did not know how much social behaviors each participant had before the second state of emergency. Before the second declaration, the people's outings were generally returning to the level before the COVID-19 pandemic (Secretariat, 2022), but it is possible that some participants answered that they had not changed after the second declaration because they had originally refrained from social behaviors. Third, this study was cross-sectional in nature. Our results are different from the studies during the first state of emergency in Japan (Hanibuchi et al., 2021; Watanabe and Yabu, 2021), so it is possible that the results will continue to change over time. Further investigation is required for the time period covering the third and subsequent state of emergency.

5. Conclusions

Self-restraint from social behaviors during a pandemic is an important concept for developing measures to prevent the spread of infectious diseases. Our results showed that the groups who had the least self-restraint in unnecessary and nonurgent contexts were men, young to middle-aged people, people who had never been married, people with less education, people with lower incomes, and people whose work was mainly physical. Regarding shopping for daily necessities, older people had low self-restraint. Interventions designed specifically for these groups that recommend self-restraint from social behaviors may enhance the efficacy of the implementing measures that request self-restraint.

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CRediT authorship contribution statement

Takahiro Mori: Conceptualization, Methodology, Formal analysis, Writing – original draft. **Tomohisa Nagata:** Conceptualization, Methodology, Investigation, Writing – review & editing, Funding acquisition. **Kazunori Ikegami:** Conceptualization, Writing – review & editing. **Ayako Hino:** Conceptualization, Writing – review & editing, Funding acquisition. **Seiichiro Tateishi:** Conceptualization, Writing – review & editing, Funding acquisition. **Mayumi Tsuji:** Conceptualization, Writing – review & editing, Funding acquisition. **Shinya Matsuda:** Conceptualization, Writing – review & editing, Funding acquisition. **Yoshihisa Fujino:** Conceptualization, Methodology, Investigation, Writing – review & editing, Supervision, Funding acquisition. **Koji Mori:** Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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