

1 **Japanese citizens' behavioral changes and**
2 **preparedness against COVID-19:**
3 **How effective is Japan's approach of self-restraint ?**

4
5 **Short title: Japanese citizens' behavioral changes and preparedness against COVID-19**

6
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20 **Abstract**

21

22 The Japanese government instituted countermeasures against COVID-19, a pneumonia caused
23 by the new coronavirus, in January 2020. Seeking “people’s behavioral changes,” in which the
24 government called on the public to take precautionary measures or exercise self-restraint, was
25 one of the important strategies. The purpose of this study is to investigate how and from when
26 Japanese citizens have changed their precautionary behavior under these circumstances, where
27 the government has only requested their cooperation. This study uses micro data from a
28 cross-sectional survey conducted on an online platform of an online research company, based on
29 quota sampling that is representative of the Japanese population. By the end of March 2020, we
30 had recruited a total of 11,342 respondents, aged from 20 to 64 years. About 85% reported
31 practising the social distancing recommended by the government. More females than males and
32 more older than younger participants are supportive of practicing social distancing. Frequent
33 handwashing is conducted by 86 percent of all, 92 percent of female and 87.9 percent of
34 over-40 participants. The most important event influencing these precautionary actions was the
35 infection aboard the Diamond Princess cruise ship, which occurred in early February 2020
36 (23%). Information from the central and local governments, received by 60% of the participants,
37 was deemed trustworthy by 50%. However, the results also showed that about 20% of the
38 participants were reluctant to implement proper prevention measures. The statistical analysis

39 indicated that the typical characteristics of those people were male, younger (under 30 years
40 old), unmarried, from lower-income households, with a drinking or smoking habit and a higher
41 extraversion score. To prevent the spread of infection in Japan, it is imperative to address these
42 individuals and encourage their behavioral changes using various means to reach and influence
43 them.

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46 **Introduction**

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48 **The new coronavirus in Japan**

49 Pneumonia of unknown cause was detected in China and first officially reported on 31
50 December 2019. The World Health Organization (WHO) announced a name for the new
51 coronavirus disease, COVID-19 (coronavirus disease 2019), on 11 February 2020.^[1] Since then,
52 COVID-19 has been spreading throughout the world, and a rapid increase in deaths has been
53 reported in many countries. As of 28 March, a total of 571,678 cases and 26,494 deaths have
54 been confirmed.^[2] One study has estimated that there will be a total of 81,114 deaths from
55 COVID-19 over the next four months in the US alone.^[3] The number of COVID-19 cases and
56 deaths in Japan is gradually increasing, with 1,499 cases (including 60 critical cases) and 49
57 deaths reported as of 28 March.^[4] Several small clusters of infected groups have been increasing
58 in urban areas, including those in hospitals and nursing homes, in addition to cases with
59 unlinked infections. Nevertheless, the total number of deaths and severely ill patients has been
60 comparatively small, especially relative to the country's population size, and the trend of the
61 increase is not sharp. The reasons for this mild trend have been questioned outside Japan.^[5]

62 Over the past few decades, Japan has not experienced any serious damage from new
63 infectious diseases, such as SARS (severe acute respiratory syndrome), MERS (Middle East
64 respiratory syndrome) or the Ebola virus. Ironically, this history of escapes might delay the

65 establishment of the emergency operation headquarters in Japan. The implementation of
66 polymerase chain reaction (PCR) tests, which must be the frontline response to the novel
67 coronavirus outbreak, has faced time-consuming obstacles. In Japan, a recent revision of the Act
68 on Special Measures for Pandemic Influenza and New Infectious Diseases Preparedness and
69 Response allows the Prime Minister to declare a state of emergency for the outbreak, but under
70 the current legislation, no central or local government can enforce lockdowns such as those
71 undertaken in other countries. If the Act on the Prevention of Infectious Diseases and Medical
72 Care for Patients with Infectious Diseases is revised for COVID-19, local governors can restrict
73 or block the traffic in contaminated places for a specified period of not more than 72 hours for
74 the purpose of preventing the spread of the coronavirus.

75 Under such limitations, the current goal of the Japanese government is to avoid an
76 explosive increase in patients that would exceed the limit of intensive or critical care units in
77 hospitals in urban areas. To meet this goal, the government policy consists of three strategies:
78 early detection of clusters and rapid response, enhancement of the early diagnosis of patients
79 and intensive care for severely affected patients, and strengthening of the universal healthcare
80 system and people's behavioral change.^[6]

81

82 **Three strategies against COVID-19**

83 With regards to the first and second strategies, the Ministry of Health, Labor and Welfare
84 (MHLW) strongly promotes contact tracing, social distancing and pneumonia surveillance under
85 the direction of the Patient Cluster Countermeasure Group in the MHLW Headquarters for
86 Novel Coronavirus Disease Control. Regional public health centers conduct contact tracing,
87 asking infected persons and their close contacts to maintain social distancing for 14 days and
88 allocating available hospital beds or hospital wards in designated local communities. In clinical
89 settings, the large number of computed tomography (CT) scanners in Japan (111.49 per million
90 population^[7]) supports physicians with investigating suspicious pneumonia cases in the absence
91 of conducting massive PCR tests in the population. This policy approach might lead to a
92 relatively slower increase in the number of cases and deaths.

93 Regarding the third strategy, people's behavioral change, by the middle of February 2020,
94 the MHLW encouraged the Japanese public to practise frequent handwashing and “coughing
95 etiquette” (using a handkerchief or sleeve instead of hands to catch a cough or sneeze).
96 Furthermore, the MHLW has prioritized access to healthcare for elderly people, people suffering
97 from fatigue or shortness of breath and people with underlying health conditions. The MHLW
98 has also asked the public not to visit clinics for at least four days if they have experienced cold
99 symptoms or a fever of 37.5°C or over.^[8] This restriction might be a shock to Japanese citizens,

100 who are typically allowed to freely access clinics and hospitals.

101 In analyses of contact tracing, it was found that one infected person tended to infect more
102 than one other person at locations with certain characteristics. On 24 February, the Expert
103 Meeting on the Control of Novel Coronavirus Infection asked the public to refrain from
104 attending places involving close face-to-face contact (within an arm's length of each other) in
105 conversations and similar interactions for more than a given length of time in crowds. Since
106 then but prior to other similar slogans that have appeared in the world, the government has been
107 campaigning for avoidance of these situations with the slogan "Avoid overlapping three Ms"
108 *mippei-kukan* [poorly ventilated closed space], *misshu-basho* [large gathering] and
109 *missetsu-bamen* [conversations or shouting in close proximity], in addition to regular ventilation
110 and wiping of shared surfaces (door handles, knobs, and bed fences) and goods with diluted
111 household chlorine bleach. "Avoid overlapping three Ms" has been the core and unique message
112 against COVID-19 in Japan.

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114 **Previous studies and our research questions**

115 This study examines three research questions: 1) How do Japanese citizens implement the
116 government's three Ms precautionary measures? 2) How effective are these requests from the
117 government? and 3) Who has changed their daily precautionary behavior and who has not?

118 Several previous studies have investigated changes in people’s precautionary behavior
119 against the coronavirus. For example, an online survey conducted on 29 January of 3,083
120 mainland Chinese respondents revealed that adults living in urban areas had a better awareness
121 of the issue than those in rural areas (72.7% vs. 66.1%, $p<0.001$).^[9] Another online survey
122 conducted between 23 February and 2 March in the US (N=2,986) and the UK (N=2,988) adult
123 residents showed that people have a good understanding of the main mode of disease
124 transmission and common symptoms, although they also have several important misconceptions
125 and discriminatory attitudes towards people with East Asian ethnicity due to COVID-19’s origin
126 in China.^[10] The latest study in Italy clarified the three types of attitude to COVID-19 among
127 Italian citizens: people who trust authority and choose isolation, fatalists who are keen on social
128 media and uniformed youth.^[11] The Gallup International Association also recently conducted a
129 snap poll in 28 countries (including 1,115 Japanese participants), asking about precautionary
130 procedures, and their findings indicated that 71 percent of Japanese participants had adopted
131 more frequent handwashing.^[12] It is still unclear, however, what the trigger is for behavioral
132 change around COVID-19 and who is more actively implementing the prevention measures. In
133 this survey, the response period and sample attribution are also unclear. Furthermore, this survey
134 is not necessarily informative for policymaking, as it does not reveal who is *not* implementing
135 prevention measures.

136 Using a large sample of cross-sectional survey data, this study investigates how and at what
137 point Japanese citizens changed their precautionary behavior in this situation, where the
138 government has only requested, rather than mandated, their cooperation.

139

140 **Materials and Methods**

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142 **Survey design and participants**

143 This study uses micro data from a cross-sectional survey conducted via an online
144 platform of an online research company, MACROMILL INC, Japan. From a pool of
145 approximately 1.2 million registered individuals residing in Japan, we recruited a total of 11,342
146 males and females aged from 20 to 64 years. In the recruitment process for this study, quota
147 sampling was conducted so that the sample distributions among gender (male or female), age
148 group (20s, 30s, 40s, 50s or 60s), and employment status (regular employee, non-regular
149 employee, self-employed or not working) became equal to those of the representative Japanese
150 population, based on the statistics of the Labor Force Survey (Ministry of Internal Affairs and
151 Communications). The survey was conducted between 26 and 28 March 2020.

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153 **Questionnaire and analysis**

154 In addition to providing individual characteristics, the participants were asked to

155 answer 11 items rating their prevention measures against novel coronavirus infections, such as
156 social distancing and coughing etiquette on a scale of 1 to 5. Thus, after summarizing
157 demographic characteristics based on the total, male and female, and under-40 and over-40
158 categories, we aggregate and compare a proportion of the participants who have been taking
159 those prevention measures.

160 The participants were also asked what kind of events caused them to change their
161 behaviors and rated the frequency and reliability of 10 information sources about the
162 coronavirus on a scale of 1 to 5. Thus, we calculate and compare the frequency and reliability
163 depending on the information sources.

164 Next, to detect factors associated with behavioral change, the participants were also
165 asked about their drinking and smoking habits. Personality traits were measured by the Five
166 Factor Personality Questionnaire: Ten-Item Personality Inventory (TIPI). We estimate a logit
167 model, where the dependent variable is a dummy indicating 1 if the participant chose “not at all”
168 or “not true” to the question “Do you avoid the three overlapping Ms?” and where independent
169 variables are individual characteristics.

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171 **Data analysis**

172 We analyzed the data using STATA/MP version 16.0 for Mac (StataCorp, College

173 Station, TX, United States).

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175 **Ethical issues**

176 Our survey falls outside the scope of the Japanese government’s Ethical Guidelines for
177 Medical and Health Research Involving Human Subjects, and there are no national guidelines in
178 Japan for social and behavioral research. Therefore, our study was carried out in accordance
179 with the Ethical Principles for Sociological Research of the Japan Sociological Society, which
180 do not require ethical reviews.

181 All survey participants gave consent to participate in the anonymous online survey by
182 MACROMILL INC. The authors did not obtain any personal information about the participants.
183 After being informed about the purposes of the study and their right to quit the survey,
184 participants agreed to participate. They were provided with the option of “I don’t want to
185 respond” for all questions. Completion of the entire questionnaire was considered as participant
186 consent.

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188 **Results**

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190 **Demographic characteristics**

191 The characteristics of the sample, both as a whole and separated by gender (male or

192 female) or age (under or over 40 years old), are summarized in Table 1. The total sample size is
193 11,342, with almost equal gender distribution. Gender and age distribution are proportional to
194 that of the Japanese population. University or college graduates constituted about 50–60 percent
195 of respondents. About half of the total sample is composed of regular employees (usually,
196 indefinite and full-time employees). About a quarter of respondents had a household income of
197 4–5 million yen.

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Table 1. Sample characteristics

	n, (%)									
	All		Male		Female		Under 40 y		Over 40 y	
Total respondents	11,342		5,734		5,608		4,300		7,842	
Female	5,608	(49.44)					2,110	(49.07)	3,498	(49.67)
Age										
20-29 years old	1,964	(17.32)	994	(17.34)	970	(17.30)	1,964	(45.67)	0	(0.00)
30-39 years old	2,336	(20.60)	1,196	(20.86)	1,140	(20.33)	2,336	(54.33)	0	(0.00)
40-49 years old	3,098	(27.31)	1,568	(27.35)	1,530	(27.28)	0	(0.00)	3,098	(43.99)
50-59 years old	2,754	(24.28)	1,373	(23.94)	1,381	(24.63)	0	(0.00)	2,754	(39.11)
60-64 years old	1,190	(10.49)	603	(10.52)	587	(10.47)	0	(0.00)	1,190	(16.90)
Married	6,620	(58.37)	3,241	(56.52)	3,379	(60.25)	1,859	(43.23)	4,761	(67.61)
Parents with children under junior high school	2,972	(26.20)	1,493	(26.04)	1,479	(26.37)	1,464	(34.05)	1,508	(21.41)
University or college graduate	6,278	(55.35)	3,415	(59.56)	2,863	(51.05)	2,478	(57.63)	3,800	(53.96)
Work status										
Regular employee	5,817	(51.29)	3,986	(69.52)	1,831	(32.65)	2,460	(57.21)	3,357	(47.67)
Nonregular employee	2,865	(25.26)	733	(12.78)	2,132	(38.02)	1,010	(23.49)	1,855	(26.34)
Self-employed and others	660	(5.82)	422	(7.36)	238	(4.24)	138	(3.21)	522	(7.41)
Not working	2,000	(17.63)	593	(10.34)	1,407	(25.09)	692	(16.09)	1,308	(18.57)
Household annual income										
Less than 2,000K JPY	646	(7.56)	312	(6.67)	334	(8.63)	250	(8.28)	396	(7.16)
2,000-3,999K JPY	1,939	(22.68)	925	(19.77)	1,014	(26.21)	773	(25.59)	1,166	(21.10)
4,000-5,999K JPY	2,247	(26.29)	1,224	(26.16)	1,023	(26.44)	869	(28.77)	1,378	(24.93)
6,000-6,999K JPY	1,606	(18.79)	929	(19.85)	677	(17.50)	541	(17.91)	1,065	(19.27)
8,000-8,999K JPY	1,052	(12.31)	619	(13.23)	433	(11.19)	322	(10.66)	730	(13.21)
10,000-11,999K JPY	516	(6.04)	318	(6.80)	198	(5.12)	139	(4.60)	377	(6.82)
12,000-14,999K JPY	306	(3.58)	192	(4.10)	114	(2.95)	58	(1.92)	248	(4.49)
15,000-19,999K JPY	151	(1.77)	100	(2.14)	51	(1.32)	42	(1.39)	109	(1.97)
More than 20,000K JPY	85	(0.99)	60	(1.28)	25	(0.65)	27	(0.89)	58	(1.05)

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205 **To what extent have prevention measures been taken?**

206 In the survey, the participants were first asked to answer to the question “Have you
207 ever conducted any measures to prevent novel coronavirus infections or outbreaks?” About 76
208 percent of participants evaluated themselves as having taken some action.

209 To observe the details of those actions, Table 2 shows a variety of prevention measures
210 taken, aggregating a proportion of the participants who answer “very true” and “true” for each
211 prevention measure.

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Table 2. “Have you ever conducted anything to prevent novel coronavirus infections or outbreaks?”

	% of very true and true, (C.I.)				
	All	Male	Female	Under 40 y	Over 40 y
1. Avoid a poorly-ventilated closed space	80.6 (79.8 - 81.3)	75.9 (74.8 - 77.0)	85.3 (84.4 - 86.3)	77.6 (76.3 - 78.8)	82.4 (81.5 - 83.3)
2. Avoid large gatherings	80.5 (79.8 - 81.2)	77.5 (76.4 - 78.6)	83.6 (82.6 - 84.6)	76.3 (75.1 - 77.6)	83.1 (82.2 - 83.9)
3. Avoid conversations or shouting in close proximity	57.0 (56.1 - 57.9)	55.6 (54.3 - 56.8)	58.5 (57.2 - 59.8)	52.3 (50.9 - 53.8)	59.9 (58.7 - 61.0)
4. Avoid places where items 1-3 above overlap	80.6 (79.8 - 81.3)	76.9 (75.8 - 77.9)	84.4 (83.4 - 85.3)	76.7 (75.4 - 77.9)	82.9 (82.1 - 83.8)
5. Do not go to mass gatherings	86.8 (86.2 - 87.5)	82.7 (81.8 - 83.7)	91.0 (90.3 - 91.8)	82.7 (81.6 - 83.8)	89.4 (88.6 - 90.1)
6. Undertake frequent handwashing	86.3 (85.7 - 87.0)	81.9 (80.9 - 82.9)	90.9 (90.2 - 91.7)	83.8 (82.7 - 84.9)	87.9 (87.1 - 88.6)
7. Undertake cough etiquette (use handkerchiefs or sleeves instead of hands)	77.0 (76.2 - 77.8)	72.0 (70.9 - 73.2)	82.1 (81.1 - 83.1)	73.9 (72.6 - 75.2)	78.9 (77.9 - 79.8)
8. Always wear a surgical-style mask when going out	70.1 (69.2 - 70.9)	62.7 (61.4 - 63.9)	77.6 (76.5 - 78.7)	70.0 (68.6 - 71.3)	70.1 (69.1 - 71.2)
9. Avoid going out when you have a cold	76.7 (76.0 - 77.5)	70.9 (69.7 - 72.1)	82.7 (81.7 - 83.7)	72.8 (71.4 - 74.1)	79.2 (78.2 - 80.1)
10. Get sufficient rest and sleep	73.1 (72.3 - 73.9)	68.3 (67.1 - 69.5)	77.9 (76.9 - 79.0)	71.6 (70.2 - 72.9)	74.0 (73.0 - 75.0)
11. Eat a nutritious diet	69.5 (68.6 - 70.3)	64.2 (62.9 - 65.4)	74.9 (73.7 - 76.0)	69.1 (67.7 - 70.5)	69.7 (68.6 - 70.8)
12. Prepare consultation and transportation methods for when you feel ill	41.5 (40.6 - 42.4)	42.7 (41.4 - 44.0)	40.3 (39.0 - 41.6)	41.9 (40.4 - 43.3)	41.3 (40.1 - 42.4)

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218 Looking at the first four prevention measures, which have been continuously
219 requested by the Japanese government and the Expert Meeting on Control of Novel Coronavirus
220 Infection, it was found that 80 percent have attempted to avoid the “overlapping three Ms.” Of
221 the total, 57% have attempted avoid conversations or shouting in close proximity, which was a
222 relatively low figure among the three Ms. Looking next at the fifth prevention measure, more
223 than 85 percent of all participants reported practising social distancing by avoiding mass

224 gatherings. Regarding gender and age differences, more females than males and more older than
225 younger participants are supportive of social distancing, as shown by the differences in the
226 confidence intervals.

227 Regarding hygiene practices, frequent handwashing is conducted by about 86 percent
228 of all, about 91 percent of female and about 88 percent of over-40 participants. Coughing
229 etiquette was implemented by 77 percent of the participants. Many also answered that they have
230 avoided going out when ill with a cold.

231 As for the measures to strengthen individual immunity, around 70 percent of the
232 participants reported getting sufficient rest and sleep or eating a nutritious diet. Again, focusing
233 on gender and age differences, prevention measures are conducted more often by females and
234 older people.

235 However, regardless of gender and age, about 40 percent of participants have prepared
236 consultation and transportation methods for if they were to become ill.

237

238 **What has caused the behavioral changes?**

239 To explore the triggers of the behavioral changes and preparedness observed above,
240 the participants were asked “What was the most important event influencing these actions?”; the
241 responses are summarized in Fig 1. The figure shows that about 23 percent of the participants

242 cited the infection aboard the *Diamond Princess* cruise ship ^[13] that occurred around early
243 February 2020, when there were still few domestic cases. *Diamond Princess* is a
244 British-registered cruise ship on which an 80-year-old passenger from Hong Kong tested
245 positive for COVID-19 on 1 February 2020. Because the ship was in Japanese waters, the ship
246 was quarantined in February 2020 for nearly a month with about 3,700 passengers and crew on
247 board. Other participants noted events from the end of February, including the alert from the
248 Expert Meeting (5.6 percent), the statement of emergency by the governor of Hokkaido
249 (northern island of Japan) (7.4 percent) and the request by the Prime Minister to not attend mass
250 gatherings (7.8 percent). The next large trigger was the request by the Prime Minister for
251 nationwide school closures in Japan on 28 February 2020 (about 14 percent). Finally, worldwide
252 outbreak around early March (22 percent) also attracted participants' attention.

253 To explore what kind of information affected their behavioral change and
254 preparedness, the survey asked participants to report the frequency at which they consult certain
255 sources about the novel coronavirus infection and rate their reliability of the information source.
256 The results are summarized in Table 3.

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Table 3. “From where do you get and trust information about novel coronavirus infection?”

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	%, (C.I.)				
	All	Male	Female	Under 40 y	Over 40 y
1. TV news programs					
Get information: frequently or sometimes	89.0 (88.5 - 89.6)	85.4 (84.5 - 86.3)	92.7 (92.1 - 93.4)	85.2 (84.1 - 86.2)	91.4 (90.8 - 92.1)
Trust information: very much or yes	55.2 (54.3 - 56.1)	51.0 (49.7 - 52.3)	59.5 (58.3 - 60.8)	50.5 (49.0 - 52.0)	58.1 (56.9 - 59.2)
2. TV talk and variety shows					
Get information: frequently or sometimes	69.4 (68.6 - 70.3)	62.4 (61.2 - 63.7)	76.6 (75.5 - 77.7)	67.5 (66.1 - 68.9)	70.6 (69.5 - 71.7)
Trust information: very much or yes	31.4 (30.6 - 32.3)	27.2 (26.0 - 28.3)	35.8 (34.5 - 37.0)	32.5 (31.1 - 33.9)	30.8 (29.7 - 31.9)
3. Newspapers (national and local newspapers)					
Get information: frequently or sometimes	42.0 (41.1 - 42.9)	45.4 (44.1 - 46.7)	38.6 (37.3 - 39.9)	30.0 (28.6 - 31.4)	49.4 (48.2 - 50.5)
Trust information: very much or yes	47.5 (46.6 - 48.5)	45.2 (43.9 - 46.4)	50.0 (48.7 - 51.3)	41.0 (39.6 - 42.5)	51.5 (50.3 - 52.7)
4. Tabloid paper					
Get information: frequently or sometimes	7.9 (7.4 - 8.4)	11.4 (10.5 - 12.2)	4.3 (3.7 - 4.8)	9.6 (8.7 - 10.5)	6.8 (6.2 - 7.4)
Trust information: very much or yes	12.7 (12.1 - 13.3)	13.4 (12.6 - 14.3)	11.9 (11.1 - 12.8)	16.1 (15.0 - 17.2)	10.6 (9.9 - 11.4)
5. Internet news sites					
Get information: frequently or sometimes	86.6 (86.0 - 87.3)	84.7 (83.7 - 85.6)	88.7 (87.8 - 89.5)	84.4 (83.3 - 85.5)	88.0 (87.3 - 88.8)
Trust information: very much or yes	41.8 (40.9 - 42.7)	41.3 (40.0 - 42.5)	42.3 (41.0 - 43.6)	42.1 (40.6 - 43.5)	41.6 (40.5 - 42.8)
6. SNS app news					
Get information: frequently or sometimes	45.6 (44.7 - 46.5)	42.8 (41.5 - 44.1)	48.4 (47.1 - 49.8)	57.5 (56.0 - 58.9)	38.3 (37.2 - 39.5)
Trust information: very much or yes	24.5 (23.7 - 25.3)	23.4 (22.3 - 24.5)	25.7 (24.5 - 26.8)	29.9 (28.5 - 31.3)	21.2 (20.3 - 22.2)
7. Information sent by the Prime Minister					
Get information: frequently or sometimes	66.3 (65.4 - 67.2)	63.6 (62.3 - 64.8)	69.1 (67.9 - 70.3)	59.8 (58.3 - 61.3)	70.3 (69.2 - 71.4)
Trust information: very much or yes	47.5 (46.6 - 48.4)	46.0 (44.8 - 47.3)	48.9 (47.6 - 50.2)	45.7 (44.2 - 47.2)	48.6 (47.4 - 49.7)
8. Information sent by the Ministry of Health, Labor and Welfare					
Get information: frequently or sometimes	63.4 (62.5 - 64.3)	60.8 (59.5 - 62.1)	66.0 (64.8 - 67.2)	58.3 (56.8 - 59.7)	66.5 (65.4 - 67.6)
Trust information: very much or yes	48.8 (47.9 - 49.7)	46.9 (45.7 - 48.2)	50.7 (49.4 - 52.0)	47.6 (46.1 - 49.1)	49.5 (48.4 - 50.7)
9. Information provided by government Expert Meetings					
Get information: frequently or sometimes	56.9 (55.9 - 57.8)	55.2 (54.0 - 56.5)	58.5 (57.2 - 59.8)	50.3 (48.8 - 51.8)	60.8 (59.7 - 62.0)
Trust information: very much or yes	51.4 (50.5 - 52.3)	49.7 (48.4 - 51.0)	53.1 (51.8 - 54.4)	48.8 (47.3 - 50.3)	53.0 (51.8 - 54.1)
10. Information sent by local (prefecture) government					
Get information: frequently or sometimes	58.0 (57.1 - 58.9)	53.7 (52.4 - 55.0)	62.4 (61.1 - 63.6)	54.3 (52.8 - 55.8)	60.2 (59.1 - 61.4)
Trust information: very much or yes	55.6 (54.7 - 56.6)	52.5 (51.2 - 53.8)	58.8 (57.6 - 60.1)	54.0 (52.5 - 55.4)	56.7 (55.5 - 57.8)

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263 Table 3 shows that almost 90 percent receive information from TV news programs and
264 Internet news sites, and that about 50 percent trust such information. Mainstream scientists are
265 annoyed about the fear-mongering that happens on TV talk and variety shows; indeed, these
266 formats are slightly favored, but considered less credible, among the public. Meanwhile,
267 information from the central and local government (received by 60 percent), including the
268 Prime Minister and the Expert Meeting, is relatively trusted by the participants (50 percent).
269 Among official sources, the local government is most trusted. Newspapers (national and local)
270 are read by only about 42 percent of the participants, and about 48 percent answered that they
271 trust information from newspapers.

272 Looking at the differences in gender and age, females tend to seek more information
273 and trust it more than males, except for the information from newspapers. Participants over 40
274 years old tend to access and trust the information from TV, newspapers and officials more than
275 those under 40 years old do, while young people often seek and trust news from the Internet and
276 SNS apps.

277

278 **Who does not adhere to social distancing?**

279 As we confirmed in Table 2, more than 80 percent of the participants have been

280 implementing social distancing measures and most Japanese citizens seem to be exhibiting
281 some behavioral change to prevent coronavirus infections. However, this also means that about
282 20 percent may not be conducting sufficient prevention measures.

283 To detect what kind of individuals are included in the group not conducting prevention
284 measure, Table 4 shows the estimation results of the logit model. Like the other tables, Table 4
285 shows the results based on the total, male and female, and under-40 and over-40 categories. The
286 number shown in the table is an odds ratio, so the estimates that are significantly higher than 1
287 indicate a higher tendency to not conduct proper social distancing.

288

289

Table 4. Estimation results of logit model for not conducting social distancing

Dependent variable: Avoid places where items 1-3 above overlap in Table 2 -> Not at all or not tue		odds ratio, (C.I.)			
	All	Male	Female	Under 40 y	Over 40 y
Male	1.635*** (1.304 - 2.049)			1.431** (1.039 - 1.970)	1.854*** (1.335 - 2.575)
Age (ref. = 40-49 y)					
20-29 years old	1.671*** (1.274 - 2.192)	1.819*** (1.285 - 2.574)	1.647** (1.053 - 2.574)	1.830*** (1.354 - 2.474)	
30-39 years old	0.910 (0.683 - 1.213)	0.916 (0.639 - 1.314)	0.949 (0.589 - 1.529)		
50-59 years old	0.819 (0.610 - 1.099)	0.915 (0.632 - 1.325)	0.689 (0.423 - 1.123)		0.858 (0.634 - 1.163)
60-64 years old	0.437*** (0.264 - 0.724)	0.631 (0.357 - 1.117)	0.112*** (0.026 - 0.471)		0.448*** (0.265 - 0.758)
Not married	1.445*** (1.117 - 1.870)	1.372* (0.985 - 1.912)	1.514* (0.979 - 2.340)	1.476* (0.954 - 2.282)	1.422** (1.020 - 1.984)
Not having children younger than junior high school age	1.246 (0.935 - 1.661)	1.114 (0.774 - 1.603)	1.485 (0.922 - 2.392)	1.366 (0.868 - 2.151)	1.165 (0.792 - 1.713)
High or junior high school graduate	1.171 (0.957 - 1.434)	1.174 (0.914 - 1.508)	1.152 (0.813 - 1.633)	1.347* (0.999 - 1.815)	1.053 (0.798 - 1.390)
Work status (Ref. = Regular employee)					
Nonregular employee	1.035 (0.795 - 1.349)	0.992 (0.670 - 1.468)	1.119 (0.763 - 1.642)	0.952 (0.654 - 1.387)	1.151 (0.783 - 1.692)
Self-employee and others	0.727 (0.446 - 1.185)	0.958 (0.569 - 1.613)	0.164* (0.022 - 1.197)	0.658 (0.233 - 1.860)	0.745 (0.425 - 1.307)
Not working	0.767 (0.552 - 1.066)	1.089 (0.707 - 1.678)	0.596* (0.343 - 1.035)	0.745 (0.463 - 1.201)	0.807 (0.509 - 1.279)
Household annual income (Ref. = 4,000-5,999K JPY)					
Less than 2,000K JPY	1.441* (0.990 - 2.099)	1.103 (0.667 - 1.824)	1.760* (0.970 - 3.195)	1.883** (1.115 - 3.180)	1.110 (0.638 - 1.931)
2,000-3,999K JPY	1.159 (0.879 - 1.530)	1.064 (0.752 - 1.505)	1.284 (0.797 - 2.068)	1.480* (0.991 - 2.211)	0.936 (0.632 - 1.385)
6,000-6,999K JPY	1.182 (0.880 - 1.589)	1.143 (0.803 - 1.625)	1.234 (0.713 - 2.137)	1.430 (0.908 - 2.254)	1.002 (0.678 - 1.481)
8,000-8,999K JPY	0.984 (0.687 - 1.411)	0.893 (0.577 - 1.383)	1.189 (0.629 - 2.249)	1.119 (0.633 - 1.977)	0.877 (0.550 - 1.401)
10,000-11,999K JPY	0.894 (0.544 - 1.467)	0.919 (0.523 - 1.614)	0.737 (0.253 - 2.144)	1.212 (0.571 - 2.575)	0.694 (0.357 - 1.350)
12,000-14,999K JPY	0.730 (0.362 - 1.471)	0.519 (0.205 - 1.313)	1.366 (0.463 - 4.029)	1.748 (0.653 - 4.677)	0.384* (0.137 - 1.079)
15,000-19,999K JPY	0.460 (0.143 - 1.482)	0.365 (0.087 - 1.525)	0.740 (0.097 - 5.656)	0.415 (0.055 - 3.124)	0.456 (0.108 - 1.922)
More than 20,000K JPY	0.707 (0.216 - 2.314)	0.530 (0.125 - 2.241)	2.026 (0.246 - 16.664)	0.434 (0.056 - 3.340)	0.967 (0.227 - 4.125)
Drinking habit: Drink 3-6 times per week or everyday	1.150 (0.911 - 1.451)	1.278* (0.976 - 1.675)	0.773 (0.476 - 1.256)	1.326 (0.909 - 1.935)	1.053 (0.784 - 1.413)
Smoking habit: Smoke sometimes or everyday	1.077 (0.856 - 1.355)	0.956 (0.729 - 1.253)	1.529* (0.995 - 2.350)	1.124 (0.791 - 1.597)	1.043 (0.767 - 1.419)
Big 5 Personality traits					
Extraversion	1.113*** (1.032 - 1.200)	1.108** (1.008 - 1.219)	1.125* (0.992 - 1.275)	1.151** (1.032 - 1.284)	1.087 (0.978 - 1.208)
Neuroticism	0.986 (0.909 - 1.069)	0.977 (0.880 - 1.085)	1.005 (0.884 - 1.143)	0.988 (0.880 - 1.109)	0.987 (0.880 - 1.107)
Openness	0.976 (0.900 - 1.059)	0.952 (0.861 - 1.054)	1.014 (0.884 - 1.164)	0.917 (0.815 - 1.031)	1.030 (0.919 - 1.154)
Conscientiousness	0.865*** (0.798 - 0.937)	0.865*** (0.782 - 0.957)	0.875* (0.765 - 1.002)	0.909 (0.810 - 1.020)	0.826*** (0.738 - 0.925)
Agreeableness	0.884*** (0.814 - 0.959)	0.906* (0.818 - 1.004)	0.851** (0.742 - 0.976)	0.896* (0.799 - 1.005)	0.874** (0.776 - 0.985)
Constant	0.075*** (0.037 - 0.152)	0.138*** (0.059 - 0.322)	0.055*** (0.017 - 0.182)	0.045*** (0.016 - 0.123)	0.100*** (0.038 - 0.266)
Number of observations	8,548	4,679	3,869	3,021	5,527

291 Note: *** p<0.01, ** p<0.05, * p<0.1

292 Looking at the estimation results in Table 4, males, people in their 20s and unmarried
293 people exhibit significantly higher odds ratios, indicating that these groups tend not to conduct
294 preventive social distancing. Although work status is not generally associated with this
295 prevention measure, females, regular employees and non-regular employees tended to exhibit
296 higher odds ratios than self-employed or unemployed people.

297 Regarding household annual income, the lowest group (less than 2,000K JPY) has
298 significantly higher odds ratio for the total, female and under-40 categories.

299 Higher odds ratios for not conducting social distancing are associated with drinking
300 for males and smoking for females. Furthermore, those with higher extraversion scores also
301 tend to exhibit significantly higher odds ratio in many cases, while conscientiousness and
302 agreeableness are associated with lower odds ratio in most cases.

303

304 **Should the government change its policy on mass gatherings?**

305 Before this survey was conducted, the request by the Japanese government for
306 self-restraint in avoiding mass gatherings had become an issue. For example, on 22 March 2020,
307 the K-1 Grand Prix, a martial arts event, was held despite the Minister's and local governor's pleas
308 for restraint, and 6,500 participants were packed into the Saitama Super Arena. On 23 March, more
309 than 50,000 gathered in Sendai to see the Olympic flame, which had recently arrived from

310 Greece.^[14] We asked the participants whether they supported this policy approach. About 29
 311 percent of participants supported the idea that the government should now allow mass
 312 gatherings. Males tend to support allowing mass gatherings more than females. On the other
 313 hand, 65 percent supported government limitations of movement, in addition to self-restraint to
 314 avoid mass gatherings in order to shorten the period of the pandemic. There are no significant
 315 differences in gender and age category for this question.

316

317 **Table 5. “Do you support the government’s policy?”**

	% of agree and relatively agree, (C.I.)				
	All	Male	Female	Under 40 y	Over 40 y
1. The government should allow mass gatherings now	28.8 (27.9 - 29.6)	31.2 (30.0 - 32.4)	26.3 (25.1 - 27.5)	30.5 (29.1 - 31.8)	27.7 (26.7 - 28.8)
2. The government should limit movement in addition to mass gatherings	64.9 (64.0 - 65.7)	64.1 (62.9 - 65.4)	65.6 (64.4 - 66.9)	63.4 (62.0 - 64.8)	65.8 (64.7 - 66.9)

318

319

320 Discussion

321

322 Under circumstances where there is no enforced ban on mass gathering or travelling
 323 beyond the home region, our findings indicate that a large portion of Japanese citizens seem to
 324 be implementing proper prevention measures on their own.

325 First, more than three-quarters of the survey participants have taken some preventive
 326

327 actions, including social distancing, handwashing, coughing etiquette and strengthening
328 immunity. Because the previous empirical studies did not include developed countries like
329 Japan,^[15] there is little scientific evidence that Japanese people prefer cleanliness and tend to
330 wash their hands relatively more frequently than other countries. In Japanese communities,
331 water facilities for handwashing with soap and hand sanitizers are normally placed various
332 public places, such as train stations and supermarkets. Moreover, handwashing became part of
333 regular practice at home and school through post-war education.^[16] In general, Japanese people
334 have developed the discipline of washing their hands before having meals or after using the
335 toilet. It is also well known that Japanese bow for greetings instead of handshaking, kissing and
336 hugging. This cultural behavior implies that the frequency of body contact among Japanese
337 people may be less than for those who greet with handshaking, kissing and hugging. During hay
338 fever season, Japanese citizens regularly wear surgical-style masks for prevention; it may be
339 that wearing a mask was a less popular preventive measure than some of the others in this study
340 due to there being a shortage of these products. These already habitual practices might help
341 behavioral changes develop among Japanese citizens during these unusual times.

342 In the survey, more than half of the participants had not prepared access to
343 consultation centers or transportation methods for if they were to become ill, implying that they
344 had not planned for the possibility of contracting COVID-19. We must advise the public to

345 prepare for such an event, to talk to family and close friends about unexpected advanced care
346 planning, and to imagine not being able to use ventilators or extracorporeal membrane
347 oxygenation at the severe stage.

348 Second, one of the main motivations for people’s behavioral changes was the infection
349 aboard the *Diamond Princess* cruise ship in early February 2020. At that time, only a few cases
350 of domestic infection had been reported in Japan, but news of the quarantine and positive test
351 results among the passengers was broadcasted daily. This may have contributed to Japanese
352 citizens changing their mindset and behavior toward precautionary measures earlier than in
353 Europe and the US. The sudden request by the Prime Minister for nationwide school closures in
354 the end of February might also have been an effective measure for changing the mindsets of
355 Japanese citizens toward prevention, even though this move was scientifically questioned and
356 confusing to the public, especially to single parents and double-income households.

357 Third, information from the Expert Meeting and central/local governments, including
358 the Prime Minister, are relatively trusted by survey participants. The Expert Meeting and
359 central/local government have held frequent press conferences, trying to clarify the tentative
360 scientific risks and advocating for citizens to conduct prevention measures. Such crisis
361 communication attempts may have caused behavioral changes in Japanese citizens. The most
362 trusted resource in this study was information from the local government, which was a hopeful

363 result, considering that the countermeasures against the virus are decided and conducted by the
364 local government. It is also important to support residents with disadvantages to information
365 and communication in the local communities.

366 However, the results also show that about 20 percent of the participants are reluctant
367 to implement proper prevention measures. The statistical analysis indicates that typically those
368 people are male, younger (under 30 years old), unmarried, are in lower income household, have
369 a drinking or smoking habit and have a higher extraversion score. To prevent the spread of
370 infection in Japan, it is imperative to address these individuals and encourage their behavioral
371 change in various ways that will reach and move them. It is notable that approximately 65
372 percent of the participants support stricter countermeasures, such as limitation of movement. As
373 we mentioned in the introduction, as of yet, the government has not made stay-at-home orders
374 mandatory and it has not offered financial aid to those affected by such measures. The current
375 requests from central/local governments are not legally binding and people/businesses have to
376 arrange financial compensation independent of the government. We should observe how
377 effective these measures are in Japan over the long term.

378 There are several limitations to this study. First, the data were self-reported, and
379 participants' actual behaviors have not been observed. Second, the sample was not collected
380 based on random sampling. Quota sampling ensured a similar distribution to the Japanese

381 population among demographic groups (gender, age and work status), but the sample within
382 each group does not necessarily reflect the population. Third, we obtained this dataset at the end
383 of March 2020, when the infection is not explosively widespread in Japan. This study should be
384 reanalyzed after the COVID-19 pandemic comes to an end.

385

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387

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392

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448

Fig 1. "What was the most important event influencing these actions?"

(%)

