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Original Article

Association between preventive measures against workplace infection and preventive behavior against personal infection

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Abstract: To prevent the spread of infection, it is necessary for each individual to adopt infection prevention behavior. We investigated the effect of infection control measures implemented in the workplace on personal infection prevention behavior. We conducted a self-administered questionnaire survey through the Internet from December 22 to 25, 2020, during which period coronavirus disease 2019 (COVID-19) was spreading. Among respondents aged 20 to 65 years (n=27,036), 21,915 workers were included in the analysis. The results showed that as the number of infection control measures in the workplace increased, implementation of infection prevention behavior by individuals also significantly increased. However, the relationship differed depending on the type of personal infection prevention behavior. Specifically, infection control measures against COVID-19 in the workplace may affect personal infection prevention behavior. Implementation of infection control measures in the workplace increases awareness of the importance of individual infection prevention behavior and its implementation by all individuals. These findings may be applicable not only to COVID-19 measures but also to responses to other emerging infections and seasonal influenza.

Key words: COVID-19, Personal infection prevention behavior, Infection control measures, Workplace, Pandemic

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Introduction

An outbreak of coronavirus disease 2019 (COVID-19) occurred in Wuhan, China in December 2019, and the World Health Organization (WHO) declared a "Public Health Emergency of International Concern" on January 30, 2020[1]. The WHO recommends taking all measures, such as avoiding the 3Cs (closed spaces, crowded places, and close-contact settings), wearing a mask, and opening windows, to protect the individual and others from COVID-19[2]. In order to prevent the spread of the infection, it is necessary not only to take measures nationally and regionally, such as prohibiting travel or outings around the world, but also to ensure that infection prevention behavior is implemented at an individual level[2].

Workplaces where many workers share the same space are generally vulnerable to the spread of infectious diseases. Therefore, from the perspective of business continuity, companies need to actively adopt telework, in accordance with the guidelines issued by the government and related organizations and checklists of the specific infection control measures, etc. If telework is not possible, it is necessary to implement feasible infection control measures to prevent infection in the workplace, in addition to basic measures (social distancing, wearing a mask, washing hands)[3]. However, disease clusters in the workplace are still being reported: for an approximately one-month period around December 2020, the Japanese media reported a total of 95 workplace-related disease clusters with 5 or more people, involving 1,103 persons in Japan[4]. Reasons for these disease clusters were eating while talking face-to-face without wearing a mask, staying in a poorly ventilated room, seating close to other workers, and failure to disinfect shared items and equipment, etc[5].

However, even if the infection control measures in the workplace are properly implemented, infection cannot be completely prevented if workers do not adopt appropriate infection prevention behavior, or if infection prevention behavior outside the workplace is not appropriate. It has been demonstrated that the establishment of a safe and healthy work environment under a policy of health maintenance and promotion in the workplace has a positive impact on the health of individual workers[6–8]. It has also been reported that training managers is an effective and efficient way to educate workers about health issues in the workplace[9]. Furthermore, it has been reported that when managers reach out to their workers, influenza vaccination rates increase[10]. We thought that we could apply these studies to COVID-19 infection control. We hypothesized that implementing infection control measures in the workplace could promote personal infection prevention behaviors.

In a survey of Chinese occupational fields, China at the time of a factory restart after lockdown for COVID-19, it was reported that the number of preventive measures implemented by the factory in Shenzhen was associated with self-reported compliance with all four personal preventive measures (wearing a face mask consistently in any public space; sanitizing hands every time after returning from public spaces or touching installations; avoiding social and meal gatherings with people who do not live together; and avoiding crowded places)[11]. Since this survey only included factory workers in one city in China at the specific occasion of factory restart after a lockdown in which strict measures were imposed, further investigations were deemed necessary to generalize the association between workplace infection control measures and workers' personal infection prevention behavior. Here therefore, we conducted an Internet survey during the period when COVID-19 infection was spreading in Japan and examined the relationship between infection control measures in the workplace and personal infection prevention behavior.

Subjects and Methods

A research group from the University of Occupational and Environmental Health, Japan, conducted a prospective cohort study, known as the Collaborative Online Research on Novel-coronavirus and Work study (CORoNaWork study[12]), as a self-administered questionnaire survey via an internet survey company (Cross Marketing Inc.; Tokyo, Japan). During the baseline survey, conducted from December 22 to 25, 2020, Japan was in the midst of its third wave of the pandemic, at which point the number of COVID-19 infections and deaths was markedly higher than in the first and second waves, and the country was accordingly on high alert.

The study protocol of the CORoNaWork study, including the sampling plan and subject recruitment procedure, has been reported in our previous study[12] and shown in Supplemental Table1 according to the CHERRIES checklist[13]. Participants were aged 20–65 years who were working at the time of the baseline survey (n = 33,087 total). For participation in the CORoNaWork study, they were stratified by disease cluster sampling for gender, age, region, and occupation. After excluding 6,051 initial subjects who provided invalid responses, we included 27,036 in the database[12].

Table 1. Participants' characteristics by category of infection control measures in the workplace

	Number of infection control measures in the workplace				
	0	1–2	3–4	5–7	8–9
Number of subjects	1,313	1,984	3,263	7,871	7,484
Age, mean (SD)	46.7 (10.2)	46.1 (10.1)	46.0 (10.5)	46.2 (10.7)	46.5 (10.6)
Sex, Men	736 (56.1%)	988 (49.8%)	1,558 (47.7%)	3,757 (47.7%)	3,861 (51.6%)
Equivalent income (million JPY)					
<2.50	411 (31.3%)	522 (26.3%)	743 (22.8%)	1,333 (16.9%)	970 (13.0%)
≥2.50 and <3.75	392 (29.9%)	663 (33.4%)	1,056 (32.4%)	2,265 (28.8%)	1,861 (24.9%)
≥3.75 and <4.99	289 (22.0%)	444 (22.4%)	747 (22.9%)	2,103 (26.7%)	2,005 (26.8%)
≥4.99	221 (16.8%)	355 (17.9%)	717 (22.0%)	2,170 (27.6%)	2,648 (35.4%)
Educational background					
Junior high or high school	556 (42.3%)	737 (37.1%)	1,041 (31.9%)	1,999 (25.4%)	1,528 (20.4%)
Vocational school, junior college or technical school	303 (23.1%)	508 (25.6%)	832 (25.5%)	1,899 (24.1%)	1,579 (21.1%)
University	418 (31.8%)	697 (35.1%)	1,263 (38.7%)	3,570 (45.4%)	3,758 (50.2%)
Graduate School	36 (2.7%)	42 (2.1%)	127 (3.9%)	403 (5.1%)	619 (8.3%)
Marital status					
married	652 (49.7%)	1,012 (51.0%)	1,671 (51.2%)	4,439 (56.4%)	4,617 (61.7%)
widowed/divorced	149 (11.3%)	249 (12.6%)	367 (11.2%)	833 (10.6%)	630 (8.4%)
unmarried	512 (39.0%)	723 (36.4%)	1,225 (37.5%)	2,599 (33.0%)	2,237 (29.9%)
Occupation					
General employee	947 (72.1%)	1311 (66.1%)	1,793 (54.9%)	3,899 (49.5%)	3,741 (50.0%)
Manager	95 (7.2%)	146 (7.4%)	249 (7.6%)	795 (10.1%)	1,157 (15.5%)
Executive manager	27 (2.1%)	69 (3.5%)	104 (3.2%)	171 (2.2%)	179 (2.4%)
Public employee, faculty member, or non-profit organization employee	56 (4.3%)	119 (6.0%)	418 (12.8%)	1,302 (16.5%)	824 (11.0%)
Temporary/contract employee	132 (10.1%)	245 (12.3%)	507 (15.5%)	1,012 (12.9%)	906 (12.1%)
Professional occupation (lawyer, tax accountant, medical-related, etc.)	43 (3.3%)	76 (3.8%)	167 (5.1%)	613 (7.8%)	625 (8.4%)
Other occupation	13 (1.0%)	18 (0.9%)	25 (0.8%)	79 (1.0%)	52 (0.7%)
Number of employees in the workplace					
5–9	273 (20.8%)	362 (18.2%)	369 (11.3%)	328 (4.2%)	146 (2.0%)
10–99	576 (43.9%)	998 (50.3%)	1,405 (43.1%)	2,469 (31.4%)	1,316 (17.6%)
100–999	272 (20.7%)	415 (20.9%)	881 (27.0%)	2,757 (35.0%)	2,700 (36.1%)
≥1,000	192 (14.6%)	209 (10.5%)	608 (18.6%)	2,317 (29.4%)	3,322 (44.4%)

The flow diagram of this study is shown in Fig. 1. Respondents were asked to answer yes/no to the following two questions about COVID-19 infection: "Have you had COVID-19?" and "Have you come in close contact with a person infected with COVID-19?" Those who answered yes to either question were excluded from the study (n=399), because they may have influenced their personal infection prevention behavior. We also excluded self-em-

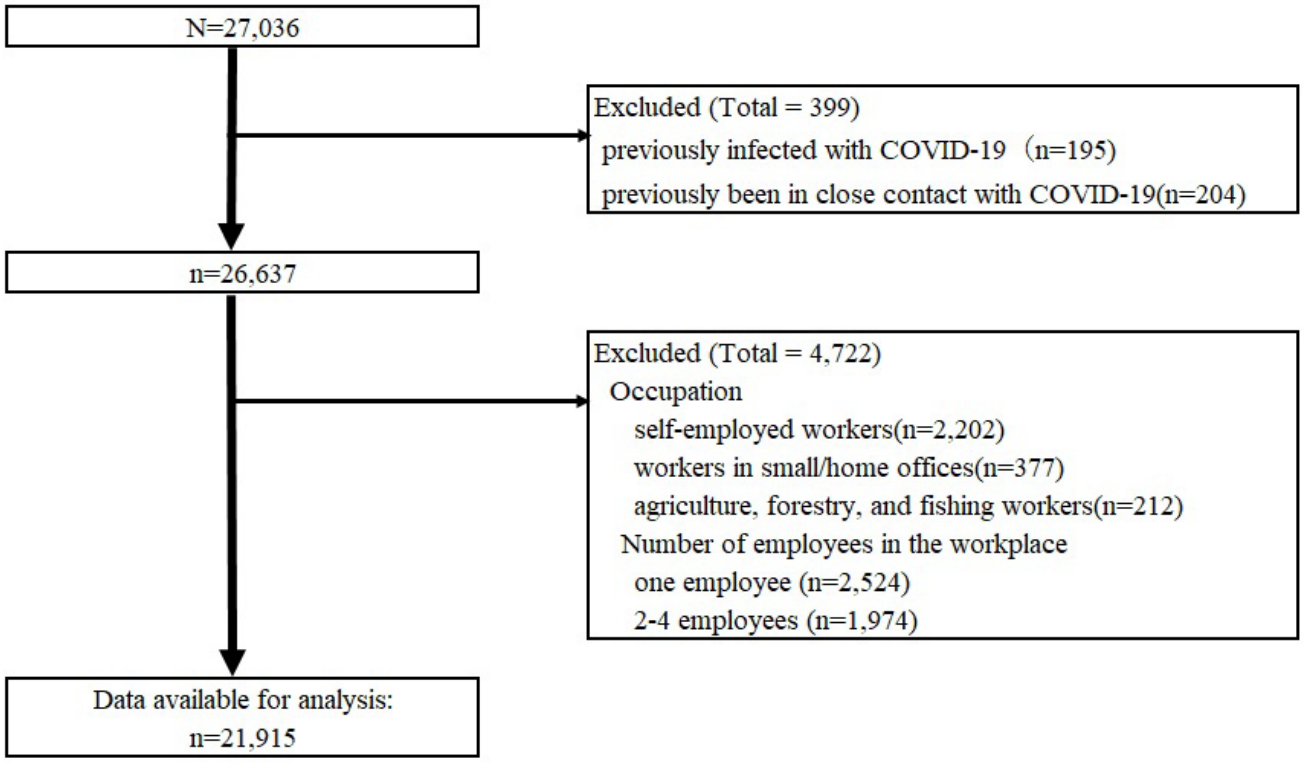

Fig. 1. The flow diagram of this study.

ployed workers (2,202), workers in small/home offices (377) and those in agriculture, forestry, and fishing (212) because of the need to evaluate infection control measures in the workplace. Workplaces with four or fewer employees were excluded from the analysis because it can be assumed that infection control measures in the workplace and personal infection prevention behavior were closely similar (one employee (n=2,524) and 2–4 employees (n=1,974)). We finally analyzed 21,915 workers.

Assessment of infection control measures in the workplace

For each of the following nine infection control measures in the workplace, respondents were asked to choose whether or not the measures were being implemented: (1) prohibition/restriction of business trips; (2) prohibition/restriction of visitors; (3) prohibition of holding or limiting the number of people participating in social gatherings and banquets; (4) restriction on face-to-face meetings; (5) requirement to always wear masks during working hours; (6) installation of partitions and change of workplace layout; (7) recommendation for daily temperature check; (8) recommendation to telecommute; and (9) Request not to come to work when sick. These nine items were selected by the researchers based on discussion about infection control measures against COVID-19 in the workplace described in the guidelines of the Japanese government[3] and professional organizations[14]. While the government has requested workplaces to implement some kind of infection control measures, we considered workplaces that have not implemented such measures at all to be unique. We classified the implementation status into five categories: 0, 1–2, 3–4, 5–7, and 8–9.

Assessment of personal infection prevention behavior

For each of the following seven personal infection prevention behaviors, respondents were asked to select from among four options (almost always; almost often; not often; or almost never) of how often they had performed the behavior in the last month: (1) wearing a mask in the presence of others; (2) disinfecting hands with alcohol before going indoors; (3) washing hands after using the toilet; (4) gargling when returning home; (5) opening windows and doors to ventilate the room; (6) carrying alcohol disinfectant when going out; and (7) disinfecting hands and washing hands after touching things that many people have touched. These seven items were based on the infection control guidelines for COVID-19 drawn up by the WHO[2] and the Japanese government[15–17] for the general public. The researchers selected infection control measures commonly implemented by Japanese people. In addition, we

included carrying alcohol disinfectant in personal infection preventive behaviors, because regularly and thoroughly clean hands with an alcohol-based hand rub is an effective infection control measure. We created a binary variable by defining almost always as having good behavior, and the other responses as not having good behavior.

Assessment of covariates

Covariates included demographics, socioeconomic factors, occupation and number of employees in the workplace. Age was expressed as a continuous variable. Yearly household income was classified into four categories: <2.50 million Japanese yen (JPY); ≥2.50 and <3.75 million JPY; ≥3.75 and <5.00 million JPY; and ≥5.00 million JPY. Education was classified into four categories: junior high school or high school, vocational school, junior college or technical college, and university or graduate school. Marital status was classified into three categories: married; divorce or widowed; or unmarried. In this survey, participants chose 1 occupation from among 10 options: general employee; manager; executive manager; public employee, faculty member, or non-profit organization employee; temporary or contract employee; self-employed; small office home office (SOHO); agriculture, forestry, or fishing; professional occupation (lawyer, tax accountant, medical-related, etc.); and other occupations. Three of these categories were excluded from this study, as mentioned above, so occupation was ultimately classified into seven categories. The number of employees in the workplace was classified into four categories: 5–9, 10–99, 100–999, and ≥1,000. In addition, the cumulative incidence rate of COVID-19 infection one month prior to the conduct of the survey in the prefecture of residence was used as a community-level variable. Information was collected from the websites of public institutions.

Statistical analyses

The odds ratios (ORs) of having good personal infection prevention behavior associated with infection control measures in the workplace were estimated using a multilevel logistic model nested in the prefectures of residence. An analysis was conducted for each of the seven personal infection prevention behaviors. The multivariate model was adjusted for age and sex, income (by category), educational background (by category), marital status, occupation and number of employees in the workplace (by category). The incidence rate of COVID-19 by prefecture was also used as a prefecture-level variable. A trend test was performed by conducting the same analysis for each of the seven personal infection prevention behaviors in the workplace using the number of infection control measures in the workplace (0–9) as a continuous variable. A *p*-value less than 0.05 was considered statistically significant. All analyses were conducted using Stata (Stata Statistical Software release 16; StataCorp LLC, TX, USA).

The present study was approved by the Ethics Committee of the University of Occupational and Environmental Health, Japan (reference No. R2-079). Informed consent was obtained from all participants.

Results

Table 1 shows participant characteristics by category of the number of infection control measures in the workplace. Of the 21,915 participants, 7,484 (34%) were in a workplace with eight or nine infection control measures, and 1,313 (6%) were in a workplace with no infection control measures.

Table 2 and Supplemental Table 2–8 shows the association between the number of infection control measures in the workplace and the percentage of good personal infection prevention behaviors among the 21,915 participants. The number of infection control measures in the workplace was positively associated with all the good personal infection prevention behaviors (*p* for trend; $p<0.001$). However, the number of workplace infection control measures for which the execution of prevention behavior was significant compared to no measures differed depending on the type of personal infection prevention behavior. The number of infection control measures in the workplace associated with wearing a mask in the presence of others were 1–2 measures (aOR=2.12, 95% confidence interval [CI]: 1.81–2.49, $p<0.001$), 3–4 measures (3.22 (2.77–3.75), $p<0.001$), 5–7 measures (5.21 (4.52–6.01), $p<0.001$) and 8–9 measures (6.75 (5.80–7.86), $p<0.001$). That positively associated with carrying alcohol disinfectant when going out was 8–9 measures (1.73 (1.51–1.99), $p<0.001$). That associated with disinfecting hands and washing hands after touching things that many people had touched under conditions wherein infection control in the workplace is thoroughly implemented were 5–7 measures (1.36 (1.19–1.56), $p<0.001$) and 8–9 measures (2.33 (2.03–2.68), $p<0.001$).

Discussion

In this study, we classified the implementation status of infection control measures in the workplace by the number of implementation items and investigated the relationship

Table 2. Odds ratios by number of infection control measures in the workplace and good personal infection prevention behavior

Number of infection control measures in the workplace	Personal infection preventive behaviors		Crude				Multi-variate adjusted*			
	n	%	OR	95%CI		*p* value	OR	95%CI		*p* value
	(1) Wearing a mask in the presence of others									
0	812	61.8	reference			<0.001†	reference			<0.001†
1–2	1,551	78.2	2.22	1.90	2.59	<0.001	2.12	1.81	2.49	<0.001
3–4	2,762	84.6	3.41	2.95	3.95	<0.001	3.22	2.77	3.75	<0.001
5–7	7,078	89.9	5.54	4.84	6.33	<0.001	5.21	4.52	6.01	<0.001
8–9	6,878	91.9	6.97	6.06	8.01	<0.001	6.75	5.80	7.86	<0.001
	(2) Disinfecting hands with alcohol before going indoors									
0	499	38.0	reference			<0.001†	reference			<0.001†
1–2	827	41.7	1.18	1.02	1.36	0.025	1.13	0.98	1.31	0.103
3–4	1,595	48.9	1.57	1.38	1.79	<0.001	1.54	1.35	1.76	<0.001
5–7	4,479	56.9	2.19	1.94	2.47	<0.001	2.18	1.93	2.48	<0.001
8–9	4,932	65.9	3.19	2.82	3.60	<0.001	3.34	2.94	3.80	<0.001
	(3) Washing hands after using the toilet									
0	852	64.9	reference			<0.001†	reference			<0.001†
1–2	1,559	78.6	1.99	1.70	2.32	<0.001	1.94	1.65	2.28	<0.001
3–4	2,753	84.4	2.92	2.52	3.39	<0.001	2.85	2.44	3.32	<0.001
5–7	6,974	88.6	4.21	3.69	4.81	<0.001	4.18	3.63	4.82	<0.001
8–9	6,753	90.2	5.00	4.36	5.73	<0.001	5.15	4.43	5.98	<0.001
	(4) Gargling when returning home									
0	533	40.6	reference			<0.001†	reference			<0.001†
1–2	868	43.8	1.16	1.00	1.34	0.044	1.14	0.99	1.32	0.072
3–4	1,512	46.3	1.29	1.13	1.48	<0.001	1.27	1.11	1.45	<0.001
5–7	3,931	49.9	1.52	1.35	1.71	<0.001	1.48	1.30	1.67	<0.001
8–9	4,458	59.6	2.18	1.93	2.46	<0.001	2.11	1.86	2.40	<0.001
	(5) Opening windows to ventilate the room									
0	434	33.1	reference			<0.001†	reference			<0.001†
1–2	702	35.4	1.11	0.95	1.28	0.179	1.06	0.91	1.23	0.464
3–4	1,257	38.5	1.28	1.12	1.46	<0.001	1.24	1.08	1.42	0.003
5–7	3,413	43.4	1.58	1.39	1.78	<0.001	1.55	1.36	1.76	<0.001
8–9	4,115	55.0	2.46	2.17	2.79	<0.001	2.56	2.24	2.92	<0.001
	(6) Carrying alcohol disinfectant									
0	363	27.6	reference			<0.001†	reference			<0.001†
1–2	531	26.8	0.96	0.82	1.12	0.594	0.90	0.76	1.06	0.193
3–4	896	27.5	0.99	0.86	1.15	0.913	0.95	0.82	1.11	0.526
5–7	2,195	27.9	1.02	0.89	1.16	0.807	1.01	0.88	1.15	0.941
8–9	2,870	38.3	1.62	1.42	1.84	<0.001	1.73	1.51	1.99	<0.001
	(7) Disinfecting hands and washing hands after touching things									
0	369	28.1	reference			<0.001†	reference			<0.001†
1–2	562	28.3	1.02	0.87	1.19	0.833	0.96	0.82	1.13	0.627
3–4	987	30.2	1.11	0.97	1.28	0.138	1.08	0.93	1.25	0.322
5–7	2,723	34.6	1.37	1.20	1.56	<0.001	1.36	1.19	1.56	<0.001
8–9	3,451	46.1	2.19	1.92	2.49	<0.001	2.33	2.03	2.68	<0.001

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

of this classification with the implementation of personal infection prevention behavior. Results showed that implementation of infection prevention behavior by individuals significantly increased as the number of infection control measures in the workplace increased. Specifically, it was suggested that infection control measures against COVID-19 in the workplace may affect personal infection prevention behavior.

In this survey, the number of infection control measures in the workplace was found to be associated with good personal infection prevention behavior. It has been reported that workplace-initiated health promotion programs encourage workers to adopt better health behavior[6–8]. Raising awareness to change the behavior of employees is recommended as a measure of COVID-19 control in the workplace[18, 19]. Therefore, it is possible that guidance may be provided as part of infection prevention measures for individuals in those workplaces where infection control measures are actively implemented, and this may have had a direct effect on the behavior of individuals.

In addition, the implementation of infection control measures in the workplace would send a message to employees about the risks associated with COVID-19 infection. In a survey of Japanese people, it was reported that "the number of workplace measures taken in response to COVID-19 was positively associated with global fear of COVID-19[20]." In a survey of Ethiopian waiters, it was reported, with regard to good preventive behavior, that knowledge of COVID-19 was not high but risk perception was high[21]. In a survey of Chinese occupational fields, it was reported that knowledge about transmission routes of COVID-19 was correlated with all four personal infection prevention behaviors (wearing a face mask consistently in any public space; sanitizing hands every time after returning from public spaces or touching installations; avoiding social and meal gatherings with people who do not live together; and avoiding crowded places) but the perceived severity of COVID-19 was not associated with consistent face mask wearing or sanitizing hands[11]. Considering these previous studies, thorough implementation of infection control measures may increase knowledge and awareness of risks of COVID-19 infection, resulting in the adoption of personal infection prevention behavior.

The survey showed that the number of people taking infection prevention actions tended to increase significantly as the number of infection control measures in the workplace increased. This result suggests that proactive implementation of infection control measures in the workplace can lead to an observational feeling, an increase in personal motivation, and an acceleration of personal infection prevention behaviors toward a common goal for the workplace and employees[22].

The association in our present survey varied according to the items of infection prevention behaviors. Compared to the situation in which the number of infection control measures in the workplace was 0, significant differences when the number of infection control measures in the workplace was 1–2 were seen wearing a mask and washing hands after using the toilet. These items had a higher implementation rate than other personal infection prevention behaviors. Further, when there were 3–4 workplace measures, significant differences were additionally seen for alcohol hand disinfection, gargling when returning home, and room ventilation. These findings indicate that personal items that can be implemented relatively easily with a larger overall number of workplace implementations are more susceptible to the effect of the number of workplace infection control measures.

In the future, attainment of herd immunity through vaccination is considered to be the most effective way to prevent COVID-19[23]. However, given the time required to acquire herd immunity in many countries and the impact of variants on vaccine effectiveness, it can be said that a thorough implementation of personal behavior aimed at infection prevention will continue to be an essential measure against pandemic[24]. In Japan, even at of the end of March 2020, when the government's request for cooperation was made, Japanese people in general had changed their behavior, indicating that understanding of the need for each individual to take action against COVID-19 was already widespread, thanks to the influence of mass media and social media[25]. The present findings indicate that to encourage people who are not ready to change their behavior, it is important to strengthen infection control measures in the workplace where workers spend many hours of the day. In addition, it is desirable to combine multiple infection control measures, as it has been reported that the pandemic can be delayed by implementing a strategy that combines multiple measures rather than individual measures[26]. In such cases, there are levels of difficulty in implementing infection control measures differ among different industries and job types, such as restrictions on telecommuting and interviews, and it is considered more effective to increase the number of measures to be implemented in accordance with the actual circumstances of the workplace. Although there are differences in the likelihood that the effects of workplace infection control measures influence the item of personal infection prevention behavior, it is important that

workplace infection control measures are thoroughly implemented.

There are several limitations to this study. First, since this is a cross-sectional study, it is unclear whether the number of infection control measures in the workplace influences the infection prevention behavior of individuals or vice versa. Similar studies can be conducted in the future to clarify the causal relationship. Second, this study was conducted on monitors registered with Cross Marketing Inc. The survey targets those who have Internet access and have registered as monitors. However, since subject bias was reduced by random sampling for each region/worker status/sex/age based on the incidence of infections, our results appear to be generalizable within Japan[12]. We used the personal infection prevention behaviors recommended in Japan, so generalizability of this study to other countries appears limited. Third, it is said that Japanese people characteristically adjust themselves to others easily[27], and that the implementation of infection control measures in the workplace might therefore be strongly related to personal infection prevention behavior. This study appears to support this idea, given that implementation of workplace infection control measures tended to promote personal infection prevention behavior. The findings of this study are likely to be utilized in the future not only for COVID-19 control but also for other infections, including emerging infectious diseases and seasonal influenza.

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Competing Interests

None declared.

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Authors' Contributions

MK; analysis and writing the manuscript, TN; creating the questionnaire, analysis, drafting the manuscript and advice on interpretation, HA, AH, ST, MT, and SM; Review of manuscripts, and advice on interpretation, YF; overall survey planning, creating the questionnaire, and review of manuscripts, KM; drafting the manuscript, review of manuscripts, and advice on interpretation.

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Table S1. Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category	Checklist Item	Response
Development and pre-testing		
	Development and testing	Several researchers actually answered the web questions. They checked inappropriate expressions, ease of answering and other issues, and revised.
Recruitment process and description of the sample having access to the questionnaire		
	Open survey versus closed survey	Only people who are registered with Cross Marketing Inc. (Tokyo, Japan) can answer this survey.
	Contact mode	Only on the internet
	Advertising the survey	Of the 605,381 people who were emailed invitations to participate, 55,045 registered monitors answered the initial screening questions and participated in the survey. 33,302 who matched the survey's criteria (worker status, region, gender, and age) responded.
Survey administration		
	Web/E-mail	Cross Marketing Inc. (Tokyo, Japan) sent out through e-mail. There was an automatic method for capturing responses.
	Context	It is a survey company that includes questionnaires in a variety of fields. The purpose of web site is to answer surveys. (e.g., Research Panel, Inc. https://research-panel.jp/)
	Mandatory/voluntary	It was a voluntary survey.
	Incentives	Yes
	Time/Date	December 22 to 25, 2020
	Randomization of items or questionnaires	No
	Adaptive questioning	Yes
	Number of Items	1 item per page
	Number of screens (pages)	55 pages
	Completeness check	We did consistency or completeness checks before the questionnaire is submitted. In case of inconsistency in a question, an alert was displayed to control the consistency.
	Review step	Yes
Response rates		
	Unique site visitor	We count the monitor ID given to the respondents when they accessed the survey system.
	View rate (Ratio of unique survey visitors/unique site visitors)	We don't know. We sent first e-mail to 605,381 people, and 55,045 people agree to complete the survey.
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	We don't count number of people who filled in the first survey page, or who visit the first page of the survey.
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The completeness rate is 81.7%. 33,087 people submitted the last questionnaire page (215 of the 33,302 respondents were excluded because they were deemed to have provided fraudulent responses by Cross Marketing Inc.) 27,036 people agreed to participate. (6,051 surveys determined to contain invalid responses or response errors were excluded. The exclusion criteria were as follows: extremely short response time (less than 6 minutes), extremely low body weight (<30 kg), extremely short height (<140 cm), inconsistent answers to similar questions throughout the survey (e.g., inconsistency to questions about marital status and living area), and wrong answers to a staged question used to identify fraudulent responses (choose the third largest number from the following five numbers).
Preventing multiple entries from the same individual		
	Cookies used	No
	IP check	No
	Log file analysis	No
	Registration	It is managed by member ID.

Table S2. Odds ratios by number of infection control measures in the workplace and wearing a mask in the presence of others

	(1) Wearing a mask in the presence of others			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	2.12	1.81	2.49	<0.001
3–4	3.22	2.77	3.75	<0.001
5–7	5.21	4.52	6.01	<0.001
8–9	6.75	5.80	7.86	<0.001
Age	1.00	0.99	1.00	0.46
Sex				
Men	reference			
Women	2.43	2.19	2.70	<0.001
Equivalent income (million JPY)				
<2.50	0.90	0.79	1.03	0.11
≥2.50 and <3.75	1.02	0.91	1.15	0.72
≥3.75 and <4.99	1.04	0.93	1.18	0.49
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.12	0.99	1.26	0.07
University	1.09	0.98	1.21	0.10
Graduate School	0.97	0.79	1.17	0.72
Marital status				
married	reference			
widowed/divorced	0.94	0.81	1.09	0.44
unmarried	0.86	0.78	0.95	<0.001
Occupation				
General employee	reference			
Manager	1.09	0.95	1.25	0.22
Executive manager	1.24	0.95	1.62	0.11
Public employee, faculty member, or non-profit organization employee	1.13	0.98	1.30	0.09
Temporary/contract employee	1.19	1.03	1.36	0.02
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.24	1.01	1.53	0.04
Other occupation	1.28	0.77	2.13	0.33
Number of employees in the workplace				
5–9	reference			
10–99	0.88	0.75	1.04	0.14
100–999	0.85	0.71	1.01	0.06
≥1,000	0.89	0.75	1.07	0.21

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

Table S3. Odds ratios by number of infection control measures in the workplace and disinfecting hands with alcohol before going indoors

	(2) Disinfecting hands with alcohol before going indoors			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	1.13	0.98	1.31	0.103
3–4	1.54	1.35	1.76	<0.001
5–7	2.18	1.93	2.48	<0.001
8–9	3.34	2.94	3.80	<0.001
Age	0.99	0.99	1.00	<0.001
Sex				
Men	reference			
Women	1.75	1.63	1.87	<0.001
Equivalent income (million JPY)				
<2.50	1.09	0.99	1.19	0.07
≥2.50 and <3.75	0.99	0.92	1.08	0.88
≥3.75 and <4.99	1.04	0.96	1.12	0.33
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.11	1.02	1.20	0.01
University	0.95	0.88	1.02	0.14
Graduate School	0.76	0.67	0.87	<0.001
Marital status				
married	reference			
widowed/divorced	0.89	0.81	0.98	0.02
unmarried	0.82	0.77	0.88	<0.001
Occupation				
General employee	reference			
Manager	1.10	1.00	1.22	0.05
Executive manager	1.24	1.03	1.49	0.02
Public employee, faculty member, or non-profit organization employee	0.96	0.88	1.06	0.44
Temporary/contract employee	0.91	0.83	0.99	0.03
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.31	1.16	1.48	<0.001
Other occupation	1.19	0.88	1.63	0.26
Number of employees in the workplace				
5–9	reference			
10–99	1.08	0.96	1.22	0.20
100–999	0.98	0.87	1.11	0.78
≥1,000	0.95	0.84	1.08	0.42

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

Table S4. Odds ratios by number of infection control measures in the workplace and washing hands after using the toilet

	(2) Disinfecting hands with alcohol before going indoors			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	1.13	0.98	1.31	0.103
3–4	1.54	1.35	1.76	<0.001
5–7	2.18	1.93	2.48	<0.001
8–9	3.34	2.94	3.80	<0.001
Age	0.99	0.99	1.00	<0.001
Sex				
Men	reference			
Women	1.75	1.63	1.87	<0.001
Equivalent income (million JPY)				
<2.50	1.09	0.99	1.19	0.07
≥2.50 and <3.75	0.99	0.92	1.08	0.88
≥3.75 and <4.99	1.04	0.96	1.12	0.33
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.11	1.02	1.20	0.01
University	0.95	0.88	1.02	0.14
Graduate School	0.76	0.67	0.87	<0.001
Marital status				
married	reference			
widowed/divorced	0.89	0.81	0.98	0.02
unmarried	0.82	0.77	0.88	<0.001
Occupation				
General employee	reference			
Manager	1.10	1.00	1.22	0.05
Executive manager	1.24	1.03	1.49	0.02
Public employee, faculty member, or non-profit organization employee	0.96	0.88	1.06	0.44
Temporary/contract employee	0.91	0.83	0.99	0.03
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.31	1.16	1.48	<0.001
Other occupation	1.19	0.88	1.63	0.26
Number of employees in the workplace				
5–9	reference			
10–99	1.08	0.96	1.22	0.20
100–999	0.98	0.87	1.11	0.78
≥1,000	0.95	0.84	1.08	0.42

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

Table S5. Odds ratios by number of infection control measures in the workplace and gargling when returning home

	(4) Gargling when returning home			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	1.14	0.99	1.32	0.072
3–4	1.27	1.11	1.45	<0.001
5–7	1.48	1.30	1.67	<0.001
8–9	2.11	1.86	2.40	<0.001
Age	1.00	0.99	1.00	<0.001
Sex				
Men	reference			
Women	1.19	1.11	1.27	<0.001
Equivalent income (million JPY)				
<2.50	1.06	0.97	1.16	0.21
≥2.50 and <3.75	1.03	0.95	1.11	0.46
≥3.75 and <4.99	0.97	0.89	1.04	0.37
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.14	1.05	1.23	<0.001
University	1.24	1.15	1.33	<0.001
Graduate School	1.22	1.07	1.39	<0.001
Marital status				
married	reference			
widowed/divorced	0.78	0.71	0.86	<0.001
unmarried	0.94	0.88	1.00	0.05
Occupation				
General employee	reference			
Manager	0.99	0.90	1.09	0.89
Executive manager	1.07	0.89	1.28	0.47
Public employee, faculty member, or non-profit organization employee	1.01	0.93	1.11	0.76
Temporary/contract employee	0.87	0.80	0.95	<0.001
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.00	0.89	1.12	0.99
Other occupation	1.13	0.84	1.52	0.41
Number of employees in the workplace				
5–9	reference			
10–99	1.01	0.89	1.13	0.92
100–999	0.91	0.81	1.03	0.14
≥1,000	1.00	0.89	1.14	0.95

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

Table S6. Odds ratios by number of infection control measures in the workplace and opening windows to ventilate the room

	(5) Opening windows to ventilate the room			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	1.06	0.91	1.23	0.464
3–4	1.24	1.08	1.42	0.003
5–7	1.55	1.36	1.76	<0.001
8–9	2.56	2.24	2.92	<0.001
Age	1.00	1.00	1.00	0.84
Sex				
Men	reference			
Women	1.62	1.51	1.73	<0.001
Equivalent income (million JPY)				
<2.50	0.98	0.89	1.07	0.64
≥2.50 and <3.75	0.96	0.89	1.04	0.33
≥3.75 and <4.99	0.98	0.91	1.06	0.62
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.07	0.99	1.16	0.10
University	1.00	0.94	1.08	0.90
Graduate School	0.88	0.77	1.00	0.06
Marital status				
married	reference			
widowed/divorced	1.02	0.92	1.12	0.72
unmarried	0.92	0.86	0.98	0.01
Occupation				
General employee	reference			
Manager	1.08	0.98	1.19	0.10
Executive manager	1.37	1.14	1.65	<0.001
Public employee, faculty member, or non-profit organization employee	1.20	1.09	1.31	<0.001
Temporary/contract employee	0.83	0.76	0.91	<0.001
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.17	1.04	1.31	0.01
Other occupation	1.41	1.04	1.89	0.03
Number of employees in the workplace				
5–9	reference			
10–99	1.08	0.96	1.22	0.20
100–999	0.89	0.78	1.00	0.05
≥1,000	0.90	0.79	1.02	0.09

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

Table S7. Odds ratios by number of infection control measures in the workplace and carrying alcohol disinfectant

	(6) Carrying alcohol disinfectant			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	0.90	0.76	1.06	0.193
3–4	0.95	0.82	1.11	0.526
5–7	1.01	0.88	1.15	0.941
8–9	1.73	1.51	1.99	<0.001
Age	0.99	0.99	1.00	<0.001
Sex				
Men	reference			
Women	2.41	2.23	2.59	<0.001
Equivalent income (million JPY)				
<2.50	1.03	0.93	1.13	0.59
≥2.50 and <3.75	0.93	0.86	1.01	0.10
≥3.75 and <4.99	1.01	0.93	1.10	0.76
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.04	0.96	1.14	0.34
University	0.92	0.85	0.99	0.03
Graduate School	0.83	0.71	0.96	0.01
Marital status				
married	reference			
widowed/divorced	0.92	0.83	1.02	0.11
unmarried	0.83	0.77	0.89	<0.001
Occupation				
General employee	reference			
Manager	1.09	0.98	1.22	0.11
Executive manager	1.54	1.27	1.87	<0.001
Public employee, faculty member, or non-profit organization employee	0.99	0.90	1.10	0.88
Temporary/contract employee	0.81	0.74	0.90	<0.001
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.18	1.05	1.33	0.01
Other occupation	1.22	0.90	1.65	0.20
Number of employees in the workplace				
5–9	reference			
10–99	0.94	0.83	1.07	0.35
100–999	0.79	0.69	0.90	<0.001
≥1,000	0.81	0.70	0.92	<0.001

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend

Table S8. Odds ratios by number of infection control measures in the workplace and disinfecting hands and washing hands after touching things

	(7) Disinfecting hands and washing hands after touching things			
	OR*	95%CI		*p* value
Number of infection control measures in the workplace				
0	reference			<0.001†
1–2	0.96	0.82	1.13	0.627
3–4	1.08	0.93	1.25	0.322
5–7	1.36	1.19	1.56	<0.001
8–9	2.33	2.03	2.68	<0.001
Age	0.99	0.99	0.99	<0.001
Sex				
Men	reference			
Women	2.18	2.03	2.34	<0.001
Equivalent income (million JPY)				
<2.50	1.00	0.91	1.09	0.93
≥2.50 and <3.75	0.93	0.85	1.01	0.07
≥3.75 and <4.99	1.04	0.96	1.13	0.34
≥4.99	reference			
Educational background				
Junior high or high school	reference			
Vocational school, junior college or technical school	1.00	0.92	1.09	0.95
University	0.93	0.86	1.00	0.05
Graduate School	0.90	0.78	1.04	0.14
Marital status				
married	reference			
widowed/divorced	0.98	0.89	1.09	0.76
unmarried	0.86	0.80	0.92	<0.001
Occupation				
General employee	reference			
Manager	1.07	0.97	1.19	0.17
Executive manager	1.63	1.35	1.96	<0.001
Public employee, faculty member, or non-profit organization employee	0.97	0.89	1.07	0.60
Temporary/contract employee	0.83	0.76	0.92	<0.001
Professional occupation (lawyer, tax accountant, medical-related, etc.)	1.24	1.11	1.40	<0.001
Other occupation	1.31	0.97	1.77	0.08
Number of employees in the workplace				
5–9	reference			
10–99	0.89	0.78	1.00	0.06
100–999	0.79	0.70	0.90	<0.001
≥1,000	0.79	0.69	0.90	<0.001

* Odds ratio adjusted for age and sex, equivalent income, educational background, marital status, occupation and number of employees in the workplace.

† *p* for trend