**Major Coping-behavior and Risk-perception Factors for the COVID-19 Pandemic and
their Psychobehavioral Characteristics**

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Abstract

Background: The coronavirus disease 2019 (COVID-19) has dramatically changed people's behavior to prevent infection and overcome the general adversity caused by the implementation of infection-prevention measures. However, current COVID-19 studies still lack an objectively constructed model that can provide a parsimonious structure and help separate the nuances of different coping-behavior and risk-perception factors. Moreover, the psychological mechanisms (e.g., survival-oriented psychobehavioral characteristics) of coping behavior remains unclear.

Objective: This study aims to develop a compact model to elucidate the main coping-behavior and risk-perception factors. In addition, we examine the underlying psychological mechanisms of coping behavior.

Method: We recruited 2,885 Japanese participants (1,524 women, ages 20–91 years). The survey was distributed to responders between March 19th and 24th, 2020. We used exploratory factor analysis to identify the major factors of coping behavior and risk perception. Then we conducted a hierarchical multiple regression analysis to investigate the relationship between coping-behavior factors and demographic information, risk-perception factors, and psychobehavioral characteristics.

Results: From our analysis, we identified four types of coping behavior (CB1 mask-wearing, CB2 information-seeking, CB3 resistance to social stagnation, and CB4 infection prevention) and three risk-perception factors (RP1 shortages of daily necessities, RP2 medical concerns, and RP3 socioeconomic concerns). The results showed that CB1 was positively associated with female sex and etiquette. CB2 was positively related to RP1 and RP3. CB3 was positively related to RP1 and leadership while negatively associated with etiquette. CB4 was positively contributed by female sex, etiquette, and active well-being.

Conclusions: This study identified four coping-behavior and three risk-perception factors

encompassing primary aspects of coping behavior and risk perception during the pandemic. Mask-wearing (CB1) and infection prevention (CB4) are two independent infection-prevention factors enhanced by female sex and etiquette but not by medical concern. Additionally, infection prevention (CB4) is facilitated by active well-being. The two coping behaviors for general adversity (CB2 and CB3) are encouraged by shortages of daily necessities (RP1), and information-seeking (CB2) is facilitated by socioeconomic concerns (RP3), while resistance to social stagnation (CB3) is inhibited by etiquette and facilitated by leadership. These results demonstrate the unique psychological mechanisms of different coping behavior, and they can inform strategic approaches that seek to optimize the social response to the pandemic.

Keywords: COVID-19, coping behavior, risk perception, psychobehavioral characteristics

Introduction

Since the first case of coronavirus disease 2019 (COVID-19) was reported to the WHO, governments have spared no effort to prevent infection and transmission of this virus [1]. As a health disaster [2], the response to this novel infectious disease is a public health issue that involves psychological and behavioral effects on individuals. Many studies have reported severe mental-health problems related to COVID-19, such as anxiety, depression, and suicide [3]. People are wearing masks, disinfecting their hands, and avoiding crowds to prevent infection and transmission of the virus; simultaneously, they manage social disruptions caused by the pandemic and precautions, such as shortages of masks and toilet paper and losses of jobs and important events. In such a stressful environment, it is vital to understand how individuals manage both types of adversity (i.e., infection and general adversity) to maintain their current standard of living.

Recent studies have shown facilitative associations between these two types of coping behaviors (infection-prevention and general-adversity coping behaviors) and risk perception, as well as mixed relationships with psychobehavioral characteristics. Self-isolation is positively associated with the risk perceptions of personal safety and health service [4]. Information-seeking is positively associated with perceived risks to the individual and the community [5], while behavior change (e.g., informing others about COVID-19) is positively associated with the risk perception of infection [6]. This facilitative effect of risk perception on coping behavior is consistent with the findings for other types of hazards, such as hurricanes, tornadoes, earthquakes, and volcanoes [7–12]. Previous findings concerning the relationships between coping behavior and psychobehavioral characteristics implied that the Big Five personality traits are significantly associated with infection-prevention behaviors [13–20]. Extraversion, openness, conscientiousness, and agreeableness are positively associated with infection-prevention behaviors, while neuroticism is negatively associated with such behaviors

[13,19].

However, consensus regarding these findings is difficult because there is no common model of the main coping-behavior and risk-perception factors; this situation has led to the use of variables with different levels of specificity or conceptual overlap in different studies. For example, coping behavior has been defined at different levels of specificity, such as infection prevention [13] and both problem-focused and emotion-focused coping behaviors [21]. Similar risk-perception labels have been used to measure different things. For example, risk perception has been used to represent the degree to which people perceive COVID-19 to be a dangerous disease [22]; it has also been used to indicate the level of knowledge of the risks associated with COVID-19 [5]. Different variable labels have been used to measure similar perceptions of risk, such as the likelihood of infection [19] and concerns related to COVID-19 [13]. Furthermore, coping behavior and risk perception have not been separated. Researchers have attempted to identify risk-perception factors from risk-related items [13], instead of from a mixed pool containing coping behaviors.

In addition, expansion of the scope of psychobehavioral characteristics to survival-oriented characteristics may provide insights into individual differences in perceptions and responses to adversity in disaster situations. We are interested in the Power to Live scale, which was developed in the context of the 2011 Tohoku earthquake and tsunami. That scale identified eight psychobehavioral characteristics that are advantageous for survival: leadership, problem-solving, altruism, stubbornness, etiquette, emotional regulation, self-transcendence, and active well-being. Compared to the Big Five scale, the Power to Live scale provides a more nuanced understanding of the relationships between psychobehavioral characteristics and coping behaviors, particularly in the context of disasters [11,23,24].

In this study, we aimed to build a common model of major coping-behavior and risk - perception factors, while exploring the contributions of risk-perception factors and

psychobehavioral characteristics to coping behavior. We used a battery of questions to investigate people's coping behaviors and risk perception of COVID-19, demographic information, and two sets of psychobehavioral characteristics (i.e., the Power to Live and Big Five scales). First, we conducted an exploratory factor analysis of various coping behaviors and risk perceptions related to five aspects (i.e., self-infection, other infection, shortages of daily necessities, social and economic impacts, and information access) to identify the major factors. Second, we examined the contributions of demographic factors, risk-perception factors (as an exploratory factor), and psychobehavioral characteristics to coping behavior.

Methods

Ethics statement

The survey was reviewed and approved by the Ethical Committee of the International Research Institute of Disaster Science, Tohoku University (2019-035).

Participants

The survey was conducted online by Neo Marketing (Tokyo, Japan) between 19 and 24 March 2020 during the early phase of the pandemic in Japan. The first coronavirus death had been reported (February 13); people had experienced a nationwide closure of elementary and junior high schools (March 2) and a national shortage of masks and toilet paper (March). The survey company emailed an advertisement and provided the data of 3,600 respondents (mean age = 49.73 ± 16.75 years). In addition to these 3600 respondents, 481 participants were previously excluded because of inconsistencies between registered and reported demographic information or identical responses to all questions. We also excluded 715 satisfiers (i.e., people who presumably responded to the questions simply to meet the minimum requirements to finish the session, or people who responded carelessly) whose response time was < 4 min (see the Supplemental Material for further details regarding this criterion) resulting in a valid dataset of 2,885 individuals (1,524 women, mean age = 52.23 ± 16.52 years). No respondents had

127 COVID-19. The demographic details are listed in Table 1.

128 **Table 1.** Demographic information.

Item		N
Sex	Male	1361 (47%)
	Female	1524 (53%)
Age	20s	364 (13%)
	30s	423 (15%)
	40s	470 (16%)
	50s	500 (17%)
	60s	548 (19%)
	70s or older	580 (20%)
Household structure (HS)	Single	525 (18.2%)
	Couple	888 (30.9%)
	Two generations (parents and children)	1232 (42.8%)
	Three generations (parents, children, and grandchildren)	179 (6.1%)
	Other	61 (2.1%)
Toddlers	Have toddlers	250 (9%)
	No toddlers	2635 (91%)
Children	Have children	322 (11%)
	No children	2563 (89%)
Local case of infection	Yes	1109 (38%)
	No (including “don’t know” response)	1776 (62%)
Knowledge	1 (I have no expertise or experience in infectious diseases at all)	1043 (36%)
	2	597 (21%)
	3	582 (20%)
	4	458 (16%)
	5	162 (6%)
	6 (I have extensive expertise and experience with infectious diseases)	43 (1%)
Chronic disease	1 (I have no chronic disease that can cause severe infection)	1666 (58%)
	2	437 (15%)
	3	194 (7%)
	4	228 (8%)
	5	173 (6%)
	6 (I have chronic diseases that can cause severe infection)	187 (6%)
	1 (My age is unlikely to cause infection to become severe)	1021 (35%)
	2	457 (16%)

High-risk age	3	367 (13%)
	4	417 (14%)
	5	344 (12%)
	6 (My age is likely to cause infection to become severe)	279 (10%)
High-risk family members	1 (My family members are unlikely to develop severe infection because of chronic disease or age)	1139 (39%)
	2	330 (11%)
	3	272 (9%)
	4	334 (12%)
	5	332 (11%)
	6 (My family members are likely to develop severe infection because of chronic disease or age)	478 (17%)

Note. The number of samples (%) for each option is shown. Ordinal variables for the regression analyses are coded according to age and degree; binary variables were coded as 1 for male and 0 for female; 1 for “Yes” and 0 for “No”; household structure was coded as a dummy variable.

Measures

The survey was developed with three sections (n = 104 in total), including five aspects of COVID-19-related items that consisted of coping behavior (n = 33), risk perception (n = 17), demographic questions (n = 10), and two psychobehavioral scales (n = 44).

Coping behavior and risk perception

We collected 50 items to measure coping behavior and risk perception from previous studies and interviews with people in our network [25,26]. We included five aspects of coping behavior and risk perception: self-infection, other-infection, daily shortages of necessities, social and economic impacts, and information access (see Supplemental Material for more details).

Demographic information

The demographic questions included 10 items (Table 1): sex, age, place of residence, family structure, have toddlers or not, have children or not, reported local cases of infection, the degree of risk of self-infection becoming severe because of chronic disease or age (two separate items), and the degree of risk of severe disease among their family members because

of underlying disease or age.

Psychobehavioral characteristics

We used the 34-item Power to Live scale, which measures eight psychobehavioral characteristics: leadership, problem-solving, altruism, stubbornness, etiquette, emotional regulation, self-transcendence, and active well-being. Previous studies have validated the internal consistency and concurrent validity [27,28]. Participants responded using a six-point scale: 0 (not at all) to 5 (very much). We calculated the mean score for each characteristic.

We also briefly assessed the Big Five personality traits using the Japanese version of the Ten-Item Personality Inventory (TIPI-J). The TIPI-J has good internal consistency and concurrent validity [29,30]. Participants responded using a six-point scale: 0 (not at all) to 5 (very much). Each of the five dimensions (extraversion, agreeableness, conscientiousness, neuroticism, and openness) included a positive and a reverse item. We calculated the dimension score by subtracting the reverse-item score from the positive-item score.

Analysis

All analyses were performed in R [31] using the tidyverse [32], psych [33], GPArotation (Bernaards & I. Jennrich, 2005), EFA.MRFA [35], parameters [36], and effectsize [37] packages.

Exploratory Factor Analysis

We performed a factor analysis by pooling all coping-behavior and risk-perception items. The factor analysis aimed to dissociate coping behavior and risk perception by eliminating items that may convey similar nuances of coping behavior and risk perception. First, we confirmed the appropriateness of the data for exploratory factor analysis by performing the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests [38]. Then, the number of factors was suggested by the minimum average partial procedure (Velicer, 1976), the Hull method [40], parallel analysis [41], and a scree plot. We used the maximum likelihood

extraction method with promax rotation. We set three exclusion criteria to remove an item: commonality < 0.3 , loading < 0.4 , or loading > 0.4 on more than one factor (cross-loading). After item removal, we repeated the analysis until all items met the criteria. Cronbach's α was calculated for each factor to estimate internal consistency.

Correlation Analysis

We performed correlation analysis to explore the relationships among the identified coping-behavior factors, risk-perception factors, and psychobehavioral characteristics. Considering the large sample size, we set $|r| > 0.3$ as the effect-size threshold [42,43].

Hierarchical Regression Analysis

To explore the factors contributing to coping behavior, we performed hierarchical regression analyses for each of the four coping-behavior factors. We used the factor score as the dependent variable; we used 13 background factors in the first block, three risk-perception factors in the second block, and 13 psychobehavioral characteristics in the third block as explanatory variables.

To explore the factors contributing to risk perception, we applied similar hierarchical regression models for each of the three risk-perception factors. We entered the 13 background-factor variables in the first block and the 13 psychobehavioral characteristics in the second block as explanatory variables.

Hierarchical regression analyses were performed using the stepwise method, and the variables were selected based on Akaike's Information Criterion. For each regression model, we calculated tolerance and the variance inflation factor to detect multicollinearity among predictors. Tolerance values < 0.2 or variance inflation factor > 4 were considered problematic [44]. We used Cohen's f^2 as the overall effect size for each block in the hierarchical regression [42], and $f_{B/A}^2$ as the effect size for each predictor [45]. Because of the large sample size, we used a small effect size (i.e., Cohen's $f^2 = 0.02$) as the threshold.

Results

Exploratory Factor Analysis

The results of the KMO and Bartlett's tests indicated that the data were suitable for factor analysis ($KMO = 0.92$; $\chi^2 (1225) = 75783.41$, $P < .001$). The minimum average partial, Hull method, and scree plot suggested extraction of eight factors, while the parallel analysis suggested extraction of 11 factors. Therefore, we selected an eight-factor solution; however, the results had a factor containing only two items. Thus, we eliminated one factor and reached a seven-factor solution in accordance with the suggestion that a factor includes at least three items [46]. Finally, we removed nine items based on the commonality criterion and three items based on the two loading criteria; we thus achieved satisfactory results for the seven-factor solution (Table 2).

Table 2 shows the results of the seven factors. There were four coping-behavior factors: two related to infection: CB1, mask-wearing (represented mask use related to infection-prevention behavior); and CB4, infection prevention (represented general infection-prevention measures, such as hand washing); two related to general adversity: CB2, information-seeking (indicated searching for or checking COVID-19-related information); and CB3, resistance to social stagnation. The CB3's labeling was based on the fact that all described behaviors are prevention of social stagnation. This stagnation may be caused by reduced communication, reduced economic activity, and psychological depression. Item 5 and 6 are also behaviors to counteract social disorders, albeit from different viewpoints. There were three risk-perception factors: one related to infection: RP2, medical concerns (indicated concerns about medical resources and becoming infected); and two related to general adversity: RP1, shortages of daily necessities (measured concerns about shortages of daily supplies); and RP3, socioeconomic concerns (represented concerns about society and the economy). The internal consistency coefficients (Cronbach's α) of all factors were > 0.70 . They constituted 55% of the total

222 variance.

223 **Table 2.** Factor analysis for the COVID-19 questionnaire.

Description	CB1	RP1	CB2	RP2	CB3	RP3	CB4	α
CB1: Mask-wearing								0.89
I wear a mask to avoid infecting others	1.02	-0.07	0.03	-0.01	-0.01	-0.01	-0.09	
I wear a mask so that people around me do not feel uncomfortable if I cough or sneeze	0.98	-0.05	-0.01	-0.04	-0.02	0.01	-0.03	
I wear a mask to prevent myself from becoming infected	0.71	0.01	-0.02	0.01	0.06	-0.08	0.14	
I cover my mouth and nose when I cough or sneeze to avoid infecting others	0.47	0.04	-0.02	0.00	-0.11	0.15	0.23	
RP1: Shortages of daily necessities								0.79
I am worried about shortages of daily necessities caused by disruptions in production and distribution related to the spread of infection	-0.04	0.99	0.01	-0.05	-0.10	-0.01	0.07	
I am worried that daily necessities may not be sufficient because of hoarding	-0.04	0.92	-0.03	-0.03	-0.08	-0.03	0.08	
I am worried that lifelines (water, gas, electricity) may be cut off because of the social chaos caused by the spread of infection	0.00	0.44	0.01	0.08	0.25	0.00	-0.12	
CB2: Information-seeking								0.92
I frequently check the national and local governments' responses to the COVID-19 pandemic and predictions about what will happen	-0.02	-0.02	0.93	-0.01	-0.13	0.01	0.05	
I frequently check on the number of people infected with the coronavirus	0.02	0.01	0.91	-0.01	-0.14	-0.02	-0.01	
I frequently check on the social and economic impacts of infection control	-0.04	-0.02	0.82	0.01	-0.04	0.08	0.06	
I frequently check on the shortages of daily necessities	0.02	0.13	0.71	-0.03	0.11	-0.07	-0.02	
I collect information from specialized organizations, such as the Ministry of Health, Labor, and Welfare	0.00	-0.11	0.70	0.03	0.20	-0.05	0.02	
I monitor COVID-19-related news on TV and in the newspapers	0.01	0.00	0.68	-0.05	-0.12	0.15	0.06	
I spend time searching for COVID-19-related information on the internet	-0.01	0.01	0.67	0.03	0.16	-0.01	-0.08	
RP2: Medical concerns								0.87
I am worried that I will become infected	-0.04	-0.10	-0.01	0.91	-0.03	-0.02	0.09	
I am worried that my family and friends will become infected	-0.07	-0.05	-0.05	0.85	-0.08	-0.00	0.11	
I am worried that I will be infected and it will be serious	0.00	-0.11	0.08	0.74	-0.04	-0.08	0.07	
I am worried that many people around us will become infected	-0.06	-0.06	-0.04	0.67	0.10	-0.01	-0.01	
I am worried about infecting others (if I were infected)	0.06	-0.01	-0.01	0.67	0.06	-0.01	-0.07	
I am worried that people around me may think that I am infected and feel anxious when I cough	0.07	0.07	0.00	0.56	0.06	0.01	-0.04	
When I or my family members are infected, I am worried that I will not be able to respond appropriately	0.01	0.08	-0.04	0.53	-0.07	0.06	-0.06	
When I or my family are infected, I am worried that the medical system will not be adequate to manage the infection	-0.01	0.17	-0.01	0.48	-0.13	0.10	0.03	
CB3: Resistance to social stagnation								0.80
I get together with my friends and relatives to stay in touch, particularly during these times	-0.02	-0.01	-0.05	-0.06	0.76	0.00	0.06	
I try to spend my money, particularly during these times	-0.01	-0.10	-0.08	0.03	0.69	0.00	-0.01	
I communicate using the phone, email, or text, particularly during	-0.01	-0.03	0.03	-0.04	0.69	0.03	0.12	

these times

I try to do fun things, particularly during these times	-0.05	-0.03	-0.11	-0.08	0.65	0.14	0.13
I try to advise my friends and acquaintances not to buy extra things that they don't need right now	-0.02	0.05	0.06	-0.01	0.54	-0.1	0.07
I advise my friends and acquaintances to stockpile daily necessities	0.10	0.07	0.11	0.06	0.51	-0.15	-0.05
I am worried that refraining from events will lead me to lose events that are important in my life	0.01	0.01	0.03	0.04	0.44	0.26	-0.16

RP3: Socioeconomic concerns

0.83

I am worried that the spread of infection will not be under control after April and that this situation will continue	0.00	-0.09	0.01	0.02	-0.06	0.92	-0.01
I am worried that the situation may worsen in the future, causing further turmoil in society	0.00	-0.07	0.01	0.07	0.07	0.85	-0.09
I am worried that economic stagnation could affect many people because of poor corporate balance, bankruptcy, and job loss.	0.00	0.09	0.07	-0.03	-0.10	0.61	0.11
I am worried that refraining from events will lead many people to lose events that are important in their lives	0.01	0.03	0.00	-0.03	0.12	0.56	0.04

CB4: Infection prevention

0.81

I ventilate rooms to prevent infection	-0.04	0.07	0.00	0.00	0.16	-0.08	0.72
I have been washing my hands well and gargling regularly	0.11	0.09	-0.09	0.01	0.02	0.05	0.66
I avoid going to crowded places	-0.04	0.01	0.05	0.02	-0.10	0.06	0.65
I am careful about physical condition management, such as eating, exercising, and sleeping	-0.05	-0.04	0.07	-0.01	0.07	0.03	0.63
I try not to touch door handles or buttons that are touched by many people unknown to me	0.07	-0.04	0.04	0.08	0.14	-0.07	0.59

SS loadings 2.79 2.18 4.34 3.89 3.01 2.47 2.37

Cumulative variance 0.07 0.13 0.24 0.35 0.43 0.49 0.55

Notes. Loadings larger than 0.40 are in bold. α : Cronbach's α .

Correlation Analysis

Among the coping-behavior factors, information-seeking (CB2) was significantly associated with all other coping-behavior factors (CB1, CB3, and CB4) and socioeconomic concerns (RP3). Furthermore, mask-wearing (CB1) was associated with infection prevention (CB4). Three risk-perception factors were significantly associated with each other; socioeconomic concerns (RP3) were significantly associated with mask-wearing (CB1) and information-seeking (CB2) (Table 3).

All four coping-behavior factors were significantly associated with at least one characteristic in the Power to Live scale, but the risk-perception factors did not demonstrate such associations. Both infection-prevention factors (CB1 and CB4) were associated with etiquette; infection prevention (CB4) was additionally associated with problem-solving, emotional regulation, self-transcendence, and active well-being. Both general-adversity coping

behaviors (CB2 and CB3) were associated with leadership, altruism, and active well-being; information-seeking (CB2) was additionally associated with problem-solving, etiquette, and self-transcendence. However, no significant associations were observed between factors and Big Five characteristics (Table 3).

Table 3. Correlation matrix between coping behavior, risk-perception factors, and psychobehavioral characteristics

		Coping behavior				Risk perception		
		CB1	CB4	CB3	CB2	RP2	RP1	RP3
CB1	Mask-wearing	—						
CB4	Infection prevention	0.574	—					
CB3	Resistance to social stagnation	0.135	0.228	—				
CB2	Information-seeking	0.374	0.467	0.380	—			
RP2	Medical concerns	0.230	0.159	0.137	0.237	—		
RP1	Shortages of daily necessities	0.250	0.180	0.236	0.279	0.419	—	
RP3	Socioeconomic concerns	0.309	0.259	0.170	0.347	0.340	0.457	—
Power to Live								
	Leadership	0.152	0.299	0.468	0.355	-0.043	0.017	0.072
	Problem-solving	0.229	0.367	0.217	0.304	-0.020	0.070	0.209
	Altruism	0.188	0.217	0.311	0.301	0.068	0.104	0.155
	Stubbornness	0.088	0.135	0.171	0.182	0.049	0.101	0.147
	Etiquette	0.355	0.437	0.094	0.315	0.021	0.083	0.255
	Emotional regulation	0.186	0.353	0.256	0.293	-0.041	0.029	0.153
	Self-transcendence	0.254	0.368	0.270	0.349	0.030	0.078	0.196
	Active well-being	0.200	0.391	0.342	0.354	-0.024	0.043	0.124
Big Five								
	Extraversion	0.055	0.131	0.248	0.161	-0.102	-0.064	-0.011
	Agreeableness	0.217	0.244	0.007	0.178	-0.108	-0.043	0.102
	Conscientiousness	0.126	0.296	0.073	0.195	-0.155	-0.108	-0.011
	Neuroticism	-0.025	-0.165	-0.094	-0.091	0.210	0.164	0.079
	Openness	0.004	0.126	0.269	0.157	-0.050	-0.017	-0.015

Note: $|r| > 0.3$ in bold.

Hierarchical Regression Analysis

Tolerance and variance inflation factor analyses indicated no evidence of multicollinearity in any hierarchical regressions.

Table 4. Hierarchical regression analysis for the COVID-19 coping-behavior factors.

	Mask-wearing		Infection prevention		Resistance to social stagnation		Information-seeking	
	β	$f_{B/A}^2$	β	$f_{B/A}^2$	β	$f_{B/A}^2$	β	$f_{B/A}^2$
Sex	-0.232	0.059	-0.179	0.035	-0.026	0.001	-0.061	0.004
Knowledge	0.078	0.007	0.143	0.022	0.176	0.032	0.155	0.026
Local case of infection	0.067	0.005	0.084	0.008			0.079	0.007
Hs_single	-0.037	0.001	-0.027	0.001			-0.066	0.005
High-risk age	0.167	0.030	0.120	0.010			0.156	0.016
Toddler			0.053	0.003	0.033	0.001	0.036	0.001
Age			0.086	0.005			0.110	0.008
Child					0.057	0.003		
Hs_couple			0.035	0.001				
Block 1		0.106		0.119		0.037		0.119
ΔR^2		0.096		0.106		0.036		0.106
ΔF		61.150*		42.759*		26.994*		48.733*
Medical concerns	0.068	0.004	0.041	0.002			0.074	0.005
Shortages of daily necessities	0.109	0.010	0.084	0.006	0.200	0.035	0.159	0.023
Socioeconomic concerns	0.209	0.041	0.19	0.033	0.072	0.005	0.237	0.056
+ Block 2		0.116		0.076		0.064		0.175
ΔR^2		0.094		0.063		0.058		0.133
ΔF		111.065*		72.681*		92.179*		167.796*
Leadership					0.483	0.118	0.178	0.015
Problem-solving					-0.177	0.014	-0.076	0.003
Altruism	-0.042	0.002	-0.083	0.006	0.101	0.009	0.043	0.002
Stubbornness			-0.061	0.004	-0.052	0.003		
Etiquette	0.194	0.023	0.181	0.022	-0.250	0.043		
Emotional regulation	-0.043	0.001	0.056	0.002	0.084	0.004		
Self-transcendence	0.053	0.001	0.042	0.002	0.047	0.001	0.057	0.002
Active well-being	0.058	0.002	0.191	0.027	0.163	0.018	0.154	0.016
Extraversion					-0.047	0.002	-0.035	0.001
Agreeableness	0.107	0.011	0.034	0.002	-0.094	0.009		
Conscientiousness			0.135	0.019	-0.038	0.002	0.052	0.003
Openness	-0.035	0.001			0.103	0.012		
+ Block 3		0.087		0.222		0.429		0.130
ΔR^2		0.065		0.151		0.272		0.087
ΔF		35.744*		79.676*		102.521*		53.093*

Note: * $P < .001$ only for ΔF , $f_{B/A}^2 > 0.02$ are in bold; High-risk age: the infection will become severe because of age; HS: household structure. Variables selected by the stepwise method are presented. The results for each block are from the date they were entered.

Table 5. Hierarchical regression analysis for the COVID-19 risk-perception factors.

	Medical concerns		Shortages of daily necessities		Socioeconomic concerns	
	β	$f_{B/A}^2$	β	$f_{B/A}^2$	β	$f_{B/A}^2$
Age	-0.296	0.061	-0.225	0.031	-0.138	0.011
High-risk age	0.351	0.054	0.149	0.011	0.197	0.014
High-risk family member	0.177	0.029	0.089	0.006	0.073	0.004
Sex			-0.048	0.002	-0.031	0.001
Child	0.030	0.001	0.042	0.002		
Local case of infection	0.039	0.002			0.048	0.002
Chronic disease	0.088	0.006			-0.056	0.002
HS_two generations	0.040	0.002				
Knowledge					0.028	0.001
Block 1		0.249		0.052		0.037
ΔR^2		0.199		0.050		0.035
ΔF		102.241*		30.109*		15.028*
Leadership					-0.102	0.006
Problem-solving	0.171	0.013	0.080	0.002	0.163	0.010
Altruism	0.060	0.003	0.053	0.002		
Stubbornness			0.036	0.001	0.055	0.002
Etiquette	0.046	0.001	0.096	0.004	0.213	0.023
Emotional regulation	-0.061	0.002				
Self-transcendence			0.042	0.001	0.057	0.002
Extraversion	-0.076	0.006	-0.069	0.004		
Agreeableness	-0.100	0.009	-0.048	0.002	0.053	0.002
Conscientiousness	-0.110	0.010	-0.085	0.005	-0.087	0.006
Neuroticism	0.128	0.013	0.141	0.014	0.149	0.017
Openness			0.032	0.001		
+ Block 2		0.074		0.060		0.128
ΔR^2		0.055		0.054		0.109
ΔF		26.601*		17.261*		45.795*

Note: Other details are as shown in Table 4.

Table 4 summarizes the results of the four coping-behavior factors (see Supplemental Material for details). Among the demographic factors, sex negatively contributed to two infection-prevention factors (CB1 and CB4). Among risk-perception factors, shortages of daily necessities (RP1) significantly contributed to two general-adversity coping behaviors (CB2 and CB3), while socioeconomic concerns (RP3) positively contributed to information-seeking (CB2). However, medical concerns (RP2) did not contribute to any of the coping behaviors. Among the psychobehavioral characteristics, etiquette was positively associated with two infection-prevention factors (CB1 and CB4), while it was negatively associated with resistance to social stagnation (CB3). Leadership and active well-being were positively associated with

resistance to social stagnation (CB3) and infection prevention (CB4), respectively.

Table 5 displays a summary of the results for the risk-perception factors (see Supplemental Material for details). Among the demographic factors, age, high-risk age, and having a high-risk family member significantly contributed to medical concerns (RP2), but age demonstrated a negative association. Among psychobehavioral characteristics, etiquette contributed only to socioeconomic concerns (RP3).

Discussion

The two main goals of this study were to identify major coping-behavior and risk-perception factors, then explore the factors that influenced coping behavior. We identified four coping-behavior factors (two related to infection and two related to general adversity) and three risk-perception factors (one regarding infection and two regarding general adversity). We discovered that female sex and etiquette facilitated infection-prevention behaviors (CB1 and CB4), whereas shortages of daily necessities (RP1) contributed to general-adversity coping behaviors (CB2 and CB3). We also found that active well-being promoted infection prevention (CB4), and socioeconomic concerns (RP3) promoted information-seeking (CB2), while resistance to social stagnation (CB3) was inhibited by etiquette and facilitated by leadership. Nevertheless, we did not observe associations of the Big Five characteristics with coping-behavior factors (Table 6).

The identified facilitative factors to infection-prevention behaviors were largely consistent with existing knowledge. Our findings show that etiquette and female sex contributed to two infection-prevention factors, while medical concerns (RP2) did not. Considering the effects of etiquette, which was defined as adherence to social norms [28], infection-prevention behaviors may arise from the motivation to comply with the social norm. The finding that medical concerns (RP2) did not contribute, while etiquette did, is consistent with the previous report that mask-wearing in Japan is related to social norms, rather than the

perceived risk of COVID-19 [47]. In addition, the finding that women were more inclined to exhibit infection-prevention behaviors is consistent with the previous report that women are more willing to self-isolate than are men [48].

Table 6. Schematic summary of the contributions of the coping-behavior factors.

		Infection		General adversity	
		CB1 Mask-wearing	CB4 Infection prevention	CB2 Information-seeking	CB3 Resistance to social stagnation
Demographic information	Female sex	+	+		
Risk-perception factors	RP1 Shortages of daily necessities			+	+
	RP3 Socioeconomic concerns			+	
Psychobehavioral characteristics	Leadership				+
	Etiquette	+	+		-
	Active well-being		+		

There are two potential reasons for the identification of two infection-prevention factors in this study (i.e., mask-related and mask-unrelated). The first involves the executability of the two types of infection prevention. The availability of masks may have caused a separation of infection prevention because of the severe shortage and hoarding of masks that occurred during the early stage of the pandemic [49]. The second reason involves the emphasis on wearing masks. The Ministry of Health, Labor, and Welfare released 61 documents concerning the latest domestic coronavirus situation in 77 days (1/1/2020–3/18/2020 [immediately before the survey]); each of the documents included the same message to the public that wearing masks and washing hands are important practices [50]. Most indoor and public places required a mask before entering. Thus, people could be divided into two groups: a group that wore masks and followed the mask-wearing recommendation and a group that lacked masks and focused more on general infection prevention.

Shortage of daily necessities (RP1) is a common facilitative factor of general-adversity coping behaviors. Media-dependency theory states that people become increasingly dependent

on social media during a severe social disruption [51]. Consistent with this theory, our results reveal that individuals tended to use information-seeking strategies (CB2) to be informed, prepared, and respond to COVID-19 when they knew about shortages of daily necessities. The contribution of shortages of daily necessities (RP1) to resistance to social stagnation (CB3) is congruent with the results of disaster research described in the introduction. Shortage of daily necessities, while not totally representing social stagnation, might be seen as an early warning sign of subsequent social stagnation in multiple fields, such as long-lasting impacts on the supply chain [52]. Thus, when our participants perceived an existed threat to society (i.e., shortage of daily necessities), they might start to respond to imminent social stagnation.

However, each of the two general-adversity coping-behavior factors had unique features. Except for shortages of daily necessities (RP1), information-seeking (CB2) was facilitated by socioeconomic concerns (RP3); resistance to social stagnation (CB3) was inhibited by etiquette and enhanced by leadership. The relationship between information-seeking (CB2) and socioeconomic concerns (RP3) is also consistent with the media-dependency theory: perceived social risk enhances information-seeking. The negative contribution of etiquette to resistance to social stagnation (CB3) may have originated from obedience to guidance. For instance, people with high etiquette scores are more likely to maintain social distance and limit their engagement in non-essential activities. On the other hand, people with strong etiquette skills might attempt to maintain their usual routines as before. They may not do extra things to resist social stagnation because fussiness also violates social norms [53]. The factor essence of leadership, namely the spontaneous problem-tackling tendency through communication, may directly explain its contribution to responses of imminent social stagnation (CB3). For example, one of the leadership items was, “To resolve problems, I gather everyone involved together to discuss the matter.” People with strong leadership are more likely to take the initiative to reach out to others to cope and solve adversity.

Previous studies also reported the contribution of leadership to spontaneous evacuation in the imminent tsunami attack [11], including encouraging other people to evacuate [23] and resolving problems through mutual aid [24].

Our study implies that each coping behavior has distinct facilitatory/inhibitory psychological processes supported by a partial conflict between survival-oriented characteristics. Etiquette facilitated two infection-prevention factors (CB1 and CB4) but inhibited the a general-adversity coping-behavior factor (i.e., CB3 resistance to social stagnation). This conflict may be the result of a trade-off between infection-prevention and general-adversity coping behavior. For example, maintaining social distance (or self-isolation) is an effective and critical method to stop transmission. However, people may not be able to attend important events or socialize, which makes them feel socially isolated and impairs both physical and mental health.

Policymakers should consider methods to obtain the best trade-off between the two types of coping behaviors to achieve the maximum benefits for people. For instance, to reduce shortage-related stress, policymakers could ensure adequate supplies before disasters and offer a convenient delivery policy during the disaster. They could also provide secure channels, e.g., hold online events, to increase ways to resist social stagnation. These measures may help people to relieve stress, feel more socially engaged, and avoid infection.

Our findings offer a helpful framework for balancing infection-prevention and its impact on people's lives in the post-pandemic world. These findings will help national and local governments in their information-dissemination efforts, as well as economic and social responses. In addition, it may be possible able to detect low- and high-risk mental-health groups through a focus on the mental-health aspects of resistance to social stagnation. Researchers can provide further guidance for the government by considering the leadership and etiquette in the Power to Live scale as life forces in the post-pandemic world.

Our study had some limitations. First, the survey was conducted during the early days of the pandemic in Japan; there was a shortage of masks and toilet paper, but infection and fatality rates were not high at that time. People may have had more concerns about the crisis that had already occurred (i.e., shortages of toilet paper and masks), rather than COVID-19 itself. Second, optimistic bias may have affected some demographic information (e.g., chronic disease and knowledge) because we used a self-reporting approach. For example, participants may have overestimated their knowledge of infectious diseases or underestimated the risk of the disease at their age. Such individual differences in optimistic bias could have had an impact on the relationships between variables reported here. Future investigations are needed to clarify this aspect of our findings. Third, because none of our participants had COVID-19, our results are limited to individuals without COVID-19.

Conclusion

We have proposed a new model of coping-behavior and risk-perception factors for COVID-19; we have demonstrated that infection-prevention and general-adversity coping behaviors involve different psychological mechanisms (etiquette for infection-prevention; shortages of daily necessity for general-adversity coping behaviors). These results can help guide policymakers to strike a balance between protecting people's lives and maintaining a higher quality of life.

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Conflicts of Interest

No potential conflict of interest was reported by the author(s).

References

1. Anderson RM, Heesterbeek H, Klinkenberg D, Hollingsworth TD. How will country-based mitigation measures influence the course of the COVID-19 epidemic? *The Lancet Elsevier*; 2020 Mar 21;395(10228):931–934. PMID:32164834
2. Alcántara-Ayala I, Burton I, Lavell A, Mansilla E, Maskrey A, Oliver-Smith A, Ramírez-Gómez F. Editorial: Root causes and policy dilemmas of the COVID-19 pandemic global disaster. *Int J Disaster Risk Reduct* 2021 Jan;52:101892. PMID:32995255
3. Nomura S, Kawashima T, Yoneoka D, Tanoue Y, Eguchi A, Gilmour S, Kawamura Y, Harada N, Hashizume M. Trends in suicide in Japan by gender during the COVID-19 pandemic, up to September 2020. *Psychiatry Res* 2021 Jan;295:113622. PMID:33290942
4. Bacon AM, Corr PJ. Coronavirus (COVID-19) in the United Kingdom: A personality-based perspective on concerns and intention to self-isolate. *Br J Health Psychol* 2020;25(4):839–848. PMID:32348015
5. Capone V, Caso D, Donizzetti AR, Procentese F. University student mental well-being during COVID-19 outbreak: What are the relationships between information seeking, perceived risk and personal resources related to the academic context? *Sustainability Multidisciplinary Digital Publishing Institute*; 2020 Jan;12(17):7039. [doi: 10.3390/su12177039]
6. Kuang J, Ashraf S, Das U, Bicchieri C. Awareness, Risk Perception, and Stress during the COVID-19 Pandemic in Communities of Tamil Nadu, India. *Int J Environ Res Public Health* 2020 Sep 30;17(19):E7177. PMID:33007992
7. Dash N, Gladwin H. Evacuation decision making and behavioral responses: Individual and household. *Nat Hazards Rev American Society of Civil Engineers*; 2007 Aug;8(3):69–77. [doi: 10.1061/(asce)1527-6988(2007)8:3(69)]
8. Dooley D, Catalano R, Mishra S, Serxner S. Earthquake preparedness: Predictors in a community survey. *J Appl Soc Psychol John Wiley & Sons, Ltd*; 1992 Mar;22(6):451–470. [doi: 10.1111/j.1559-1816.1992.tb00984.x]
9. Lindell MK, Perry RW. The protective action decision model: theoretical modifications and additional evidence. *Risk Anal John Wiley & Sons, Ltd*; 2012 Apr;32(4):616–632. [doi: 10.1111/j.1539-6924.2011.01647.x]
10. Miceli R, Sotgiu I, Settanni M. Disaster preparedness and perception of flood risk: A study in an alpine valley in Italy. *J Environ Psychol* 2008;28(2):164–173. [doi: 10.1016/j.jenvp.2007.10.006]
11. Sugiura M, Sato S, Nouchi R, Honda A, Ishibashi R, Abe T, Muramoto T, Imamura F. Psychological processes and personality factors for an appropriate tsunami evacuation. *Geosci Switz* 2019;9(8):1–19. [doi: 10.3390/geosciences9080326]
12. Weinstein ND, Lyon JE, Rothman AJ, Cuite CL. Preoccupation and affect as predictors of protective action following natural disaster. *Br J Health Psychol John Wiley & Sons, Ltd*; 2000 Nov 1;5(4):351–363. [doi: 10.1348/135910700168973]
13. Aschwanden D, Strickhouser JE, Sesker AA, Lee JH, Luchetti M, Stephan Y, Sutin AR, Terracciano A. Psychological and behavioural responses to Coronavirus disease 2019: The role of personality. *Eur J Personal SAGE Publications Ltd*; 2021 Jan 1;35(1):51–66. [doi: 10.1002/per.2281]
14. Bogg T, Milad E. Demographic, personality, and social cognition correlates of coronavirus guideline adherence in a U.S. sample. *Health Psychol US: American Psychological Association*; 2020;39(12):1026. [doi: 10.1037/hea0000891]
15. Carvalho L de F, Pianowski G, Gonçalves AP. Personality differences and COVID-19: are extroversion and conscientiousness personality traits associated with engagement with containment measures? *Trends Psychiatry Psychother Associação de Psiquiatria do Rio Grande do Sul*; 2020 Apr 9;42:179–184. [doi: 10.1590/2237-6089-2020-0029]

16. Liu S, Lithopoulos A, Zhang C-Q, Garcia-Barrera MA, Rhodes RE. Personality and perceived stress during COVID-19 pandemic: Testing the mediating role of perceived threat and efficacy. *Personal Individ Differ* 2020/08/21 ed Elsevier Ltd.; 2021 Jan 1;168:110351. [doi: 10.1016/j.paid.2020.110351]
17. Mazza C, Ricci E, Marchetti D, Fontanesi L, Di Giandomenico S, Verrocchio MC, Roma P. How personality relates to distress in parents during the Covid-19 lockdown: The mediating role of child's emotional and behavioral difficulties and the moderating effect of living with other people. *Int J Environ Res Public Health Multidisciplinary Digital Publishing Institute*; 2020 Jan;17(17):6236. [doi: 10.3390/ijerph17176236]
18. Prentice C, Zeidan S, Wang X. Personality, trait EI and coping with COVID 19 measures. *Int J Disaster Risk Reduct* 2020 Dec 1;51:101789. [doi: 10.1016/j.ijdrr.2020.101789]
19. Qian K, Yahara T. Mentality and behavior in COVID-19 emergency status in Japan: Influence of personality, morality and ideology. *PLoS ONE* 2020;15(7 July):1–16. [doi: 10.1371/journal.pone.0235883]
20. Zajenkowski M, Jonason PK, Leniarska M, Kozakiewicz Z. Who complies with the restrictions to reduce the spread of COVID-19?: Personality and perceptions of the COVID-19 situation. *Personal Individ Differ* 2020;166:110199. PMID:32565591
21. Guo J, Feng XL, Wang XH, van IJzendoorn MH. Coping with COVID-19: Exposure to COVID-19 and negative impact on livelihood predict elevated mental health problems in Chinese adults. *Int J Environ Res Public Health* 2020 May 29;17(11):E3857. PMID:32485859
22. Abdelrahman M. Personality traits, risk perception, and protective behaviors of Arab residents of Qatar during the COVID-19 pandemic. *Int J Ment Health Addict Springer US*; 2020 Jun 22;1–12. [doi: 10.1007/s11469-020-00352-7]
23. Sugiura M, Nouchi R, Honda A, Sato S, Abe T, Imamura F. Survival-oriented personality factors are associated with various types of social support in an emergency disaster situation. *PloS One* 2020;15(2):e0228875–e0228875. [doi: 10.1371/journal.pone.0228875]
24. Sugiura M, Ishibashi R, Abe T, Nouchi R, Honda A, Sato S, Muramoto T, Imamura F. Self-help and mutual assistance in the aftermath of a tsunami: How individual factors contribute to resolving difficulties. *PLOS ONE Public Library of Science*; 2021 Oct 7;16(10):e0258325. [doi: 10.1371/journal.pone.0258325]
25. Duncan LA, Schaller M, Park JH. Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. *Personal Individ Differ* 2009 Oct 1;47(6):541–546. [doi: 10.1016/j.paid.2009.05.001]
26. Wang IM, Michalak NM, Ackerman JM. Threat of infectious disease. *SAGE Handb Personal Individ Differ Orig Personal Individ Differ Sage Reference*; 2018. p. 321–345. [doi: 10.4135/9781526451200.n18]
27. Ishibashi R, Nouchi R, Honda A, Abe T, Sugiura M. A concise psychometric tool to measure personal characteristics for surviving natural disasters: Development of a 16-Item Power to Live Questionnaire. *Geosciences Multidisciplinary Digital Publishing Institute*; 2019 Sep;9(9):366. [doi: 10.3390/geosciences9090366]
28. Sugiura M, Sato S, Nouchi R, Honda A, Abe T, Muramoto T, Imamura F. Eight personal characteristics associated with the power to live with disasters as indicated by survivors of the 2011 Great East Japan Earthquake Disaster. *PLoS ONE* 2015;10(7):1–14. PMID:26132753
29. Gosling SD, Rentfrow PJ, Swann WB. A very brief measure of the Big-Five personality domains. *J Res Personal* 2003;37(6):504–528. [doi: [https://doi.org/10.1016/S0092-6566\(03\)00046-1](https://doi.org/10.1016/S0092-6566(03)00046-1)]
30. Oshio A, Abe S, Cutrone P. Development, reliability, and validity of the Japanese version of Ten Item Personality Inventory (TIPI-J). *Jpn J Personal* 2012;21(1):40–52. [doi: 10.2132/personality.21.40]
31. R Core Team. R: A Language and Environment for Statistical Computing. Vienna, Austria;

2019.

32. Wickham H, Averick M, Bryan J, Chang W, McGowan LD, François R, Golemund G, Hayes A, Henry L, Hester J, Kuhn M, Pedersen TL, Miller E, Bache SM, Müller K, Ooms J, Robinson D, Seidel DP, Spinu V, Takahashi K, Vaughan D, Wilke C, Woo K, Yutani H. Welcome to the {tidyverse}. *J Open Source Softw* 2019;4(43):1686. [doi: 10.21105/joss.01686]
33. Revelle W. *psych: Procedures for Psychological, Psychometric, and Personality Research*. Evanston, Illinois; 2019.
34. Bernaards CA, IJennrich R. Gradient projection algorithms and software for arbitrary rotation criteria in factor analysis. *Educ Psychol Meas* 2005;65:676–696.
35. Navarro-Gonzalez D, Lorenzo-Seva U. EFA.MRFA: Dimensionality assessment using minimum rank factor analysis [Internet]. 2021. Available from: <https://CRAN.R-project.org/package=EFA.MRFA>
36. Lüdtke D, Ben-Shachar MS, Patil I, Makowski D. Extracting, computing and exploring the parameters of statistical models using R. *J Open Source Softw* 2020;5(53):2445. [doi: 10.21105/joss.02445]
37. Ben-Shachar MS, Lüdtke D, Makowski D. effectsize: Estimation of effect size Indices and standardized parameters. *J Open Source Softw The Open Journal*; 2020;5(56):2815. [doi: 10.21105/joss.02815]
38. Beavers A, Lounsbury J, Richards J, Huck S, Skolits G, Esquivel S. Practical considerations for using exploratory factor analysis in educational research. *Pract Assess Res Eval* [Internet] 2013;18. [doi: <https://doi.org/10.7275/qv2q-rk76>]
39. Velicer WF. Determining the number of components from the matrix of partial correlations. *Psychometrika Germany: Springer*; 1976;41(3):321–327. [doi: 10.1007/BF02293557]
40. Lorenzo-Seva U, Timmerman ME, Kiers HAL. The Hull method for selecting the number of common factors. *Multivar Behav Res Routledge*; 2011 Apr 11;46(2):340–364. PMID:26741331
41. Horn JL. A rationale and test for the number of factors in factor analysis. *Psychometrika* 1965 Jun 1;30(2):179–185. [doi: 10.1007/BF02289447]
42. Cohen J. A power primer. *Psychol Bull. US: American Psychological Association*; 1992. p. 155–159. [doi: 10.1037/0033-2909.112.1.155]
43. Fiske ST, Gilbert DT, Lindzey G. *Handbook of Social Psychology*. 5th ed. Fiske ST, Gilbert DT, Lindzey G, editors. *Handb Soc Psychol*. Hoboken, NJ: Wiley; 2010. [doi: 10.1002/9780470561119] ISBN:9780470137475
44. Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate Data Analysis: A Global Perspective*. 7th ed. New Jersey: Pearson Education Inc; 2010. ISBN:978-0-13-515309-3
45. Selya A, Rose J, Dierker L, Hedeker D, Mermelstein R. A practical guide to calculating Cohen’s f^2 , a measure of local effect size, from PROC MIXED. *Front Psychol* 2012;3:111–111. [doi: 10.3389/fpsyg.2012.00111]
46. Costello AB, Osborne JW. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Pract Assess Res Eval* 2005;10(7).
47. Nakayachi K, Ozaki T, Shibata Y, Yokoi R. Why do Japanese people use masks against COVID-19, even though masks are unlikely to offer protection from infection? *Front Psychol* 2020;11(August):1–5. [doi: 10.3389/fpsyg.2020.01918]
48. Atchison CJ, Bowman L, Vrinten C, Redd R, Pristerà P, Eaton JW, Ward H. Perceptions and behavioural responses of the general public during the COVID-19 pandemic: A cross-sectional survey of UK Adults. *medRxiv* 2020 Jan 1;2020.04.01.20050039. [doi: 10.1101/2020.04.01.20050039]
49. Noich H. Surgical mask shortages as coronavirus fears grow. *NHK WORLD* [Internet] 2020 [accessed 2021-10-01]; Available from: <https://www3.nhk.or.jp/nhkworld/en/news/backstories/865/>

50. Ministry of Health, Labour and Welfare. Press Release [Internet]. Curr Situat New Coronavirus Infect Response Minist Health Labour Welf. [accessed 2021-10-01]. Available from: <https://www.mhlw.go.jp/stf/houdou/index.html>
51. Lowrey W. Media dependency during a large-scale social disruption: The case of september 11. *Mass Commun Soc Routledge*; 2004 Jul 1;7(3):339–357. [doi: 10.1207/s15327825mcs0703_5]
52. Paul SK, Chowdhury P. Strategies for managing the impacts of disruptions during COVID-19: An example of toilet paper. *Glob J Flex Syst Manag* 2020;21(3):283–293. [doi: 10.1007/s40171-020-00248-4]
53. Scholderer J, Veflen N. Social norms and risk communication. *Trends Food Sci Technol* 2019 Feb 1;84:62–63. [doi: 10.1016/j.tifs.2018.08.002]