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Associations among anxiety, risk perception, preventive behaviors, and personality in Japanese older adults aged 78 to 99 years during the COVID-19 pandemic

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Abstract

Background and Objectives: To deepen the understanding of processes underlying older adults' behavior during the COVID-19 pandemic, we investigated associations among affective (anxiety about the coronavirus), cognitive (perceived risk of infection and fatality), and behavioral (engagement in preventive behaviors) variables. We also examined how these variables were predicted by personality traits measured before the pandemic.

Research Design and Methods: Older adults ($N = 1,727$; 78–99 years old) were recruited from an ongoing longitudinal cohort study started in 2010. They responded to a questionnaire sent in August 2020, which included four items measuring COVID-19 anxiety, infection risk perception, fatality risk perception, and engagement in preventive behaviors. Big Five personality traits were measured years ago when the participants had first participated in the study.

Results: Most participants felt anxious, engaged in preventive behaviors, and overestimated infection and fatality risks. Older age was associated with low anxiety, a low perception of infection risk, a high perception of fatality risk, and a little engagement in preventive behaviors. Women were more susceptible to the pandemic than men were, demonstrated by higher scores on all four items. Partial correlation analysis controlling for age and sex demonstrated positive associations among all four items except for infection risk perception and preventive behaviors. Anxiety and perceived infection risk were positively predicted by neuroticism and conscientiousness, respectively. Engagement in preventive behaviors was positively predicted by extraversion, openness to experience, and conscientiousness.

Discussion and Implications: We highlighted the critical distinction between infection and fatality risk perceptions and demonstrated the need to consider each individual's attributes.

Keywords: infection risk perception, fatality risk perception, new normal, Big Five, SONIC Study

Translational Significance

This study highlighted the critical distinction between infection and fatality risk perceptions to understand older adults' behavior during the COVID-19 pandemic. We also suggested considering various attributes (e.g., sex, age, and personality) of individuals that are necessary to plan interventions.

Background and Objectives

The COVID-19 pandemic has forced society to make unforeseen decisions. Notably, older adults are at higher risk of health complications and mortality due to COVID-19 than their younger counterparts are. To plan interventions to mitigate the burden of older adults, researchers must discover the processes underlying older adults' behavior during the pandemic. In particular, the present investigation of Japan perhaps contributes to explaining why the country's COVID-19 death rate has been lower than average regardless of its population size and absence of strict measures, such as lockdowns (see Thakur, 2021; Wingfield-Hayes, 2020). Thus, we analyzed data from a large sample ($N = 1,727$) of Japanese older adults aged 78 to 99 under the COVID-19 pandemic.

The present study explored the associations among affective (anxiety about the coronavirus), cognitive (perceived risks of infection and fatality), and behavioral (engagement in preventive behavior) aspects. All these variables have been studied in literature on the COVID-19 pandemic; these variables have shown to be closely related to each other (e.g., Abdelrahman 2020; Bruine de Bruin, 2021; Duong et al., 2021; Niepel et al., 2020). The present investigation adds to the existing literature, in particular, by demonstrating a necessary distinction between infection and fatality risk perceptions in older adults.

We also examined how these variables (i.e., anxiety, perceived risks, and preventive behaviors) were predicted by Big Five personality traits measured before the pandemic. In general, personality traits are associated with anxiety (e.g., Thompson, 2008), risk perception (e.g., Wang et al., 2016), and health behavior (e.g., Vollrath et al., 1999). Personality traits also are known to predict the mortality of Japanese older adults (Iwasa et al., 2008). Abdelrahman (2020) measured personality traits and other variables simultaneously and demonstrated that social distancing practices during the COVID-19 pandemic were associated with conscientiousness and neuroticism. However, considering the fact that the disease salience alters self-perceptions of personality (Mortensen et al., 2010), it is possible that the COVID-19 outbreak influenced both preventive behaviors and responses to

personality questionnaires. In addition, it still remains unclear which aspect is modulated by personality traits. To address these issues, we explored longitudinal effects of personality traits on anxiety, risk perceptions, and preventive behaviors. Here, we show that these aspects are predicted by different personality traits measured before the pandemic.

Research Design and Methods

Participants

The sample of older adults investigated in this study was recruited from participants in an ongoing longitudinal cohort study started in 2010 called the Septuagenarians, Octogenarians, Nonagenarians Investigation with Centenarians (SONIC). Details of the SONIC are provided elsewhere (Gondo et al., 2017). In summary, the SONIC comprises three sequential age cohorts of 70, 80, and 90 with a three-year age range. Participants in the 70 years cohort (69–70) and 80 years cohort (79–81) were recruited in 2010 and 2011 for the first time, respectively. The same cohort nonparticipants were recruited again for the second wave survey in 2013 and 2014, respectively. Participants in the 90 years cohort were recruited in 2012, 2015, and 2018 when they were approximately 90 (89–91) years old.

In 2020, of the original group of 3,344 participants (1,592 men and 1,754 women), 2,653 were eligible for the mail survey. We sent a letter of invitation and questionnaire booklet to them on August 3, 2020. The invitees who agreed to participate in this mail survey answered “Yes” to the first-page question requesting participation. In the case of missing items, we telephoned the participant to complete those as much as possible. We collected 1,785 (67%) replies from the participants. Because 58 participants did not respond to four items of interest, their data were excluded before analysis. Pairwise deletion was used for other missing responses.

The final sample comprised 1,727 participants (803 men and 925 women). Their mean age was 85.6 years ($SD = 5.9$, ranging from 78 to 99), which was equivalent between men (mean = 85.7, $SD = 5.8$) and women (mean = 85.4, $SD = 5.9$). Averaged education years were 11.7 ($SD = 2.8$). Almost all participants responded to the questionnaire in August (1,607) or September 2020 (71), a few (7)

responded from October to December in 2020. This study was approved by the ethics board of the School of Human Sciences of Osaka University and the Institutional Review Board of the Tokyo Metropolitan Institute of Gerontology.

Measures

The questionnaire booklet used in this study comprised four sections: living situation questions, mental health and well-being questions, general health and instrumental activities of daily living questions, and COVID-19-related questions. Among items in the questionnaire, we used four COVID-19-related items relevant to the present study. Basic sociodemographic information and personality information were collected when the participants first participated in the SONIC.

COVID-19-related items

As a measure of anxiety about the coronavirus, we used a 6-point item (“I feel anxious about the novel coronavirus.”), which was rated from 1 (“strongly disagree”) to 6 (“strongly agree”). No response was obtained from 19 of 1,727 participants.

We measured infection and fatality risk perceptions by using one item for each. For infection risk, participants read a question (“In Japan as a whole, how many individuals of your age do you think have been infected with the novel coronavirus out of 10,000 individuals? Please answer based on your intuition.”) and answered it by writing a number from 0 to 10,000. We divided the participants’ answers by 10,000 to interpret them as ratios. For fatality risk, the participants read a question (“In Japan as a whole, what do you think is the percentage of individuals of your age who die when infected with the novel coronavirus? Please answer based on your institution.”) and answered it by writing a percentage from 0% to 100%. The number of missing responses including out-of-range values was 390 and 270 for infection and fatality risk perceptions, respectively.

For preventive behaviors, we used a 6-point item (“I am practicing the ‘new normal’ to prevent the spread of the novel coronavirus”), rated from 1 (“strongly disagree”) to 6 (“strongly agree”). We

added a note, “The ‘new normal’ refers to behaviors such as keeping a distance from others, wearing a mask, refraining from going out, frequent hand washing and disinfection, frequent ventilation, and avoiding the ‘3 Cs’ (crowded places, close-contact settings, and closed spaces),” based on examples provided by the Japanese Ministry of Health, Labour, and Welfare (2020a). Thirty-nine participants did not respond to this item.

Personality

Big Five traits were assessed based on the selected 25 items from the Japanese version of NEO-FFI (Shimonaka et al., 1998). The original NEO-FFI comprises 60 items that contain 12 items for each personality dimension. To reduce the mental load for 80- and 90-year-old participants, we selected five items for each dimension and used them for personality assessment. This short version was validated by Masui et al. (2011), who showed that Pearson’s correlations between the original and short version in the 70 years cohort for neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness were .87, .86, .84, .84, and .85, respectively. Cronbach’s alphas were .69, .70, .59, .62, .75, respectively, for this study’s participants. Such short versions are often used in studies on older adults (e.g., Staudinger et al., 1998).

Results

Figure 1 presents the frequency distributions of the variables. Most participants scored above the midpoint (i.e., 4 or higher) on the scales of anxiety (72.0%, mean = 4.25, median = 4, $SD = 1.43$) and preventive behaviors (87.9%, mean = 4.67, median = 5, $SD = 1.17$). Although the actual positive and fatality rates for Japanese adults aged 70 years or older were 0.02% and 14.6%, respectively, calculated by using the number of PCR-positives as of August 12, 2020 (Japanese Ministry of Health, Labour, and Welfare, 2020b) and the population as of August 1, 2020 (Statistics Bureau of Japan, 2021), most participants overestimated the risks of infection (mean = 8.3%, median = 1%, $SD =$

Figure 1

Histograms and boxplots of variables ($N = 1,337$ – $1,727$, age range = 78–99). Dashed lines show the objective positive or fatality rate in adults aged 70 years or older as of August 12, 2020, based on statistics from the Japanese Ministry of Health, Labour and Welfare.

Table 1

Spearman's simple correlation coefficients among variables.

	1	2	3	4	5	6	7	8	9	10
1. Age										
2. Sex (women = 0, men = 1)	.028									
3. Anxiety	-.122***	-.141***								
4. Perceived infection risk	-.073**	-.095***	.110**							
5. Perceived fatality risk	.257***	-.175***	.118***	.208***						
6. Preventive behavior	-.093***	-.179***	.444***	.056*	.099***					
7. Neuroticism	-.259***	-.118***	.116***	.057*	-.032	.038				
8. Extraversion	.158***	-.154***	.031	.029	.091***	.101***	-.249***			
9. Openness to experience	.013	-.089***	.026	.004	.001	.128***	-.118***	.283***		
10. Agreeableness	.306***	-.157***	-.017	-.026	.106***	.034	-.464***	.262***	.125***	
11. Conscientiousness	.164***	.098***	-.023	.054	.031	.052*	-.279***	.338***	.298***	.146***

Note. $N = 1,251$ – $1,727$. Age range = 78–99. *** $p < .001$, ** $p < .01$, * $p < .05$.

16.9%) and death (mean = 41.2%, median = 50%, $SD = 29.8\%$). Because these variables were not normally distributed, we used Spearman's correlation coefficients (ρ) for the following correlation analyses.

Table 1 presents Spearman's simple correlations among all variables. Age was associated positively with perceived fatality risk, $\rho = .257$, $p < .0001$, and negatively with anxiety, $\rho = -.122$, $p < .0001$; perceived infection risk, $\rho = -.073$, $p = .0078$; and engagement in preventive behaviors, $\rho = -.093$, p

Table 2

Spearman's partial correlation coefficients controlling for sex and age.

	1	2	3	4	5	6	7	8
1. Anxiety								
2. Perceived infection risk	.090**							
3. Perceived fatality risk	.133***	.223***						
4. Preventive behavior	.424***	.033	.098***					
5. Neuroticism	.074**	.029	.016	-.006				
6. Extraversion	.029	.026	.024	.091***	-.242***			
7. Openness to experience	.016	-.003	-.019	.116***	-.130***	.275***		
8. Agreeableness	-.003	-.020	-.003	.036	-.448***	.205***	.114***	
9. Conscientiousness	.010	.077**	.006	.087***	-.240***	.342***	.311***	.120***

Note. $N = 1,251$ – $1,708$. Age range = 78 – 99 . *** $p < .001$, ** $p < .01$

= .0001. Men felt less anxious, $\rho = -.141$, $p < .0001$; had a more optimistic (or less pessimistic) perception of infection risk, $\rho = -.095$, $p = .0005$, and death risk, $\rho = -.175$, $p < .0001$; and were less engaged in preventive behaviors, $\rho = -.179$, $p < .0001$, than women were. Because age and sex had significant associations with almost all personality traits and COVID-19-related variables, they should be controlled when examining correlations among focal variables.

Table 2 summarizes Spearman's partial correlation coefficients controlling for age and sex. Among COVID-19-related variables, anxiety was positively correlated with the others, having the strongest association with preventive behavior, $\rho = .424$, $p < .0001$. The two indices of risk perception were correlated with each other, $\rho = .223$, $p < .0001$, but only perceived fatality risk was significantly associated with engagement in preventive behaviors, $\rho = .098$, $p = .0002$ (for perceived infection risk, $\rho = .033$, $p = .2242$).

As for associations with personality, anxiety was positively correlated only with neuroticism, $\rho = .074$, $p = .0033$ (when controlling for other traits, $\rho = .089$, $p = .0004$). Perceived infection risk was positively correlated only with conscientiousness, $\rho = .077$, $p = .0067$ (when others controlled, $\rho = .084$, $p = .0031$). Engagement in preventive behaviors had positive associations with extraversion, $\rho = .091$, $p = .0003$ (when others controlled, $\rho = .051$, $p = .0451$); openness to experience, $\rho = .116$, p

$< .0001$ (when others controlled, $\rho = .083$, $p = .0010$); and conscientiousness, $\rho = .087$, $p = .0006$ (when others controlled, however, $\rho = .043$, $p = .0867$). Perceived fatality risk had no detectable association with any personality trait ($p > .3856$).

Discussion and Implications

First, we inspected the frequency distributions of and correlations among COVID-19 anxiety, perceived risks of infection and death, and engagement in preventive behaviors. We found that the majority of our sample overestimated the risk of infection and death, felt anxious, and practiced the “new normal.” The overestimation of the probability of objectively rare events is consistent with well-known probability weighting functions in decision theory (e.g., Tversky, & Kahneman, 1992). Given the present and prior findings (e.g., Duong, et al. 2021; Niepel et al., 2020) that a higher risk perception was associated with higher engagement in preventive behaviors, the overestimation of fatality risk could be adaptive and desirable during pandemics. Although Niepel et al. (2020) reported that young and older adults in the United States underestimated fatality risk, the discrepancy might be attributed to, for example, differences in methodology (i.e., the use of multiple-choice or numerical-response items), the infection status between countries, and timing of the survey. Notably, the actual risks of infection and death for an individual are not equal to the risks presented in national statistics but are highly dependent on personal conditions such as daily activities and medical conditions. The prevalence of anxiety-related genes in the Japanese population (Murakami et al., 1999) might also explain these findings.

We demonstrated that the older age was associated with low anxiety about the COVID-19. This finding is consistent with the general findings of age-related decreases in negative emotions such as anxiety and depression (e.g., Carstensen et al., 2000; Löwe et al., 2010). Older age was also associated with lower engagement in preventive behaviors, which may be preceded by lower anxiety (e.g., Jones & Salathé, 2009), given the positive partial correlation between them. Notably, older age was

associated with a lower perception of infection risk and a higher perception of fatality risk. This seemingly paradoxical pattern can be explained: preventive behaviors decrease infection risk but not fatality risk *per se*. In other words, older age might be associated with a higher risk of death due to biological reasons and with a lower risk of infection due to social and behavioral reasons (e.g., social isolation, a tendency to lower activities).

Similar distinctions were observed in two other results. First, we demonstrated that high engagement in preventive behaviors was associated with a high perception of fatality risk but not a perception of infection risk. This finding suggests that the fear of death is more conducive to changing older adults' behavior than the fear of infection is. Second, although perceived infection risk was predicted by a personality trait (i.e., conscientiousness), no personality trait was related to perceived fatality risk. This finding might be attributed to the difference in controllability of infection and fatality. That is, infection risk can be reduced by changing behavior and thus should be susceptible to personality, whereas mortality after infection is affected by less controllable factors such as medical conditions. These findings suggest that the dissociation between infection and fatality risk perceptions should be considered to understand processes underlying older adults' behaviors under the pandemic situation.

We found that different facets of older adults' responses to the COVID-19 pandemic were predicted by different personality traits. Specifically, higher anxiety was predicted by higher neuroticism, consistent with general findings (e.g., Thompson, 2008). High infection risk perception was linked to high conscientiousness, also consistent with findings that conscientious individuals tend to show a high risk perception (e.g., Wang et al., 2016) and avoid risky health behavior (e.g., Vollrath et al., 1999). Engagement in preventive behaviors was heightened by extraversion, openness to experience, and conscientiousness; the three traits are reliable predictors of mortality of Japanese older adults (Iwasa et al., 2008). Although speculative, these associations might also reflect the acceptance of changes such as the "new normal." For sex differences, we observed that women exhibited higher

anxiety, a more pessimistic perception of infection and death risk, and higher engagement in preventive behavior than men did, conforming to the literature on epidemics and pandemics (e.g., Abdelrahman, 2020, Liao et al., 2010; Park et al., 2010; for a meta-analysis, see Moran & Del Valle, 2016). These findings suggest that each individual's attributes should be considered to understand the older adults' behavior during pandemics and to plan interventions.

The present study is limited to describing correlations, not demonstrating causal relationships, among COVID-19 anxiety, infection and fatality risk perceptions, and preventive behaviors. In other words, the observed positive correlations among them could be modulated or confounded by individual factors other than age and sex (e.g., medical conditions, areas of residence, and preferred sources of information). Since the establishment of a causal model is beyond the scope of the present study, future studies should elucidate more detailed mechanisms underlying older adults' behavior during the pandemic by considering more individual factors and their interactions and by conducting longitudinal follow-up.

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Conflict of Interest

None reported.

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Captions

Figure 1. Histograms and boxplots of variables ($N = 1,337-1,727$, age range = 78–99). Dashed lines show the objective positive or fatality rate in adults aged 70 years or older as of August 12, 2020, based on statistics from the Japanese Ministry of Health, Labour and Welfare.

Table 1. Spearman's simple correlation coefficients among variables.

Table 2. Spearman's partial correlation coefficients controlling for sex and age.

Table 1

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Note. $N = 1,251-1,727$. Age range = 78–99. *** $p < .001$, ** $p < .01$, * $p < .05$.

Table 2

Spearman's partial correlation coefficients controlling for sex and age.

	1	2	3	4	5	6	7	8
1. Anxiety								
2. Perceived infection risk	.090**							
3. Perceived fatality risk	.133***	.223***						
4. Preventive behavior	.424***	.033	.098***					
5. Neuroticism	.074**	.029	.016	−.006				
6. Extraversion	.029	.026	.024	.091***	−.242***			
7. Openness to experience	.016	−.003	−.019	.116***	−.130***	.275***		
8. Agreeableness	−.003	−.020	−.003	.036	−.448***	.205***	.114***	
9. Conscientiousness	.010	.077**	.006	.087***	−.240***	.342***	.311***	.120***

Note. $N = 1,251$ – $1,708$. Age range = 78–99. *** $p < .001$, ** $p < .01$

Figure 1

Histograms and boxplots of variables ($N = 1,337\text{--}1,727$, age range = 78–99). Dashed lines show the objective positive or fatality rate in adults aged 70 years or older as of August 12, 2020, based on statistics from the Japanese Ministry of Health, Labour and Welfare.