



The Relationship Between Social Interaction and Anxiety Regarding COVID-19 in Japanese Older Adults

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Abstract

While previous studies suggest that women have higher anxiety than men regarding COVID-19, underlying mechanisms remain unclear. This study tries to explain the mechanisms by gender difference in social interaction based on a theory of social amplification of risk framework (SARF). We surveyed older adults in Japan regarding their anxiety regarding COVID-19, as well as the frequencies of their direct and indirect social interaction in July 2020 ($N=1,587$, aged 78–99 years). To explore the way in which gender and anxiety regarding COVID-19 were mediated by these two types of social interactions, MODEL4 of SPSS's Process MACRO was applied to the data. We found that older women interacted more directly and indirectly with others than did older men. And, direct social interaction was negatively and related, but indirect social interaction was positively related to older adults' anxiety regarding COVID-19. Furthermore, direct social interaction was related to older women's low anxiety regarding COVID-19, whereas indirect social interaction was related to older women's high anxiety regarding COVID-19. The findings of our study suggest that the degree of anxiety regarding COVID-19 among older women may be dependent upon the types of social interaction they have with others.

Keywords

COVID-19, anxiety, social amplification of risk framework, social interaction, gender differences

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Introduction

Gender Differences in Older Adults' Anxiety Regarding COVID-19

The spread of COVID-19 had a significant impact on society and the global economy. Anxiety, fear, and isolation to prevent COVID-19 have negatively impacted people's mental healths (Brooks et al., 2020; Torales et al., 2020).

Previous studies have reported that individuals with specific characteristics are more vulnerable to the psychological effects of COVID-19. Studies examining the attributes of people with a high level of fear regarding COVID-19 have shown that women are more susceptible to anxiety regarding COVID-19 than are men (Bahar Moni et al., 2021; Bonati et al., 2021; Burkova et al., 2021; Every-Palmer et al., 2020; Horesh et al., 2020; Joseph et al., 2021; Litwin & Levinsky, 2022; Liu et al., 2020; Özdin & Bayrak Özdin, 2020; Rahman et al.,

2020). Studies in Japan have shown that women feel more anxious about COVID-19 than men as well (Motoyoshi, 2020; Nagasu et al., 2021; Yamagata et al., 2021; Yoshioka et al., 2021). Therefore, we suggest that gender is one of the characteristics that distinguishes

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people who experience a high level of anxiety regarding COVID-19 from those who do not.

In addition to gender, medical (Bahar Moni et al., 2021; Bonati et al., 2021; Every-Palmer et al., 2020; Horesh et al., 2020; Nagasu et al., 2021; Özdin & Bayrak Özdin, 2020), psychological (Horesh et al., 2020; Joseph et al., 2021), sociodemographic (Bonati et al., 2021; Every-Palmer et al., 2020; Horesh et al., 2020; Özdin & Bayrak Özdin, 2020; Rahman et al., 2020; Yoshioka et al., 2021), family-related (Yoshioka et al., 2021), cultural (Burkova et al., 2021), economic (Bahar Moni et al., 2021; Bonati et al., 2021; Every-Palmer et al., 2020; Litwin & Levinsky, 2022; Nagasu et al., 2021; Rahman et al., 2020; Yoshioka et al., 2021), and lifestyle (Bahar Moni et al., 2021; Bonati et al., 2021; Liu et al., 2020; Nagasu et al., 2021; Rahman et al., 2020) factors are also related to the psychological effects of COVID-19. However, research findings on the relationship between marital status and anxiety regarding COVID-19 are inconsistent (Nagasu et al., 2021; Özdin & Bayrak Özdin, 2020).

With increasing of older adults's rates of anxiety and depression during the COVID-19 pandemic, many studies have found the factors that affect older adults' mental health, including demographics, socioeconomic status, living situation, pre-existing mental health conditions and pre-existing mental conditions. And, Gender is also a significant factor affecting older adults' anxiety during the pandemic (Webb & Chen, 2022). For instance, a recent study has shown that older women experienced more anxiety or depression than older men during the pandemic (Koma et al., 2021).

These studies show that gender is an important factor that influences anxiety regarding COVID-19 not only in all age groups but also in older adults. However, the specific mechanism by which the level of women's anxiety is higher than the level of men's anxiety remains unknown.

Reasons Older Women Are More Susceptible to Anxiety Regarding COVID-19 Than Men

Previous studies have discussed several hypotheses regarding the mechanism underlying gender differences in anxiety regarding COVID-19, and include both biological and sociological perspectives. For example, a biological hypothesis proposes that women are more sensitive than men to the neural networks associated with fear and excitation responses (Liu et al., 2020). A sociological hypothesis suggests that women do most of the housework and childcare, and these roles have increased anxiety and stress during the pandemic (Rahman et al., 2020). However, another study found that both men and women who were family caregivers were more distressed (Yoshioka et al., 2021).

In this study, we examine social mechanisms based on the social amplification of risk framework (SARF),

which indicates that women are more socially active in interacting with others than men, and are therefore more likely to generate negative information diffusion reactions. The SARF is a theory that clarifies the mechanism by which information about risk is diffused. It suggests that signals of risk are transmitted to people through various means, such as media, letters, telephone, and direct conversation (Kasperson et al., 1988).

Due to gender differences in social interactions, women tend to be more exposed to information about risks, including information related to COVID-19. Women are typically more socially active than men and engage in more frequent and extensive social interactions. For example, older women tend to have direct and indirect social interaction one a month or more frequently than older men (Saito et al., 2010). Among single older men, the percentage of those with direct and indirect social interactions less than once a week is 42%, while among single older women it is 17% (Kobayashi et al., 2011). In addition, older women are more likely than older men to have direct and indirect more than two or three times a month (Ejiri et al., 2018).

And these characteristics can increase their likelihood of receiving and sharing negative information related to the pandemic. As a result, women may be more sensitive to COVID-19 and experience higher levels of anxiety and distress compared to men.

In the absence of risk, social interaction has positive benefits and is associated with subjective well-being (Choe et al., 2021; Hoogerbrugge & Burger, 2018; Li et al., 2018). However, negative social interactions may also include critical remarks, result in feelings of defeat, and violate other's private lives (Lincoln, 2000). Thus, social interaction may have both positive and negative effects.

In addition, negative social interactions tend to arise in emergencies when a risk, such as an infectious disease epidemics, occur. For example, recent studies have shown that a high frequency of social interaction during the quarantine period of COVID-19, was associated with low subjective well-being. Social interaction leads to negative information diffusion reactions through communication, which strengthens crisis awareness during negative events (Kim & Florack, 2021).

However, one study found that while direct social interaction played a positive role in mental health, indirect social interaction using electronic equipment had negative effects (Litwin & Levinsky, 2022). These results suggest that social interaction may have both positive effects and negative effects on mental health.

In summary, we suggest that women are more anxious about COVID-19 than men because women are more active in interacting with others than men. Therefore, women are more likely to receive information about events in society, and negative information may lead to anxiety.

To understand the relationship between social interaction and anxiety regarding COVID-19 in older

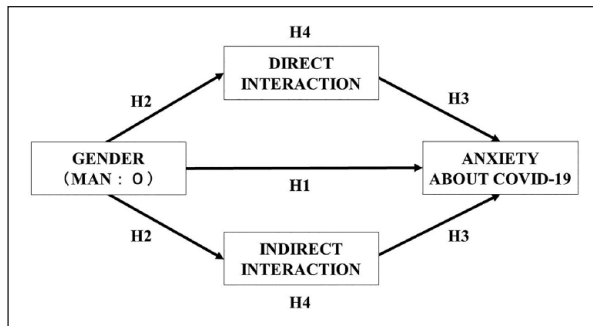


Figure 1. Model and Hypothesis.

women, we proposed the following four hypotheses, as illustrated in Figure 1.

H1: Women are more anxious about COVID-19 than men

H2: Women have higher frequencies of direct and indirect social interaction than men.

H3: Direct social interaction reduces anxiety regarding COVID-19, but indirect social interaction increases anxiety regarding COVID-19

H4: Women decrease their anxiety regarding COVID-19 through direct social interaction, but also increase through indirect social interaction.

Method

Data and Research Subjects

The data used in this analysis were obtained from the SONIC conducted by [affiliation]. In this study, we conducted longitudinal surveys with older adults in their 70s, 80s, and 90s. The study conducted longitudinal surveys with older adults in their 70s, 80s, and 90s, starting from 2010, 2011, and 2012, respectively, and conducted every 3 years. The areas included Itami City and Asago City in Hyogo, and Itabashi, and Nishitama District in Tokyo.

Following outbreak of COVID-19, we conducted mail survey in July 2020, which included all cohorts aged from 70 to 90 years old as participants and researched variables related to COVID-19.

For this paper, we used the data from mail survey in July 2020. The number of participants surveyed was 2,653, and the number of respondents was 1,785, resulting in a participation rate of approximately 67%. We analyzed the 1,587 participants with complete survey data.

Variables

Anxiety regarding COVID-19 and the frequencies of direct and indirect social interactions were measured. Anxiety regarding COVID-19 was considered a dependent variable, and the survey item used to measure this

was “I feel anxiety regarding COVID-19.” Answer choices for this item included (1) strongly disagree, (2) disagree, (3) somewhat disagree, (4) somewhat agree, (5) agree, and (6) strongly agree.

We asked participants two questions used as mediator. First question was the frequency of direct social interactions with others. The survey item used to measure this was “How often do you usually meet friends or neighbors or relatives and go out with, or invite each other to your house?” Answer choices for this item included (1) more than twice a week, (2) about once a week, (3) 2.3 times a month, (4) about once a month, (5) less than once a month, (6) not at all, and (7) do not know.

Second question was the frequency of indirect social interaction. The survey question used to measure this was “How much do you usually interact with friends or neighbors or and relatives (including telephone calls, e-mails, and faxes.)”? The answer choices for this question included (1) more than twice a week, (2) about once a week, (3) 2 to 3 times a month, (4) about once a month, (5) less than once a month, (6) not at all, (7) do not know. We reverse coded these two variables before analysis and excluded responses of (7) do not know as missing values.

Gender was considered an independent variable (male: 0), and we chose the following control variables based on previous studies: age (Every-Palmer et al., 2020; Horesh et al., 2020), educational background (primary school: 1, secondary and high school: 2, university: 3) (Bonati et al., 2021), marital status (do not have Partner: 0) (Nagasu et al., 2021), financial capacity (Litwin & Levinsky, 2022), residential area (non-urban: 0) (Özdin & Bayrak Özdin, 2020), and subjective health (Bonati et al., 2021; Every-Palmer et al., 2020).

Analytical Methods

Descriptive statistics such as average value, variance, and proportion were calculated using the statistical analysis software, SPSS28. And we conducted a regression analysis using a general linear model to examine relationships among gender, frequencies of direct and indirect social interaction, anxiety regarding COVID-19 with control variables as covariates. After that, Using MODEL4 of SPSS’s PROCESS macro (Hayes, 2018), indirect effects mediated by the frequency of direct and indirect social interaction were found. Iterative bootstrapping extraction was 5,000 times, and the confidence interval (CI) was 95%.

Ethical Consideration

This study protocol was reviewed and approved by the ethics board of the School of Human Sciences of Osaka University [Jin-kou 30-121, HB020-020] and the Institutional Review Board of the Tokyo Metropolitan Institute of Gerontology [Issue#2 in 2019, Issue#Jin11 in 2020].

Table 1. Demographic Characteristics of the Respondents.

	Mean	SD	Minimum	Maximum
Gender (man: 0)	0.53	0.50	0	1
Age	85.29	5.79	78	99
Educational Background	2.02	0.75	1	3
Marital Status (do not have partner : 0)	0.52	0.50	0	1
Financial Capacity	3.24	0.79	1	5
Residential Area (non-urban: 0)	0.62	0.49	0	1
Subjective Health	2.93	0.62	1	4
Direct Social Interaction	3.93	1.82	1	6
Indirect Social Interaction	4.42	1.62	1	6
Anxiety regarding COVID-19	4.28	1.41	1	6

Table 2. Results of the Correlation Analysis Between All Variables.

	Gender	Age	Educational background	Marital status	Financial Capacity	Residential area	Subjective health	Direct social interaction	Indirect social interaction
Age	-.021								
Educational background	-.082**	-.045							
Marital status	-.421**	-.273**	.083**						
Financial capacity	.005	.091**	.107**	.034					
Residential area	.062*	.173**	.192**	-.084**	.069**				
Subjective health	-.040	-.077**	.003	.038	.177**	-.042			
Direct Social interaction	.091**	-.225**	-.013	.003	.120**	-.211**	.187**		
Indirect social interaction	.205**	-.221**	.025	-.032	.085**	-.115**	.112**	.682**	
Anxiety regarding COVID-19	.135**	-.132**	-.027	.013	-.076**	-.016	-.082**	.033	.135**

** $p < 0.01$. * $p < .05$.

Results

Table 1 lists descriptive statistics for the variables used in our analysis and Table 2 shows the correlations between all variables. Table 3 presents results of the regression analysis for the respondents with respect to anxiety regarding COVID-19 and direct or indirect social interactions.

The regression analysis using the frequency of direct and indirect social interaction as dependent variables showed that older women had higher frequencies of direct and indirect social interaction than older men (0.32**, 0.67***). Furthermore, using anxiety regarding COVID-19 as a dependent variable and gender, the frequency of direct and indirect social interactions as independent variables, older women and those with high frequencies of indirect social interactions experienced more anxiety regarding COVID-19 (0.35***, 0.14***). However, those with high frequencies of direct social interactions experienced less anxiety regarding COVID-19 (-0.07**).

We examined the indirect effects of frequency of direct and indirect social interactions on anxiety regarding COVID-19. The indirect effect mediating the frequency of direct social interaction was -0.023 (95% CI [-0.047, -0.005]) and that of indirect social interaction

was 0.096 (95% CI [0.052, 0.148]). Both indirect effects show that direct social interactions positively mediate older women's anxiety regarding COVID-19, but indirect social interactions negatively mediate older women's anxiety regarding COVID-19.

These results show that older women who have frequent direct social interactions experience less anxiety regarding COVID-19, but who have frequent indirect social interactions experience more.

Discussion

Previous studies have revealed that women are more anxious about COVID-19 than men. However, the mechanism by which anxiety regarding COVID-19 relates to gender was unknown. To clarify the relationship between gender and anxiety regarding COVID-19, We hypothesized that because women have a higher frequency of social interaction than men, their anxieties regarding COVID-19 tend to be more amplified by exposure to negative information. Our findings showed that direct social interaction was related to low anxiety regarding COVID-19, and indirect social interaction was related to high anxiety regarding COVID-19 in older women. These results reveal that older women's social interactions may either increase or decrease

Table 3. Results of the Regression Analysis for the Respondents by Anxiety Regarding COVID-19 and Direct or Indirect Social Interactions.

	Anxiety regarding COVID-19			Direct social interaction			Indirect social interaction			Anxiety regarding COVID-19		
	B	S.E.	β	B	S.E.	β	B	S.E.	β	B	S.E.	β
Intercept	7.32	0.61		7.43	0.75		7.73	0.68		6.73	0.63	
Gender (man : 0)	0.42***	0.08	.30	0.32**	0.10	.17	0.67***	0.09	.41	0.35***	0.08	.25
Age	-0.03***	0.01	-.12	-0.06***	0.01	-.20	-0.06***	0.01	-.20	-0.03***	0.01	-.10
Educational background	-0.04	0.05	-.02	0.03	0.06	.01	0.10	0.05	.04	-0.05	0.05	-.03
Marital status (do not have Partner : 0)	0.14	0.08	.05	-0.15	0.10	-.04	-0.07	0.09	-.02	0.14	0.08	.05
Financial capacity	-0.09*	0.05	-.05	0.29***	0.06	.13	0.19***	0.05	.09	-0.10*	0.05	-.06
Residential area (non-urban: 0)	0.01	0.07	.00	-0.71***	0.09	-.19	-0.35***	0.08	-.11	0.01	0.08	.00
Subjective health	-0.17**	0.06	-.08	0.42***	0.07	.15	0.22***	0.06	.08	-0.17**	0.06	-.08
Direct social interaction										-0.07**	0.03	-.09
Indirect social interaction										0.14***	0.03	.17
R ²		.05			.14			.12			.06	
N							1,587					

B: Unstandardized coefficient; S.E : Standard error β : Standardized coefficient.

*** $p < .001$. ** $p < .01$. * $p < 0.05$.

anxiety regarding COVID-19, depending on the type of interaction experienced.

Our results supported H1 and H2. The relationship between gender and anxiety regarding COVID-19 was significant, as was the case in previous studies. In addition, our study showed that women had higher frequencies of direct and indirect social interactions than men. These results are consistent with previous studies showing that women are more active in social interaction than men (Ejiri et al., 2018; Kobayashi et al., 2011; Saito et al., 2010).

To clarify how social interactions are related to anxiety regarding COVID-19, we examined the relationship between anxiety regarding COVID-19 and the frequency of direct and indirect social interactions. We found that when the frequency of direct social interaction was high, anxiety regarding COVID-19 was low; However, when the frequency of indirect social interaction was high, anxiety regarding COVID-19 was also high. These results support H3 and are consistent with a previous study that showed direct social interaction decreased negative mental health changes, while indirect social interaction increased them (Litwin & Levinsky, 2022). From this, we can conclude that there may be either a positive or negative relationships between anxiety regarding COVID-19 and social interaction, depending upon the type of social interaction.

We also explored whether social interaction explains gender differences in anxiety regarding COVID-19, through the indirect effects of the frequency of direct and indirect social interactions. Our results indicated that frequency of direct and indirect social interactions mediate the relationship between gender and anxiety regarding COVID-19. As we hypothesized in H4, the frequency of direct social interaction positively

mediated anxiety regarding COVID-19 in older women. The findings of this study suggest that since women interact directly with others more than men, it is easier for them to receive emotional support, which in turn may suppress their anxiety regarding COVID-19.

In addition, the frequency of indirect social interaction had an indirect effect on increasing older women's anxiety regarding COVID-19. Unlike direct social interactions, indirect social interactions are often performed to exchange information during emergencies. Women are more active than men in indirect social interactions; therefore, information about COVID-19 obtained through indirect social interactions with others may increase women's anxiety regarding COVID-19. From these results, we conclude that in response to anxiety regarding COVID-19, older women may experience both more positive and negative psychological effects from social interactions than older men.

As a result of the control variables, older adults with low financial capacity and poor subjective health, had higher anxiety regarding COVID-19. This is consistent with the results of previous studies, which found that health problems (Bonati et al., 2021; Every-Palmer et al., 2020), financial capacity (Litwin & Levinsky, 2022), and low income (Nagasu et al., 2021; Yoshioka et al., 2021) were related to anxiety regarding COVID-19. At the same time, older adults felt more anxiety regarding COVID-19 than oldest old adults. Therefore, we found that not only young people, but also relatively young older adults are more vulnerable to psychological impact of COVID-19.

However, unlike previous studies, anxiety regarding COVID-19 was not significantly related to two variables of educational background, or residential area. This is because educational background and residential area did

not affect the frequency of social interaction for older adults due to retirement from work. In addition, marital status was not related to anxiety regarding COVID-19. This may be because aging and physical limitations make it difficult for older couples to support one another.

The results of our study have important implications for practice. While the COVID-19 pandemic made it difficult to directly interact with others, indirect social interactions, including those that are not limited to the exchange of information have become important. A related study indicated that Web-based socialization mitigated older adults' mental health (Haase et al., 2021). This suggests that older adults may experience both positive and negative psychological effects depending on the ways of indirect social interactions. Therefore, more future research examining the way in which indirect social interaction using electronic equipment can compensate for direct social interaction is required. This is especially crucial for the mental health of older women during the pandemic, as older women are more likely to engage in social interaction than older men. This is especially helpful for mental health of older women during the pandemic, as older women have higher frequency of social interaction than older men.

This study also had several limitations. First, since cross-sectional data was used in our analysis, we were not able to identify causal relationships. Therefore, it is unclear whether direct and indirect social interactions are the result or the cause of anxiety regarding COVID-19. Second, we selected survey subjects from four areas of Japan; Therefore, these results cannot be generalized to the entire country. Third, since we used listwise deletion to manage missing values, selection bias occurred in our analysis. Specifically, people with missing values were related to all variables except gender, residential area, and subjective health. Fourth, we used single-item measures for anxiety and social interaction. So, multiple-item measures for those variables should be used for more valid and reliable results in future research.

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Declaration of Conflicting Interests

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Ethical Approval

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