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Abstract:

Background. Health inequity in relation to COVID-19 infection and socioeconomic consequences is a major global concern. Mental health issues in vulnerable populations have received special attention in research and practice during the COVID-19 pandemic. However, there is limited evidence on the nature of the anxieties experienced as a result of COVID-19, and how such concerns vary across demographic groups.

Aim. This study examines anxiety among the working population of Japan (aged 18-59), in terms of both COVID-19 infection and socioeconomic consequences, using an internationally validated tool, the Pandemic Anxiety Scale (PAS).

Methods. Data were collected using an online survey (n=2,764). The analyses included an exploratory factor analysis (EFA), a confirmatory factor analysis (CFA), and structural equation modeling (SEM), followed by validation of the Japanese version of the PAS.

Results. A two-factor latent variable model shows the multidimensionality of anxiety in regard to the COVID-19 pandemic and the disparity across population groups in predicting the two defined anxiety dimensions. Several path coefficients showed somewhat unexpected and/or unique results from Japan compared with previous European studies. Specifically, self-reported health status was not significantly related to disease anxiety, and those who were not in paid employment reported lower consequence anxiety. The SEM results showed a greater number of significant exogenous variables for consequence anxiety compared to disease anxiety, highlighting disparities in pandemic anxiety by socioeconomic status in regard to socioeconomic consequences of the pandemic.

Conclusion. In contrast to existing European studies, evidence from the current study suggests contextual patterns of health inequity. Due to the prolonged socioeconomic

consequences of the pandemic, multidisciplinary research on mental health issues and the quality of life remains an important research agenda in exploring socioeconomic measures in context, towards addressing inequity concerns.

1. Background

During the COVID-19 pandemic, adverse socioeconomic impacts and disproportionate effects among vulnerable population groups have been studied globally. Besides macro-economic repercussions of the pandemic (1, 2), disproportionate socioeconomic impacts on low socioeconomic status groups have been reported in high-, middle-, and low-income countries. For example, evidence suggests that younger generations, low-income groups, women and children are particularly vulnerable to adverse socioeconomic consequences of the pandemic through increased risk of unemployment, decreased income, and domestic violence (3-6). The circumstances of the vulnerable population groups and their trends reportedly differ in each setting, in terms of the pattern of unemployment rate by gender, and the extent of the impact on poverty, household income decline, and food insecurity by country. Thus, a contextual analysis and intervention across different population groups would remain critical by setting.

Health equity has been receiving increasing attention in the last decade and especially in the Sustainable Development Goals (SDGs) era. Generally, health equity is referred to and defined as "the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically or geographically"(7-9). Since the onset of the COVID-19 pandemic, health equity perspectives have been further underscored in the relevant health issues, including but not limited to access and delivery of preventive and curative health care against COVID-19 infection (e.g., vaccination), infection prevention and social determinants of health (e.g., socioeconomic position), and relevant health outcomes (e.g., infection and mortality rates) (10-15). Such health equity issues have been increasingly recognized in Japan by sub-population group, including the mental health issues following the pandemic (e.g., psychological distress, suicide, health-related quality of

life) (16-20), whilst the evidence base is still limited in Japan with variations surrounding the socioeconomic perspectives.

Multidisciplinary research investigating the mental health impact of the COVID-19 pandemic has been also recognized as a research priority since the early stages of the pandemic. In particular, the need for research and interventions that address the psychological, social, and neuro-scientific aspects of the pandemic has been underscored (21). Studies caution against the adverse mental health outcomes during the COVID-19 pandemic and the variation of such deterioration by sociodemographic factor, suggesting the negative influence of the COVID-19 pandemic on mental health issues and subsequent health inequity concerns (22-24). Evidence of the adverse mental health impact of the COVID-19 pandemic on vulnerable population groups exists globally, and its disproportionate impact among children and adolescents, for instance, is of major concern (22, 25-27). Concerns about COVID-19 itself have been posited as a key factor in the increase in general mental health problems during the pandemic (28, 29). Furthermore, evidence of COVID-19-related anxiety among the lower health status population or the higher risk-taking population group is mixed, suggesting some variations across the specific aspects of anxiety (30-32). Most studies on anxiety about COVID-19, however, employ measures that focus on the disease aspect only (33) and do not distinguish the multiple dimensions that comprise anxiety.

As such, there has been increasing recognition of the multidimensionality of COVID-related anxiety during the pandemic, and several new COVID-specific anxiety measures have been developed, tested and validated (33-36). Although the majority of the COVID-specific anxiety measures address a single dimension of anxiety related to COVID-19 as a disease itself, a relevant multidimensional measure was also developed, called the “COVID-19 Stress Scales” that comprise five dimensions and thirty-three specific indicators (36). Following this, the Pandemic Anxiety Scale (PAS) was developed and validated in the United Kingdom

(UK) as a feasible and practical scale among surveys, underscoring the multidimensionality of pandemic anxiety using seven indicators. In particular, the PAS differentiates anxiety about COVID-19 infection (i.e., "disease anxiety") and negative socioeconomic consequences of the pandemic (i.e., "consequence anxiety") (35), both of which are critical factors in the health and wellbeing of the population, showing differential associations with demographics, social and health factors (e.g., gender, age, and chronic physical health conditions). In addition, a study in Austria validated and employed the PAS, finding a different pattern of pandemic anxiety from the original UK study (37).

However, studies that identify and compare distinct pandemic anxiety dimensions are still limited among the general population across generations. The evidence base of anxiety due to the COVID-19 pandemic has mainly focused on the so-called "unidimensional" anxiety that spotlights fear and anxiety about COVID-19 infection and has been statistically validated (35, 36, 38). Another study used a general mental health screening scale (i.e., the Psychological Distress Scale K6) (39). Most of these studies employed a measure that is calculated based on multiple questions or indicators, of which response scores are added to provide a summative score (33, 40, 41). However, relevant measures that assess pandemic anxiety as a latent construct considering reflective indicators are scarce. Furthermore, despite its methodological advantage, evidence is still limited from studies using structural equation modeling (SEM) in the assessment of mental health by measures of depression, anxiety, fear, risk perceptions, and negative emotions during the COVID-19 pandemic (35, 42-47).

Therefore, this study aims to examine the associations between socioeconomic position, health-related status and the multiple dimensions of anxiety during the pandemic, namely, disease-related anxiety (i.e., "disease anxiety") and socioeconomic consequence-related anxiety (i.e., "consequence anxiety"). Using SEM, this study assessed multiple

dimensions of pandemic anxiety as a latent outcome measure of mental health issues, which were predicted by a series of interrelated socioeconomic and health-related measures.

2. Methods

(1) Study setting and data

This study was conducted in Japan, particularly in the six prefectures where the central government's emergency declaration was in effect and the new COVID-19 infection cases were marked as the highest in the country at the time of study preparation in early 2021. The locations were Aichi, Chiba, Kanagawa, Osaka, Saitama, and Tokyo. Ethical approval was obtained from the Research Ethics Committee of the School of Health Management, Keio University, in February 2021.

Data were collected in March 2021 from the general working-age populations, aged 18 to 59 years. It was approximately a year after the onset of the pandemic in February 2020 and the government's direct payment program in the mid-2020. The government's COVID-19 public vaccination program, which started around April 2021, had not yet been launched at the time of the survey. The participants were registered as a survey panel for an international online survey company, Cint Japan, one of the largest online survey companies in Japan. Quota sampling methods were employed according to the national population statistics by age and gender. For data collection, study sample distributions were weighted by the sub-national population statistics of the target prefecture, approximating the distribution of the sub-national population (48). The final study sample comprised 2,764 observations.

(2) Analytic strategy and measures

This study employed latent variable SEM, including both a structural portion (i.e., with measured variables) and a measurement portion (i.e., with latent constructs) (49). The latent variable SEM comprises two latent constructs representing the distinct dimensions of

pandemic anxiety related to the COVID-19 pandemic, as described in the subsequent section. The model includes two "endogenous variables", which appear as dependent variables in one of the equations; and multiple "exogenous variables", which are never dependent variables and are related to the socioeconomic position and health-related status of the study participant. In the SEM approach in theory, Kline explains that the relationship between variables is examined in terms of "path coefficients" that are indicated as an arrow assuming a potential causal relationship. Thus, "X is a cause of Y" by the conceptual definition of SEM (49).

Endogenous variables – "disease anxiety" and "consequence anxiety"

Endogenous variables represent the anxiety about COVID-19 and the socioeconomic consequences of the COVID-19 pandemic. These anxieties are defined and measured as "disease anxiety" and "consequence anxiety" according to the PAS, which has been validated in the UK (35). The scale comprises seven indicators, including four that are related to COVID-19 infection and three that are related to the socioeconomic consequences of the pandemic. Relevant indicators of "disease anxiety" are reflected in the question that asks about the respondent's anxiety about the disease itself, including anxiety about the infection of the respondent, infection of family and friends, going out, and transmission of infection to others. Those of "consequence anxiety" inquire about the adverse socioeconomic consequences of the pandemic, including anxiety about missing school/work, reduction of income, and the impact of COVID-19 on the labor market and economy. Respondents reported their level of anxiety about each question on a five-point Likert scale (i.e., strongly disagree, disagree, neither agree nor disagree, agree, strongly agree). A two latent variable structure was confirmed based on the preliminary analysis results, as described in the subsequent section.

Exogenous variables - socioeconomic position and health-related status

Exogenous variables included socioeconomic position and health-related status of the survey participants. Respondents' age was assessed as a continuous and categorical variable in consideration of potential non-linear relationships between age and pandemic anxiety: teenagers aged 18-19, those aged 20-29, aged 30-39, aged 40-49, and aged 50-59 (reference group: ages 30-39). Gender was categorized as male, female, and other for those who reported as "other" or "do not answer" (reference group: female). Education was categorized as "high school or less" or "higher education" (i.e., technical college, 2-year college education or higher) (reference: high school or less). Household income was measured in quintiles, regarding the recent national household annual income data (lowest 20% quintile for Japanese Yen - JPY two million or less; lower 20-40% quantile - JPY 3.42 million or less; middle 40-60% quintile - JPY 5.23 million or less; higher 60-80% quintile - JPY 8.13 million or less; and highest 20% quintile - above JPY 8.13 million) (reference: the highest 20% income quintile) (48). Employment, measured as a binary variable, was asked if they were in paid employment in the last four weeks preceding the survey (reference: not in paid employment). Current schooling was also measured as a binary variable if the respondent was a student or not at the time of the survey (reference: currently not in school). Marital or partnership status was measured as a binary variable if the respondent had a partner regardless of legal status at the time of the survey (reference: not married or having a partner).

In addition, the health-related status of a respondent was measured using the international tool developed by EuroQoL and employed internationally as a health outcome measure in public health and health economics research. The five-level EQ-5D version (EQ-5D-5L) consists of two measures: the EQ-5D descriptive system and the EQ-visual analog

scale (EQ-VAS). The EQ-5D descriptive system is a health-related quality of life (HRQoL) measure comprising the following five dimensions. Respondents were asked about mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. These questions ask the respondent to select the statement that best describes one's health on the date of the survey for each dimension, and the answer options have five levels (e.g., no problems, slight problems, moderate problems, severe problems, or unable) (50). The HRQoL score is a single cardinal value assigning 0.0 for death and 1.0 for perfect health, and the score was calculated according to the Japanese version's valuation study (range: – 0.025 to 1.000) (51). The EQ-VAS is a measure of self-reported health, and respondents were asked to rate their health status on the date of the survey, indicating 100 for the best health and 0 for the worst health that the respondent could imagine (50).

(3) Analytic steps

Data analysis was conducted in four steps. First, a descriptive analysis was conducted using STATA 17. Second, the psychometric properties of the Japanese version of the PAS were tested with STATA, using skewness and kurtosis scores for normality and Cronbach's alpha values for internal consistency. Third, factor analyses were conducted using Mplus version 8.7. An exploratory factor analysis (EFA) was utilized to assess the underlying factor structure of the PAS using geomin rotation. The decision on the number of factors to retain was based on an inspection of the eigenvalues and scree plot. A confirmatory factor analysis (CFA) was employed to examine the appropriateness and generalizability of the identified multi-factor structure, which represents the multiple dimensions of pandemic anxiety, as a measurement portion of the SEM. Fourth, SEM was conducted with Mplus version 8.7 to examine the mechanism by which socioeconomic positions and health-related status predicted multidimensional anxiety about the COVID-19 pandemic.

The SEM analyzed two equations simultaneously for the two defined endogenous variables in the model and estimated standardized coefficients, such that the model enabled an examination of the multidimensionality of pandemic anxiety and a comparison of path coefficients in terms of the effect size across exogenous variables of different metrics. These equations separately and simultaneously regressed the two dimensions of pandemic anxiety using polychoric correlations and probit regressions with weighted least squares estimation (in particular, WLSMV weighted least square mean and variance adjusted). In the model, all exogenous variables were designated as covarying because of the potential relatedness among exogenous variables. In addition, the errors/disturbances of the two latent dimensions of anxiety were covarying, as the unobserved aspects of these constructs were likely to be associated with each other (49, 52).

Model fit was assessed using the following recommended indices. Root Mean Square Error of Approximation (RMSEA) was examined to be less than 0.06 as a close fit and 0.08 as an acceptable fit. A Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were assessed to be 0.95 or higher as a recommended close fit (53).

Diagnostic procedures prior to the main analysis included bivariate analyses of selected variables and testing for multicollinearity and normality using STATA 17. These diagnoses have suggested safely ignoring multicollinearity among the exogenous variables, according to the Variance Inflation Factor (VIF) < 10, and assuming normal distributions of the endogenous variable indicator score (according to skewness and kurtosis scores)(54).

3. Results

(1) Descriptive results

Table 1 shows the descriptive statistics for pandemic anxiety, socioeconomic position, and health-related status of the study population. Mean scores of each pandemic anxiety indicator

showed some variation across different types of anxiety. The respondents' mean age was approximately 40 and ranged from 18 to 59 years. Around two-thirds had a college-level education or higher and paid employment in the last four weeks preceding the survey. Their household income almost approximated the national income quintile level, with somewhat lower proportions in the second lowest income group. Approximately half were married or had a partner, regardless of legal status. Self-reported health status was 74 points out of 100 points on average. The mean HRQoL score is 0.897, against the highest possible score of 1.000.

[INSERT TABLE 1 HERE]

(2) Psychometric properties of the Pandemic Anxiety Scale

Skewness and kurtosis scores for each item of the PAS indicated normality, using a conventional guideline of values ± 3 (54). Cronbach's alpha values suggested relatively high internal consistency among the seven items of the PAS (scale reliability coefficient=0.861).

(3) Factor analysis results

The EFA and CFA results suggested a two-factor structure of pandemic anxiety – "disease anxiety" and "consequence anxiety". Table 2 reports the factor loadings of each indicator on the respective factors from CFA, with the loading of the first indicator being set free and the variance of the latent factor set to one. The EFA indicated that the first factor and an eigenvalue of 4.164, and the second had an eigenvalue 0.973, which is narrowly below the conventional cut-off of 1.0. The third factor had an eigenvalue of 0.649. Based on these results and the patterns of factor loadings, we chose to retain the two-factor structure in subsequent analyses. The two-factor structure had better model fit indices than the one-factor structure in terms of CFI/TLI and RMSEA (55). The CFA results confirmed the two-factor

structure with model fit indices that were close or acceptable according to the aforementioned thresholds (e.g., CFI/TLI) (Table 2), in support of the appropriateness and generalizability of the measurement portion of the SEM. The two defined factors had a standardized correlation of 0.71 with statistical significance.

[INSERT TABLE 2 HERE]

(4) SEM results

The results of the final adjusted SEM are shown in Table 3 and Figure 1, which report the standardized regression coefficients. The coefficients are indicated as a single-headed arrow pointing from X (cause) to Y (effect) in the figure, assuming a potential causal relationship by the traditional conceptual definition of the SEM approach in this analysis (49). The model fit indices show that the model fit the data well (CFI=0.959; TLI=0.942; RMSEA=0.071). Sensitivity analysis results are reported in a supplement file (Supplement 1).

[INSERT TABLE 3 AND FIGURE 1 HERE]

The regression coefficients of the exogenous variables predicting **disease anxiety** are reported in the column 1 of Table 3. Gender differences were statistically significant, and males reported the lower level of disease anxiety than females (b= -0.126). The oldest age group age 50-59 reported the lower disease anxiety than those aged 30-39, whilst those age 40-49 reported the lower disease anxiety at borderline significance. Unmarried respondents and those with higher quality of life scores also reported lower disease anxiety. The rest of the exogenous variables, however, did show a statistically significant association with disease anxiety, including education, current schooling, household income, paid employment, and self-reported health. Comparisons of the standardized coefficients suggest that gender,

marital relationship and age differences reflect the largest effect sizes in predicting disease anxiety among the selected exogenous variables.

Further, the standardized coefficients of exogenous variables predicting **consequence anxiety** are reported in the column 2 of Table 3. Compared to the results for disease anxiety, there are a greater number of exogenous variables with statistically significant coefficients for consequence anxiety. Specifically, gender differences were significant, with males reporting the lower level of consequence anxiety than females (b= -0.079). Respondents aged 50-59 reported lower consequence anxiety compared to those aged 30-39 (b= 0.085). Relative to the highest 20% income quintiles, the rest of the income quintile groups reported higher consequence anxiety, although no clear gradient patterns were found across groups. Paid employment and marital relationship also had a positive association. In addition, the health-related Quality of Life (HRQoL) showed a negative association, indicating that the better the HRQoL, the lower the consequence anxiety. However, the remaining exogenous variables, including education, current schooling and the self-reported health status, did not show a statistically significant relationship with consequence anxiety. Among the selected exogenous variables, differences in paid employment, income, and marital relationship reflected the larger effect sizes in predicting consequence anxiety.

4. Discussion

This study examined the associations linking socioeconomic positions and health-related status with the multidimensions of anxiety related to COVID-19 infection and adverse socioeconomic consequences of the pandemic, among the Japanese working population aged 18-59. Using a SEM approach, this analysis provides evidence of the two interrelated yet distinct dimensions of pandemic anxiety, as they are related to and likely to be influenced by a series of interrelated individual-level socioeconomic and health-related factors.

Key findings from this study emphasize the concern about the disproportionate socioeconomic impact of the pandemic and consequently, the widening health inequity following the pandemic, of which the trend and transition are likely to differ by setting. First, substantial gender differences exist in terms of the two pandemic anxiety dimensions. This gender pattern is also consistent with findings from the UK, showing higher anxiety among females than males in the both anxiety dimensions (35). This pandemic anxiety pattern may reflect the general concern in Japanese society, together with several other societal concerns that demonstrate gender differences, such as females being disproportionately affected by the adverse socioeconomic consequences of the pandemic compared to males (3, 16, 56). In addition, the lower disease anxiety among males than females may have an influence on, at least in part, the relatively higher proportion of COVID-19 infection among males, although the gender pattern undergoes transitions and variations by context (11, 57-59).

Second, this study shows unexpected results that are inconsistent with existing evidence. Self-reported health status showed no significant relationship with disease anxiety or consequence anxiety, whilst the HRQoL was negatively associated with both dimensions; that is, the higher the QoL, the lower the pandemic anxiety. This association should be further investigated in future studies, given this inconsistency with the existing literature on mental health issues among less healthy groups during the pandemic (e.g., fear, anxiety, and depression) (30-32). In addition, while the UK study demonstrated negative associations between household income and the both dimensions of pandemic anxiety (35), unique evidence is also shown from this Japanese study. Specifically, although significant negative associations between consequence anxiety and economically disadvantaged groups were somewhat foreseen in Japan – as concerned globally that the lower socioeconomic groups are disproportionately affected during the pandemic (14, 15, 56, 60) – this finding suggests that those who are not in paid employment report lower consequence anxiety. Emergency

financial support programs by both central and regional governments, as well as non-profit organizations, might have possibly mitigated, at least in part, the high-level consequence anxiety among the financially-vulnerable population in Japan. The potential of the effect of these emergency financial schemes, targeting both individuals and enterprises, on quality of life, mental health, and suicide prevention was also discussed in Japanese studies, as a possible important mitigating factor (17, 20). In consideration of mid- and long-term socioeconomic consequences of the pandemic, such financial and social support schemes beyond short-term emergency schemes should be strengthened widely, as these measures are recommended and shown to be effective (61-63).

Third, this study shows unexpected patterns of generational differences in pandemic anxiety. In this Japanese model, older generations reported lower anxiety in both dimensions, disease anxiety and consequence anxiety. Higher consequence anxiety among younger generations was somewhat foreseen, in accordance with the descriptive evidence and general societal concerns that younger generations have been more severely and negatively affected in the labor market compared to older generations who are relatively more stable in employment status (16). This Japanese finding is not consistent with the UK study finding no significant age differences regarding pandemic anxiety among the working-age adult population. Significant age differences were found, however, among UK adolescents (35). Considering the prolonged adverse socioeconomic consequences in Japan to date, a subsequent longitudinal analysis should further investigate generational disparities in anxiety related to the COVID-19 pandemic.

There are some limitations to this study. First, this was a cross-sectional survey; thus, causal inference on the hypothesized pathway is tentative, according to the controversy surrounding SEM (64). Second, the study sample was drawn from selected geographic areas and was not nationally representative, while the sample was randomly drawn from the survey

panel approximating sub-national demographic patterns. Third, there may have been unobserved variables in the study that influenced mental health issues in general and the pandemic anxiety in particular, while the significant correlation of disturbances between the two pandemic anxiety dimensions suggest that their unobserved aspects are interrelated. Fourth, given the shifting of COVID-19 infection patterns and government policy, relevant pandemic anxiety indicators and questions must be reviewed as appropriate (37). Fifth, future investigations should consider further in-depth analyses including mediation and multigroup analyses (Supplement 2). Finally, it should be noted that the timing of relevant studies and analytic model structures differ across countries (e.g., Austria, Japan, and the UK). Owing to the differential pattern of COVID-19 infection and transition globally, and the methodological features and differences across the settings (e.g., differences in data collection strategies and measures), the comparative inference of pandemic anxiety across contexts requires careful attention.

Despite these limitations, this study examined health inequity related to mental health issues and pandemic anxiety, in consideration of the multidimensionality of anxiety during the COVID-19 pandemic. This evidence from a latent variable SEM underscores the two distinct and interrelated anxiety dimensions, suggesting a unique pattern and predictors of each dimension, as well as substantial concerns about mental health issues related to the socioeconomic consequences of the pandemic. This distinction between the two anxiety dimensions highlights the more substantial disparities with mental health issues, which are likely to be due to the socioeconomic consequences of the pandemic as a key driver of widening health and social gaps in Japan. Compared to European studies, this unique finding from Japan suggests critical and possibly high potential mitigating measures to buffer the serious socioeconomic impact among the most vulnerable populations. Relevant social and economic support policies and programs need to be warranted for vulnerable populations,

beyond the short-term emergency funding scheme in the process of transition and recovery from the COVID-19 pandemic. Due to the persistent disproportionate socioeconomic impact of the pandemic on vulnerable populations globally, multidisciplinary research on mental health issues and quality of life remains an important research agenda in exploring socioeconomic measures in context, towards addressing inequity concerns.

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Table 1: Descriptive statistics of the study population in Japan (n=2,764)

Variables	Frequency	Mean (standard deviation) or Proportion/Percentage
Pandemic Anxiety Scale (PAS) with Likert scale (0=strongly disagree; 4=strongly agree)		
I'm worried that I will catch COVID-19[c]	2764	2.55 (1.10)
I'm worried that family and friends will catch COVID-19[c]	2764	2.74 (1.05)
I'm afraid to leave the house right now[c]	2764	1.81 (1.11)
I'm worried I might transmit the infection to someone else[c]	2764	2.30 (1.13)
I'm worried about missing school/work[c]	2764	1.97 (1.22)
I'm worried about the amount of money we have coming in[c]	2764	2.44 (1.17)
I'm worried about the long-term impact this will have on my job prospects and the economy[c]	2764	2.60 (1.10)
Socioeconomic position/demographics		
Age [c]	2764	38.80 (12.25)
Age 18-19	236	8.54%
Age 20-29	521	18.85%
Age 30-39	590	21.35%
Age 40-49	774	28.00%
Age 50-59	643	23.26%
Gender		
Male	1371	49.60%
Female	1372	49.64%
Other/do not answer	21	0.76%
Education		
Lower education (high school or lower)	970	35.09%
Higher education (technical college, 2-year college or higher)	1794	64.91%
Current schooling		
Currently in schooling	329	11.90%
Not in schooling	2435	88.10%
Paid employment (in the last 28 days)		
In paid employment	1914	69.25%
Not in paid employment	850	30.75%
Household income quintile		
Lowest 20% income	541	19.57%
Lower 20-40% income	372	13.46%
Middle 40-60% income	577	20.88%
Higher 60-80% income	661	23.91%
Highest 20% income	613	22.18%
Marital status/partner		
Currently married or have a partner	1279	46.27%
Not married or do not have a partner	1485	53.73%
Health-related status		
Self-reported health status [c] (100=best health; 0=worst health)	2764	74.29 (21.64)
Health-related quality of life (HRQoL) [c] (1=perfect health; 0=death)	2764	0.897 (0.167)

Note: [c]=continuous variables. Among those who are not in paid employment (850 observations), current students are 161 observations; females are 574 observations.

Table 2: Factor loadings and model fit statistics of the Pandemic Anxiety Scale among the study population in Japan (n=2,764)

		[Factor 1] Disease anxiety Factor loading	[Factor 2] Consequence anxiety Factor loading
Q1	I'm worried that I will catch COVID-19	0.901	N.A.
Q2	I'm worried that family and friends will catch COVID-19	0.909	N.A.
Q3	I'm afraid to leave the house right now	0.693	N.A.
Q4	I'm worried I might transmit the infection to someone else	0.788	N.A.
Q5	I'm worried about missing school/work	N.A.	0.879
Q6	I'm worried about the amount of money we have coming in	N.A.	0.997
Q7	I'm worried about the long-term impact this will have on my job prospects and the economy	N.A.	0.950
Model fit statistics			
	CFI	0.957	
	TLI	0.931	
	RMSEA (90% Confidence Interval)	0.182 (0.173 - 0.191)	

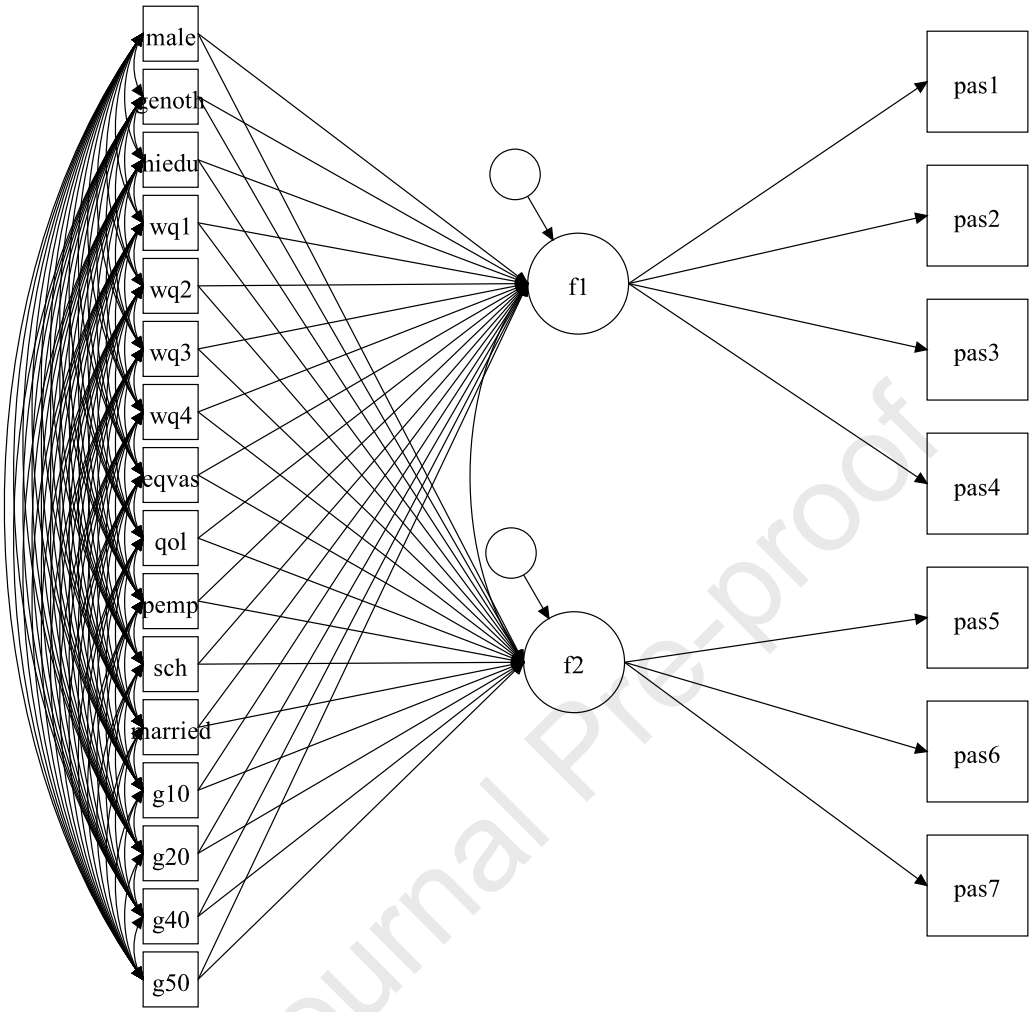
Note: Factor loadings and model fist statistics are reported from a two-factor Confirmatory Factor Analysis (CFA), with the loading of the first indicator being set free and the variance of latent factor set one.

Table 3. Standardized path coefficients of the latent variable SEM on Pandemic Anxiety Scale (Japanese n=2,764)

	Endogenous variables (Y: dependent variables in the equation): [Column 1] Disease anxiety		[Column 2] Consequence anxiety	
Exogenous variables (X: independent variables in the equation):	coefficient	p-value	coefficient	p-value
Male	-0.126	0.000	-0.079	0.000
Other gender	0.019	0.261	-0.005	0.771
Age 18-19	0.033	0.211	0.012	0.671
Age 20-29	0.029	0.247	0.012	0.653
Age 40-49	-0.048	0.063	-0.018	0.498
Age 50-59	-0.091	0.000	-0.085	0.002
Higher education	0.007	0.729	-0.012	0.596
Household income: the lowest 20%	-0.010	0.693	0.070	0.010
Household income: the lower 20-40%	-0.033	0.171	0.067	0.009
Household income: the middle 40-60%	0.007	0.784	0.101	0.000
Household income: the higher 60-80%	0.019	0.448	0.102	0.000
Paid employment	0.003	0.908	0.204	0.000
Current schooling	0.032	0.190	0.042	0.111
Marital relationship	0.100	0.000	0.102	0.000
Self-reported health (EQ-VAS)	0.022	0.326	-0.012	0.622
Health-related quality of life (HRQoL)	-0.073	0.002	-0.064	0.011
Model fit statistics				
CFI	0.959			
TLI	0.942			
RMSEA (90% Confidence Interval)	0.071	(0.067-0.074)		

Reference groups: gender=female; age=age 30-39; education=high-school or lower; household income=the highest 20% income quintile; employment=not in paid employment; schooling=not currently schooling; marital relationship=not married or do not have a partner.

Figure 1: Diagram of the latent variable SEM on Pandemic Anxiety Scale (Japanese n=2,764)



Note:
1) Variable labels in the SEM represent the following: male=male; genoth=other gender; hiedu=higher education; iq1=income quintile the lowest 20%; iq2=income quintile the second lowest 20-40%; iq3=income quintile the middle 40-60%; iq4=income quintile the higher 60-80%; eqvas=EQ-VAS; qol=HRQoL; pemp=paid employment; sch=schooling; married=married; g10=age 18-19; g20=age 20-29; g40=age 40-49; g50=age 50-59; F1=factor 1 on disease anxiety; F2=factor 2 on consequence anxiety; pas1-7=indicators per each PAS question.
2) Arrows (from left to right) indicate the relationship between the concerned variables in the tested SEM. An arrow between the two factors indicates factor correlations. All exogenous variables are covarying each other.

Supplement 1. Sensitivity Analysis: Standardized path coefficients of the latent variable SEM on Pandemic Anxiety Scale (Japanese sub-samples who are not currently schooling n=2,435)

	Endogenous variables (Y: dependent variables in the equation): [Column 1] Disease anxiety		[Column 2] Consequence anxiety	
Exogenous variables (X: independent variables in the equation):	coefficient	p-value	coefficient	p-value
Male	-0.135	0.000	-0.081	0.000
Other gender	0.018	0.324	0.004	0.812
Age 18-19	0.020	0.343	0.013	0.557
Age 20-29	0.025	0.299	0.005	0.852
Age 40-49	-0.045	0.091	-0.012	0.664
Age 50-59	-0.092	0.001	-0.083	0.003
Higher education	-0.006	0.797	-0.013	0.565
Household income: the lowest 20%	-0.021	0.445	0.083	0.004
Household income: the lower 20-40%	-0.047	0.068	0.077	0.005
Household income: the middle 40-60%	0.007	0.800	0.113	0.000
Household income: the higher 60-80%	0.020	0.450	0.125	0.000
Paid employment	0.006	0.811	0.227	0.000
Marital relationship	0.096	0.000	0.105	0.000
Self-reported health (EQ-VAS)	-0.006	0.791	-0.039	0.124
Health-related quality of life (HRQoL)	-0.067	0.006	-0.067	0.012
Model fit statistics				
CFI	0.958			
TLI	0.940			
RMSEA (90% Confidence Interval)	0.076	(0.072-0.080)		

Reference groups: gender=female; age=age 30-39; education=high-school or lower; household income=the highest 20% income quintile; employment=not in paid employment; schooling=not currently schooling; marital relationship=not married or do not have a partner.

Supplement 2: Moderation effect results from the latent variable SEM on Pandemic Anxiety Scale (Japanese n=2,764)

	Endogenous variables (Y: dependent variables in the equation):			
	[Column 1] Disease anxiety		[Column 2] Consequence anxiety	
Interaction terms (X: independent variables in the equation):	coefficient	p-value	coefficient	p-value
gender*education	0.018	0.650	0.064	0.331
employment*marital status	0.026	0.544	0.065	0.134
gender*employment	0.025	0.579	-0.029	0.539

Note: Standardized coefficients are reported. Each interaction term was included and tested respectively in the base model (Table 3 and Figure 1).

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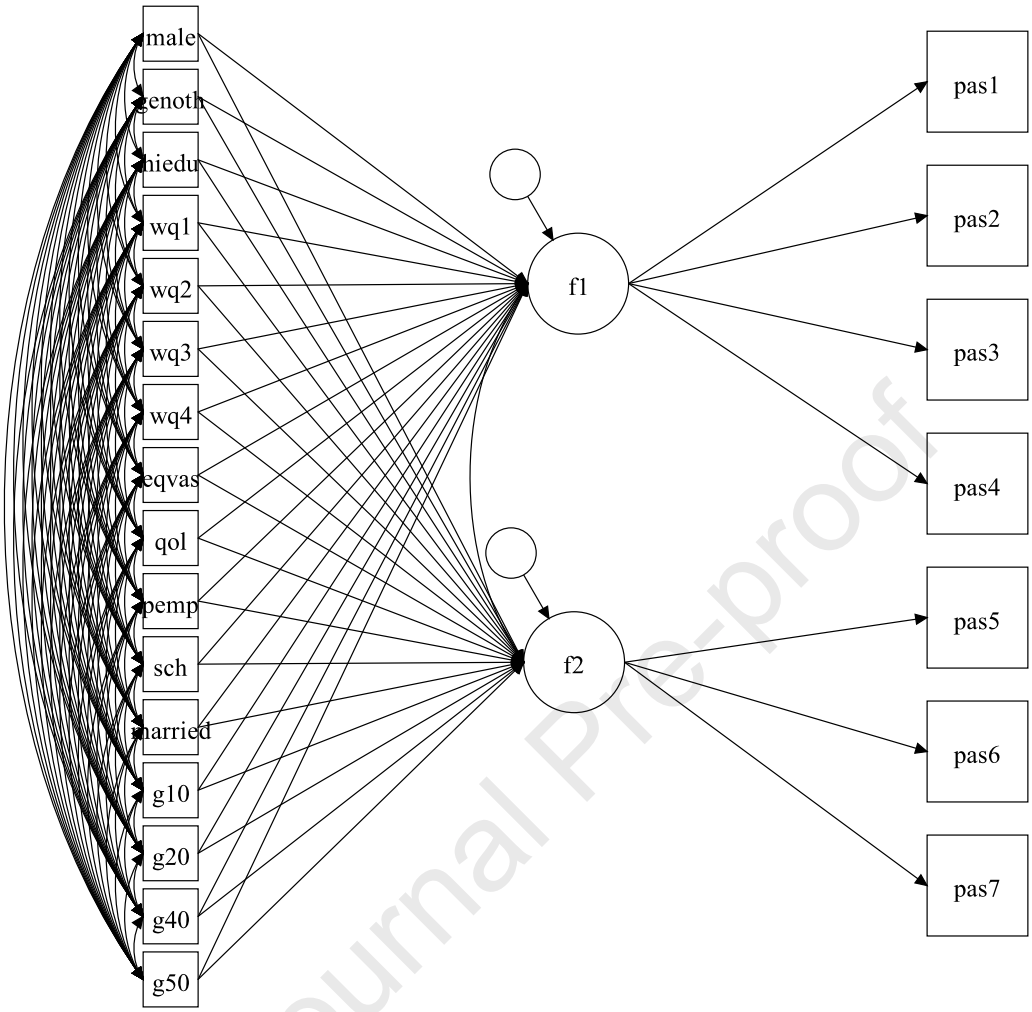

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Title: Health inequity in pandemic anxiety about COVID-19 infection and socioeconomic consequences in Japan: A structural equation modeling approach

Highlights:

- Health inequity in pandemic anxiety is assessed by SES (socioeconomic status).
- A latent variable SEM shows the multidimensionality of pandemic anxiety.
- We find unique evidence from Japan compared to European studies.
- Lower consequence anxiety under no paid work may be related to buffering measures.
- Unexpected associations between anxiety and general health to be further examined.

Ethical statement:

For the manuscript titled as “Social disparities in mental health related to anxiety about COVID-19 infection and socioeconomic consequences in Japan: A structural equation modeling approach” by Kyoko Shimamoto, Eoin McElroy and Yoko Ibuka.

The authors declare that this manuscript is the authors' own original work, which has not been previously published elsewhere. The paper is not currently being considered for publication elsewhere. The paper reflects the authors' own research and analysis in a truthful and complete manner.

Author statement:

KS - Conceptualization; Methodology; Data curation; Formal analysis; Project administration; Writing - original draft, review & editing.

EM – Conceptualization; Methodology; Writing- review & editing.

YI – Conceptualization; Writing- review & editing.