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Factors associated with serious psychological distress during the COVID-19 pandemic in Japan: a nationwide cross-sectional internet-based study

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ABSTRACT

Objective To investigate the factors associated with serious psychological distress (SPD) during the COVID-19 pandemic in Japan.

Design Nationwide cross-sectional study using survey data.

Setting Internet survey using sampling weights for national estimates conducted between 25 August and 30 September 2020 in Japan.

Exposures Demographics (age, gender), socioeconomic status (income level, employment type, educational attainment, marital status, family composition and caregiving burden); the experience of domestic violence (DV), the state of emergency and fear of and stigma related to COVID-19.

Main outcome measures Prevalence of SPD, defined as Kessler 6 Scale score ≥13.

Results Among 25 482 respondents, 10.0% met the criteria of SPD. Overall, women (adjusted OR (aOR) 1.59; 95% CI 1.17 to 2.16; p=0.003), ages 15–29 (aOR 2.35 compared with ages 45–59 years; 95% CI 1.64 to 3.38; p<0.001), low-income level (aOR 1.70 compared with intermediate income; 95% CI 1.16 to 2.49; p=0.007), providing caregiving to family members (aOR 5.48; 95% CI 3.51 to 8.56; p<0.001), experiencing DV (aOR 5.72; 95% CI 3.81 to 8.59; p<0.001) and fear of COVID-19 (aOR 1.96; 95% CI 1.55 to 2.48; p<0.001) were associated with SPD. Among women aged 15–29 years, who have a higher risk of suicide during the COVID-19 pandemic in Japan, caregiving, DV, fear of COVID-19 and COVID-19-related stigma were associated with SPD.

Conclusions Economic situation, caregiving burden, DV and fear of COVID-19 were independently associated with SPD during the COVID-19 pandemic. Among young women, similar factors, except economic situation, were associated with SPD. Targeted interventions based on age and gender may be more effective in mitigating the negative impact of the COVID-19 pandemic on the population's mental health.

INTRODUCTION

The COVID-19 has infected more than 116 million people, contributed to over 2.5 million

Strengths and limitations of this study

► This study identified the important factors associated with the prevalence of serious psychological distress (SPD) in Japan during the COVID-19 pandemic using the population-level data collected using a large, internet-based survey.

► This is the first study that investigated the important factors associated with SPD in young women who were experiencing an increased suicide rate in Japan during the COVID-19 pandemic.

► Given the cross-sectional design of our study, we could not investigate the temporal relationships between the factors we studied and the prevalence of SPD.

► Given that this study was conducted between August and September 2020, it is possible that our results would have been different if more recent data had been used.

► The survey was conducted using the internet, and thus our findings may not be generalisable to individuals who do not use the internet.

deaths globally[1] and has impacted many aspects of our lives. The COVID-19 pandemic has put a significant burden on our healthcare systems, and many countries have been struggling with an economic downturn due to reduced economic activities or lockdowns, leading to widened social inequalities.[2] Reduced social interactions due to social distancing and isolation, as well as economic downturns due to the pandemic, have the potential to negatively impact mental health conditions leading to psychological distress and increased risk for psychiatric disorders.[3 4] Some countries have been experiencing an increased suicide rate during the COVID-19 pandemic. For example, in Japan, the number of people who died of suicide increased from 20 169 in 2019 to 20 919 in 2020.[5] It is important to note that the

suicide rate has increased dramatically among young women during the COVID-19 pandemic,[6] and some have speculated that the economic downturn combined with a relatively unstable employment status often experienced among this population may be underlying reasons for increased suicides among this population. Although there are people who commit suicide without experiencing psychological distress, it is clearly one of the major risk factors for suicide.[7] Therefore, identifying risk factors associated with psychological distress is critically important for policymakers to design interventions that can effectively mitigate deteriorating mental health conditions.

An increasing number of studies have demonstrated that the psychological distress is increasing during the COVID-19 pandemic,[8] and that the underlying reasons are different before and during the pandemic.[9 10] Research has found that those who are vulnerable to financial stressors (eg, low-income levels or unemployed) are more likely to experience psychological distress during the COVID-19 pandemic.[11–13] Notably, women and the young are more likely to experience psychological distress,[13] although the risk of severe disease and death due to COVID-19 is higher in men and older adults.[14 15] The difference across age groups may account that the young people are sensitive to the change in lifestyle, concerns for their jobs or reduced social interactions.[9] The gender difference may be attributable to the difference in the prevalence of psychological distress. For example, depression and anxiety are generally more prevalent among women than men.[16] A small number of recent studies have shown sex differences in determinants of psychological distress during the COVID-19 pandemic[17 18]; however, existing studies are limited as they did not include important factors, such as domestic violence (DV), presence of caregivers and income. More importantly, to our knowledge, no study to date has examined the determinants of psychological distress among young women, who are of special interest due to an increased suicide rate in this population in Japan, a phenomenon we have not observed in previous economic depressions.

In this context, using data from a large-scale internet survey conducted during the COVID-19 pandemic (between 25 August and 30 September 2020) in Japan, we sought to answer three key questions: What are the factors associated with a higher prevalence of serious psychological distress (SPD) during the COVID-19 pandemic? Are the risk factors of SPD during the COVID-19 pandemic different between men and women? What are the risk factors of SPD among young women who are exhibiting a dramatic increase in suicides during the COVID-19 pandemic in Japan?

METHODS

Data

We analysed data from the *Japan 'COVID-19 and Society' Internet Survey* (*JACSIS*). The JACSIS is a large-scale, internet-based, self-reported questionnaire survey via a survey panel provided by a major internet survey agency in Japan (Rakuten Insight, Tokyo, Japan).[19] The total number of individuals included in the survey panel was approximately 2.2 million and comprises individuals from diverse socioeconomic backgrounds—such as educational level, household income and number of household members, and marital status—to be nationally representative.[20] This study reached out to 224 389 participants using a stratified sampling approach by gender, age and each prefecture from the panel. The study enrolment continued until it achieved the target number of respondents whose age, gender and prefectures had been a priori set (based on the distribution of the general Japanese population in 2019; and 28 000 respondents). The survey was conducted between 25 August and 30 September 2020. The overall response rate accounted for 12.5% (28 000/224 389). We excluded participants whose responses raised concerns about whether participants were answering consciously (some participants may be answering without reading the questions in order to complete fast) (online supplemental method A1).

Exposure variables

Our exposure variables of interest were respondents' demographics and socioeconomic status (SES),[21] the experience of DV,[22] the state of emergency (SOE) in response to COVID-19 (online supplemental method A2),[23] fear of COVID-19[24] and stigma related to COVID-19.[25] The demographics included age groups (15–29, 30–44, 45–59, 60–79 years), gender,[21] marital status (unmarried, married and widowed/separated), having children and caregiving to an elderly/disabled family member.[26] The SES included educational attainment (high school educated or lower, and college educated or higher),[27] income level that was calculated as dividing the household income by the square root of household size (categorised by the tertiles of household equivalent income (low, <JPY2.5 million/US$25 000/£16 667; intermediate, JPY2.5–JPY4.3 million/US$25 000–US$43 000/£16 667–£28 667; high, <JPY4.3 million/<US$43 000/<£28 667; unknown/declined to answer))[28] and employment type (employer, self-employed, regular employee, non-regular employee and unemployed).[29] The experiences of DV (including any of physical, sexual and financial violence) and COVID-19-related stigma were defined using the specific survey questions (online supplemental method A3). Fear of COVID-19 was categorised by the median of the Fear of COVID-19 Scale,[30] which is validated in Japanese.[31]

Adjustment variables

Adjustment variables were health-related status as follows: smoking status (never, ever and current smokers), alcohol use (never, ever and current users) and comorbidities. The comorbidities included those at risk of severe COVID-19, which may influence mental health during the COVID-19 pandemic (hypertension, diabetes, asthma/chronic obstructive pulmonary disease (COPD), cardiovascular disease, stroke, cancer and psychiatric disorders).[32 33]

Outcome variable

The outcome variable is SPD, defined as Kessler 6 Scale (K-6) score ≥13.[34 35] K-6 was validated in Japanese.[36] SPD is a relevant outcome for policy because it is strongly associated with mental health services.[37]

Statistical analysis

First, for each gender, we described the exposure variables (demographics, SES, experience of DV, SOE in relation to COVID-19, fear of and stigma related to COVID-19) and the adjustment variables (smoking status, alcohol use and comorbidities) with number and proportion (%) of each category.

Second, we conducted multivariable logistic regression analyses to determine the potential risk factors of SPD among exposure variables. To characterise the risk factors for each gender—and especially young women—in addition to the general public, we also conducted multivariable logistic regression analysis stratified by the gender of the participants. Finally, we conducted an analysis to examine the factors regarding occupational industry (food essential workers/healthcare workers/other workers) that the COVID-19 pandemic had a possible influence on psychological distress.[38 39] Finally, given that prior reports have shown that women aged 15–29 years are experiencing a dramatic increase in the suicide rate in Japan during the COVID-19 pandemic,[6] we repeated the analysis focused on this population. Regarding this analysis, some comorbidities (hypertension, diabetes, COPD, cardiovascular disease, stroke, cancer) were uncommon among young women, and therefore were not included as adjustment variables.

To account for the differences between the sociodemographic status in actual respondents from the survey panel and the Japanese general public, we used inverse sampling probability weighting for all analyses.[40 41] The sampling weights using propensity scores were calculated by fitting a logistic regression model using sociodemographic and health-related characteristics to adjust for the difference in respondents between the current internet survey and the 2016 Comprehensive Survey of Living Conditions, which is a nationally representative survey in Japan.[40]

Statistical significance was set at $p < 0.05$. The data were analysed using STATA V.16.1 (StataCorp, College Station, Texas, USA). This study conducted all procedures according to the ethical standards of the Helsinki Declaration. The internet survey agency fully respected the Act on the Protection of Personal Information in Japan. This study provided all respondents with web-based informed consent. The questionnaires used in this study were shown in online supplemental method A4.

Patient and public involvement

This study involved neither patients nor the public in the development of the research question and outcome measures. We did not invite patients to comment on the study design, interpretation of the results, or the readability or accuracy of this document.

RESULTS

Characteristics of respondents

After excluding 2518 respondents who met the exclusion criteria, a total of 25 482 respondents (91.0% of the overall survey respondents) were included in our study. Of the overall weighted respondents, 50.3% were women; 27.2% were aged 45–59; 51.2% were college educated or higher; 28.8% were of low-income level; 63.2% were currently married; and 30.9% were regular employees (table 1). When stratified by gender, women were younger; had higher educational levels and lower income levels; and were more likely to be unmarried and unemployed compared with men. The characteristics of overall unweighted respondents and those aged 15–29 years were shown in online supplemental tables A1 and A2, respectively.

Factors associated with SPD in overall respondents

Of the overall weighted respondents, SPD was prevalent in 10.0% of the individuals (which amounts to 2556 cases among 25 482 weighted total). After adjusting for smoking status, alcohol use and comorbidities, women (adjusted OR (aOR) 1.59; 95% CI 1.17 to 2.16; p=0.003); ages 15–29 (aOR 2.35 compared with ages 45–59 years; 95% CI 1.64 to 3.38; p<0.001) and 30–44 (aOR 1.67; 95% CI 1.35 to 2.08; p<0.001); low-income (aOR 1.70 compared with intermediate income; 95% CI 1.16 to 2.49; p=0.007) and high-income level (aOR 1.74; 95% CI 1.25 to 2.42; p<0.001); self-employed (aOR 2.11 compared with regular employee; 95% CI 1.21 to 3.68; p=0.008); caregiving to an elderly/disabled family member (aOR 5.48; 95% CI 3.51 to 8.56; p<0.001); experiencing DV (aOR 5.72; 95% CI 3.81 to 8.59; p<0.001); and fear of COVID-19 (aOR 1.96; 95% CI 1.55 to 2.48; p<0.001) were independently associated with higher odds of experiencing SPD (table 2).

Stratified analysis by gender

We found that different factors were associated with SPD between men and women. Both high-income and low-income levels were associated with higher rates of SPD among men, whereas only low income was associated with a higher likelihood of SPD among women. Unmarried or widowed/separated men experienced a higher SPD than married men, whereas the prevalence of SPD did not differ by marital status among women. The impact of caregiving was more salient among men than women, and the effect of DV and fear of COVID-19 was stronger among women (table 3).

Analysis focusing on women aged 15–29 years

Of 2295 weighted women aged 15–29 years, SPD was prevalent in 15.0% individuals (which amounts to 344 cases among 2295 weighted total). After adjustment for potential confounders, caregiving to an elderly/disabled family

Table 1 Baseline characteristics of weighted respondents

Characteristics		Overall Weighted n=25 482		Men Weighted n=12 672		Women Weighted n=12 810	
Age (years)	15–29	4426	(17.4)	2130	(16.8)	2296	(17.9)
	30–44	5996	(23.5)	2999	(23.7)	2994	(23.4)
	45–59	6921	(27.2)	3501	(27.6)	3420	(26.7)
	60–79	8139	(31.9)	4041	(31.9)	4100	(32.0)
Educational attainment	High school educated or lower	12 435	(48.8)	6493	(51.2)	5942	(46.4)
	College educated or higher	13 047	(51.2)	6179	(48.8)	6867	(53.6)
Income level	Low	7336	(28.8)	3654	(28.8)	3682	(28.7)
	Intermediate	6816	(26.8)	3613	(28.5)	3206	(25.0)
	High	5733	(22.5)	3458	(27.3)	2276	(17.8)
	Unknown/declined to answer	5596	(22.0)	1949	(15.4)	3646	(28.5)
Marital status	Married	16 100	(63.2)	8083	(63.8)	8017	(62.6)
	Unmarried	6047	(23.7)	2742	(21.6)	3305	(25.8)
	Widowed/separated	3336	(13.1)	1847	(14.6)	1488	(11.6)
Employment	Employer	1007	(4.0)	854	(6.7)	153	(1.2)
	Self-employed	2008	(7.9)	1427	(11.3)	581	(4.5)
	Regular employee	7876	(30.9)	5451	(43.0)	2423	(18.9)
	Non-regular employee	4870	(19.1)	1458	(11.5)	3412	(26.6)
	Unemployed	9721	(38.2)	3483	(27.5)	6238	(48.7)
Having children		9602	(37.7)	5010	(39.5)	4592	(35.8)
Caregiving to an elderly/disabled family member		2500	(9.8)	1452	(11.5)	1047	(8.2)
Experiencing DV		2831	(11.1)	1669	(13.2)	1162	(9.1)
SOE in response to COVID-19		11 041	(43.3)	5387	(42.5)	5654	(44.1)
Fear of COVID-19		11 569	(45.4)	5784	(45.6)	5784	(45.2)
Experiencing COVID-19-related stigma		864	(3.4)	471	(3.7)	392	(3.1)
Smoking status	Never	13 472	(52.9)	4477	(35.3)	8998	(70.2)
	Ever	8480	(33.3)	5614	(44.3)	2867	(22.4)
	Current	3527	(13.8)	2581	(20.4)	945	(7.4)
Alcohol use	Never	5639	(22.1)	2212	(17.5)	3425	(26.7)
	Ever	8315	(32.6)	3838	(30.3)	4477	(35.0)
	Current	11 531	(45.3)	6623	(52.3)	4908	(38.3)
Comorbidities	Hypertension	5053	(19.8)	3287	(25.9)	1766	(13.8)
	Diabetes	1888	(7.4)	1473	(11.6)	415	(3.2)
	Asthma/COPD	1702	(6.7)	1058	(8.3)	645	(5.0)
	Cardiovascular disease	1040	(4.1)	882	(7.0)	158	(1.2)
	Stroke	459	(1.8)	400	(3.2)	59	(0.5)
	Cancer	892	(3.5)	757	(6.0)	135	(1.1)
	Psychiatric disorders	1970	(7.7)	1165	(9.2)	808	(6.3)

All proportions are expressed as weighted numbers and weighted percentages (%). The sum of respondents did not necessarily equal the number of categories because of sample weighting and rounding. The weights, which were scaled such that the total came to 25 482 (original number of respondents), were predicted from the logistic model including area (residence), marital status, education, home ownership (household), self-rated health and smoking status which were adjusted for in individuals aged 20–79 years; and area, education, home ownership (household) and self-rated health were adjusted for (omitting marital and smoking status) in individuals aged 15–19 years.

COPD, chronic obstructive pulmonary disease; DV, domestic violence; SOE, state of emergency.

Table 2 Factors associated with serious psychological distress among the general population

Characteristics		aOR	(95% CI)	P value
Women		1.59	(1.17 to 2.16)	0.003
Age (years)	15–29	2.35	(1.64 to 3.38)	<0.001
	30–44	1.67	(1.35 to 2.08)	<0.001
	45–59	Ref		
	60–79	0.50	(0.3 to 0.81)	0.005
Educational attainment	College educated or higher	1.11	(0.86 to 1.43)	0.44
Income level	Low	1.70	(1.16 to 2.49)	0.007
	Intermediate	Ref		
	High	1.74	(1.25 to 2.42)	0.001
	Unknown/declined to answer	1.19	(0.86 to 1.66)	0.29
Marital status	Married	Ref		
	Unmarried	1.26	(0.88 to 1.81)	0.20
	Widowed/separated	1.45	(0.88 to 2.37)	0.14
Employment	Employer	1.11	(0.35 to 3.49)	0.86
	Self-employed	2.11	(1.21 to 3.68)	0.008
	Regular employee	Ref		
	Non-regular employee	0.92	(0.68 to 1.25)	0.59
	Unemployed	0.75	(0.51 to 1.1)	0.14
Having children		0.97	(0.7 to 1.35)	0.86
Caregiving to an elderly/disabled family member		5.48	(3.51 to 8.56)	<0.001
Experiencing DV		5.72	(3.81 to 8.59)	<0.001
SOE in response to COVID-19		1.23	(0.98 to 1.56)	0.08
Fear of COVID-19		1.96	(1.55 to 2.48)	<0.001
Experiencing COVID-19-related stigma		1.22	(0.69 to 2.13)	0.50

Adjusted for smoking status, alcohol use and comorbidities (hypertension, diabetes, chronic obstructive pulmonary disease or asthma, cardiovascular disease, stroke, cancer and psychiatric disorder). All CIs and p values were based on the robust variance estimator to account for the inverse probability weighting.

aOR, adjusted OR; DV, domestic violence; SOE, state of emergency.;

member (aOR 4.05; 95% CI 1.69 to 9.75; p=0.002), experiencing DV (aOR 3.44; 95% CI 1.94 to 6.11; p<0.001), fear of COVID-19 (aOR 1.94; 95% CI 1.30 to 2.89; p=0.001) and experiencing COVID-19-related stigma (aOR 2.42; 95% CI 1.31 to 4.50; p=0.005) had a significantly higher OR of SPD (table 4). We found that economic status (eg, income level, employment type) and social isolation (eg, unmarried) were not associated with a higher prevalence of SPD among this population.

Analysis focusing on workers

Of 15 454 weighted respondents who worked at that time, similar to the general public, ages 15–29 and 30–44 years, low-income and high-income levels, widowed/separated, caregiving and experience of DV were significantly associated with SPD (online supplemental table A3). Regarding occupational factors, food industry workers had a significantly higher OR for SPD after adjustment (aOR 1.55; 95% CI 1.04 to 2.32; p=0.03).

DISCUSSION

Using data from a nationally representative survey conducted during the COVID-19 pandemic, we identified several important factors that were associated with a higher rate of SPD in Japan. We found that women, younger age, income level, employment type, caregiving status, DV experience and fear of COVID-19 were independently associated with SPD. We found different patterns among men and women. For example, although both high-income and low-income levels were associated with higher rates of SPD among men, only low income was associated with a higher likelihood of SPD among women. Unmarried or widowed/separated men experienced a higher SPD rate than married men, whereas the prevalence of SPD did not differ by marital status among women. Among young women—who are exhibiting an increased suicide rate during the COVID-19 pandemic in Japan—experiencing DV, fear of COVID-19 and COVID-19-related stigma were risk factors of SPD. On the other hand, economic situation and social isolation—factors

Table 3 Factors associated with serious psychological distress, stratified by gender

Characteristics		Men			Women		
		aOR	(95% CI)	P value	aOR	(95% CI)	P value
Age (years)	15–29	2.26	(1.37 to 3.72)	0.001	2.06	(1.44 to 2.95)	<0.001
	30–44	1.81	(1.33 to 2.46)	<0.001	1.55	(1.16 to 2.06)	0.003
	45–59	Ref			Ref		
	60–79	0.38	(0.20 to 0.71)	0.003	0.49	(0.30 to 0.80)	0.004
Educational attainment	College educated or higher	1.12	(0.82 to 1.52)	0.48	1.02	(0.79 to 1.33)	0.86
Income level	Low	1.84	(1.13 to 2.97)	0.01	1.54	(1.06 to 2.23)	0.02
	Intermediate	Ref			Ref		
	High	2.12	(1.44 to 3.11)	<0.001	0.94	(0.64 to 1.37)	0.74
	Unknown/declined to answer	1.29	(0.78 to 2.13)	0.33	0.96	(0.67 to 1.37)	0.83
Marital status	Married	Ref			Ref		
	Unmarried	2.46	(1.49 to 4.07)	<0.001	0.92	(0.60 to 1.39)	0.68
	Widowed/separated	3.57	(1.84 to 6.94)	<0.001	0.81	(0.55 to 1.21)	0.30
Employment	Employer	1.04	(0.38 to 2.84)	0.93	1.08	(0.54 to 2.14)	0.84
	Self-employed	1.71	(1.07 to 2.72)	0.03	2.35	(0.92 to 6.02)	0.07
	Regular employee	Ref			Ref		
	Non-regular employee	1.42	(0.87 to 2.32)	0.16	0.86	(0.63 to 1.17)	0.34
	Unemployed	0.47	(0.23 to 0.95)	0.04	0.96	(0.68 to 1.36)	0.83
Having children		1.80	(1.16 to 2.81)	0.009	0.58	(0.42 to 0.81)	0.001
Caregiving to an elderly/disabled family member		6.67	(3.96 to 11.23)	<0.001	3.00	(2.12 to 4.25)	<0.001
Experiencing DV		4.27	(2.64 to 6.90)	<0.001	6.34	(4.15 to 9.69)	<0.001
SOE in response to COVID-19		1.23	(1.01 to 1.78)	0.08	1.01	(0.79 to 1.29)	0.94
Fear of COVID-19		1.62	(1.24 to 2.12)	<0.001	2.29	(1.72 to 3.07)	<0.001
Experiencing COVID-19-related stigma		1.28	(0.61 to 2.67)	0.51	1.91	(1.20 to 3.05)	0.007

Adjusted for smoking status, alcohol use and comorbidities (hypertension, diabetes, chronic obstructive pulmonary disease or asthma, cardiovascular disease, stroke, cancer and psychiatric disorder). All CIs and p values were based on the robust variance estimator to account for the inverse probability weighting.

aOR, adjusted OR; DV, domestic violence; SOE, state of emergency.;

considered to be causes of an increased suicide rate among this population—were not associated with the rate of SPD. Taken together, these findings indicate that underlying reasons for SPD may vary based on subgroups of the population, and therefore targeted interventions based on age and gender may be more effective in mitigating negative impacts of the COVID-19 pandemic on the population's mental health.

There are several potential mechanisms that may explain the factors associated with SPD in Japan. First, economic downturns due to the COVID-19 pandemic may negatively impact the mental health condition of the population. For example, we found that having a low-income level and being self-employed were associated with SPD in both men and women, suggesting that these individuals were potentially vulnerable population groups affected by economic stagnation itself and social distancing due to the COVID-19 pandemic.[42 43] In addition, among men, those who have children were likely to have SPD, indicating that men may feel anxious about the responsibility of supporting family members during the economic downturn. Second, the anxiety caused by fear about future uncertainties due to the COVID-19 pandemic may influence high-income as well as low-income individuals who are full-time workers. In fact, we found significant associations between high-income level and a higher rate of SPD among men, suggesting that the objective instability in SES due to the COVID-19 pandemic alone may not explain SPD. Third, social isolation due to the SOE may cause a heavier burden of caregiving as well as DV from partners, resulting in mental illness. In our study, caregiving to an elderly/disabled family member was associated with SPD in both men and women. It is known that reported cases of DV increased while people were staying home,[44] probably leading to worse mental health conditions. Finally, as COVID-19 spread and society dramatically changed, fears about COVID-19 gradually developed making people psychologically unstable. Our findings, in which fear of COVID-19 was associated with SPD in all analyses, support this hypothesis.

Evidence is limited as to which factors affected mental health status at the population level during the COVID-19

Table 4 Factors associated with serious psychological distress among those aged 15–29 years (population with the highest risk of suicide during the COVID-19 pandemic)

Characteristics		aOR	(95% CI)	P value
Age (years)	15–19	1.12	(0.59 to 2.12)	0.74
Educational attainment	College or higher	0.83	(0.50 to 1.39)	0.48
Income level	Low	1.31	(0.71 to 2.42)	0.39
	Intermediate	Ref		
	High	1.31	(0.63 to 2.74)	0.47
	Not answered	0.78	(0.38 to 1.61)	0.51
Marital status	Married	Ref		
	Unmarried	1.31	(0.71 to 2.44)	0.39
	Widowed/separated	0.68	(0.17 to 2.75)	0.59
Employment	Employer	1.29	(0.44 to 3.77)	0.65
	Self-employed	0.62	(0.12 to 3.22)	0.57
	Regular employee	Ref		
	Non-regular employee	0.87	(0.45 to 1.67)	0.67
	Unemployed	0.81	(0.44 to 1.49)	0.49
Having children		0.77	(0.41 to 1.45)	0.42
Caregiving to an elderly/disabled family member		4.05	(1.69 to 9.75)	0.002
Experiencing DV		3.44	(1.94 to 6.11)	<0.001
SOE in response to COVID-19		1.09	(0.75 to 1.59)	0.64
Fear of COVID-19		1.94	(1.30 to 2.89)	0.001
Experiencing COVID-19-related stigma		2.42	(1.31 to 4.50)	0.005

Adjusted for smoking status, alcohol use and comorbidities (asthma and psychiatric disorder). All CIs and p values were based on the robust variance estimator to account for the inverse probability weighting.
aOR, adjusted OR; DV, domestic violence; SOE, state of emergency.;

pandemic. Wang *et al* conducted a systematic review and meta-analysis examining the factors associated with psychological distress (ie, anxiety and depression) in the general population, and found that women, younger age and lower SES were associated with both anxiety and depression.[13] A recent study that investigated factors associated with SPD during the COVID-19 pandemic in Japan[45] did not include important variables such as SES and DV. Furthermore, their survey was conducted between February and April 2020, suggesting that the study period was too early to examine the SPD because suicides of the young in Japan have been reported in October. The sample size was small; therefore, the study may be underpowered to detect meaningful associations. In terms of age-related factors, Glowacz and Schmits have examined the difference of psychological distress dividing into age groups during the COVID-19 lockdown in Belgium.[46] However, their results were based on univariate comparison via a small sample size. Regarding gender-related risk factors, Rehm and Shield reported that anxiety and depression are more prevalent in women than in men.[16] In addition to such pre-existing psychological distress, previous studies reported that women in preconception,[47] pregnancy[48] or postpartum periods[49] experienced anxiety or depressive symptoms during the COVID-19

pandemic. Yan *et al* and del Río-Casanova *et al* reported gender differences in SPD after the COVID-19 pandemic in China and Spain, respectively; however, these studies did not investigate socioeconomic factors deemed as especially important during the COVID-19 pandemic, such as DV or caregiving status.[17 18] Therefore, despite its central importance, evidence regarding important determinants of SPD during the COVID-19 pandemic is still limited. While informative, evidence regarding gender differences in the factors associated with SPD is limited. To our knowledge, this is the first study that has examined the risk factors of SPD comprehensively in both the general public and the mentally vulnerable population (young women) using large-scale, nationally representative data.

Our study has limitations. First, because this survey was conducted between August and September 2020, it is possible that our findings would have been different if more recent data had been used. However, the data were collected just before October 2020, when suicides among young women actually increased in Japan,[50] and therefore our findings may reflect the most critical period regarding the underlying reasons for increased suicide rates in Japan. Second, due to the self-reported design of our study, not all the variables were based on the

validated questionnaire. For example, COVID-19-related stigma, which was an important risk factor for SPD among young women, was collected via a single-item questionnaire we developed, resulting in a lack of detailed stigma profiles.[51] However, our survey used the items (K-6), the reliability and validity of which have been tested and verified in prior studies.[36 52] Third, given that our data were collected using an internet-based survey, respondents may be different in meaningful ways than those who were not recruited. However, we used propensity score weighted analysis to adjust for the demographic, socioeconomic and health-related differences between respondents of the present study and the Japanese general public.[40 41] Fourth, because our study is a cross-sectional design, we could not examine the temporal relationship between exposure variables and SPD. For example, fear of COVID-19 may be bidirectional to and from SPD in the causal pathway. Finally, our findings may not be generalisable to populations in other countries.

CONCLUSION

Using large-scale, nationally representative survey data, we identified several important factors associated with SPD during the COVID-19 pandemic in Japan's general population. In particular, we found that female gender, younger age, income level, employment type, caregiving status, DV experience and fear of COVID-19 were key risk factors for a higher rate of SPD. We found different patterns between men and women regarding income level and marital status. Among young women who presented higher suicide rates during the COVID-19 pandemic in Japan, experience of DV, fear of COVID-19 and COVID-19-related stigma were risk factors associated with SPD. Our findings highlight the importance of designing countermeasures based on the age and gender of the population to more effectively mitigate negative impacts on mental health during the COVID-19 pandemic.

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REFERENCES

1 World health Organization. Who coronavirus disease (COVID-19) Dashboard. available. Available: https://covid19.who.int/ [Accessed 09 Mar 2021].
2 Blumenthal D, Fowler EJ, Abrams M, *et al*. Covid-19 - Implications for the Health Care System. *N Engl J Med* 2020;383:1483–8 http://www.ncbi.nlm.nih.gov/pubmed/32706956
3 Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. *N Engl J Med* 2020;383:510–2 http://www.ncbi.nlm.nih.gov/pubmed/32283003
4 Xiong J, Lipsitz O, Nasri F, *et al*. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J Affect Disord* 2020;277:55–64 http://www.ncbi.nlm.nih.gov/pubmed/32799105

5 Ministry of Health, Labor and Welfare. Current suicide statistics in Japan. [in Japanese]. Available: https://www.mhlw.go.jp/content/202101-sokuhou.pdf [Accessed 09 Mar 2021].

6 Tanaka T, Okamoto S. Increase in suicide following an initial decline during the COVID-19 pandemic in Japan. *Nat Hum Behav* 2021;5:229–38.

7 Nie J, O'Neil A, Liao B, *et al*. Risk factors for completed suicide in the general population: a prospective cohort study of 242, 952 people. *J Affect Disord* 2021;282:707–11 http://www.ncbi.nlm.nih.gov/pubmed/33445097

8 Nochaiwong S, Ruengorn C, Thavorn K, *et al*. Global prevalence of mental health issues among the general population during the coronavirus disease-2019 pandemic: a systematic review and meta-analysis. *Sci Rep* 2021;11:10173 http://www.ncbi.nlm.nih.gov/pubmed/33986414

9 Lieberoth A, Lin S-Y, Stöckli S, *et al*. Stress and worry in the 2020 coronavirus pandemic: relationships to trust and compliance with preventive measures across 48 countries in the COVIDiSTRESS global survey. *R Soc Open Sci* 2021;8:200589.

10 Ali NA, Feroz AS, Akber N, *et al*. When COVID-19 enters in a community setting: an exploratory qualitative study of community perspectives on COVID-19 affecting mental well-being. *BMJ Open* 2021;11:e049851.

11 Kawohl W, Nordt C. COVID-19, unemployment, and suicide. *Lancet Psychiatry* 2020;7:389–90.

12 Gunnell D, Appleby L, Arensman E, *et al*. Suicide risk and prevention during the COVID-19 pandemic. *Lancet Psychiatry* 2020;7:468–71.

13 Wang Y, Kala MP, Jafar TH. Factors associated with psychological distress during the coronavirus disease 2019 (COVID-19) pandemic on the predominantly general population: a systematic review and meta-analysis. *PLoS One* 2020;15:e0244630.

14 Chen Y, Klein SL, Garibaldi BT, *et al*. Aging in COVID-19: vulnerability, immunity and intervention. *Ageing Res Rev* 2021;65:101205.

15 Grasselli G, Greco M, Zanella A, *et al*. Risk factors associated with mortality among patients with COVID-19 in intensive care units in Lombardy, Italy. *JAMA Intern Med* 2020;180:1345–55.

16 Rehm J, Shield KD. Global burden of disease and the impact of mental and addictive disorders. *Curr Psychiatry Rep* 2019;21:10.

17 Yan S, Xu R, Stratton TD, *et al*. Sex differences and psychological stress: responses to the COVID-19 pandemic in China. *BMC Public Health* 2021;21:79.

18 del Río-Casanova L, Sánchez-Martín M, García-Dantas A, *et al*. Psychological responses according to gender during the early stage of COVID-19 in Spain. *Int J Environ Res Public Health* 2021;18:3731.

19 Rakuten insight, Inc. Available: https://insight.rakuten.co.jp/en/aboutus.html [Accessed 09 Mar 2021].

20 Tabuchi T, Gallus S, Shinozaki T, *et al*. Heat-not-burn tobacco product use in Japan: its prevalence, predictors and perceived symptoms from exposure to secondhand heat-not-burn tobacco aerosol. *Tob Control* 2018;27:e25–33.

21 Iob E, Frank P, Steptoe A, *et al*. Levels of severity of depressive symptoms among at-risk groups in the UK during the COVID-19 pandemic. *JAMA Netw Open* 2020;3:e2026064.

22 Chandan JS, Taylor J, Bradbury-Jones C, *et al*. COVID-19: a public health approach to manage domestic violence is needed. *Lancet Public Health* 2020;5:e309.

23 Yamamoto T, Uchiumi C, Suzuki N, *et al*. The Psychological Impact of 'Mild Lockdown' in Japan during the COVID-19 Pandemic: A Nationwide Survey under a Declared State of Emergency. *Int J Environ Res Public Health* 2020;17:9382.

24 Fitzpatrick KM, Harris C, Drawve G. Fear of COVID-19 and the mental health consequences in America. *Psychol Trauma* 2020;12:S17–21.

25 Do Duy C, Nong VM, Ngo Van A, *et al*. COVID-19-related stigma and its association with mental health of health-care workers after quarantine in Vietnam. *Psychiatry Clin Neurosci* 2020;74:566–8.

26 Prime H, Wade M, Browne DT. Risk and resilience in family well-being during the COVID-19 pandemic. *Am Psychol* 2020;75:631–43.

27 Sasson I, Hayward MD. Association between educational attainment and causes of death among white and black us adults, 2010-2017. *JAMA* 2019;322:756–63.

28 Mackenbach JP, Martikainen P, Looman CWN, *et al*. The shape of the relationship between income and self-assessed health: an international study. *Int J Epidemiol* 2005;34:286–93.

29 Helgadóttir B, Svedberg P, Mather L, *et al*. The association between part-time and temporary employment and sickness absence: a prospective Swedish twin study. *Eur J Public Health* 2019;29:147–53.

30 Ahorsu DK, Lin C-Y, Imani V, *et al*. The Fear of COVID-19 Scale: Development and Initial Validation. *Int J Ment Health Addict* 2020;1:1–9.

31 Masuyama A, Shinkawa H, Kubo T. Validation and psychometric properties of the Japanese version of the fear of COVID-19 scale among adolescents. *Int J Ment Health Addict* 2020;1:1–11.

32 Radzikowska U, Ding M, Tan G, *et al*. Distribution of ACE2, CD147, CD26, and other SARS-CoV-2 associated molecules in tissues and immune cells in health and in asthma, COPD, obesity, hypertension, and COVID-19 risk factors. *Allergy* 2020;75:2829–45.

33 Du R-H, Liang L-R, Yang C-Q, *et al*. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. *Eur Respir J* 2020;55:2000524.

34 Kessler RC, Barker PR, Colpe LJ, *et al*. Screening for serious mental illness in the general population. *Arch Gen Psychiatry* 2003;60:184–9.

35 Olfson M, Wang S, Wall M, *et al*. Trends in serious psychological distress and outpatient mental health care of US adults. *JAMA Psychiatry* 2019;76:152–61.

36 Furukawa TA, Kawakami N, Saitoh M, *et al*. The performance of the Japanese version of the K6 and K10 in the world mental health survey Japan. *Int J Methods Psychiatr Res* 2008;17:152–8.

37 Dismuke CE, Egede LE. Association of serious psychological distress with health services expenditures and utilization in a national sample of US adults. *Gen Hosp Psychiatry* 2011;33:311–7.

38 Rosemberg M-AS, Adams M, Polick C, *et al*. COVID-19 and mental health of food retail, food service, and hospitality workers. *J Occup Environ Hyg* 2021;18:169–79.

39 Maunder RG, Heeney ND, Kiss A, *et al*. Psychological impact of the COVID-19 pandemic on hospital workers over time: relationship to occupational role, living with children and elders, and modifiable factors. *Gen Hosp Psychiatry* 2021;71:88–94.

40 Tabuchi T, Shinozaki T, Kunugita N, *et al*. Study Profile: The Japan "Society and New Tobacco" Internet Survey (JASTIS): A Longitudinal Internet Cohort Study of Heat-Not-Burn Tobacco Products, Electronic Cigarettes, and Conventional Tobacco Products in Japan. *J Epidemiol* 2019;29:444–50.

41 Mayr A, Gefeller O, Prokosch H-U, *et al*. Web-based data collection yielded an additional response bias--but had no direct effect on outcome scales. *J Clin Epidemiol* 2012;65:970–7.

42 Wu M, Han H, Lin T, *et al*. Prevalence and risk factors of mental distress in China during the outbreak of COVID-19: a national cross-sectional survey. *Brain Behav* 2020;10:e01818.

43 Association of Taxation Technicians. COVID-19: Self-Employed income support scheme. available. Available: https://www.att.org.uk/covid-19-self-employed-income-support-scheme [Accessed 09 Mar 2021].

44 Piquero AR, Riddell JR, Bishopp SA, *et al*. Staying home, staying safe? A short-term analysis of COVID-19 on Dallas domestic violence. *Am J Crim Justice* 2020;1–35.

45 Kikuchi H, Machida M, Nakamura I, *et al*. Changes in psychological distress during the COVID-19 pandemic in Japan: a longitudinal study. *J Epidemiol* 2020;30:522–8.

46 Glowacz F, Schmits E. Psychological distress during the COVID-19 lockdown: the young adults most at risk. *Psychiatry Res* 2020;293:113486.

47 Micelli E, Cito G, Cocci A, *et al*. Desire for parenthood at the time of COVID-19 pandemic: an insight into the Italian situation. *J Psychosom Obstet Gynaecol* 2020;41:183–90.

48 Wu Y, Zhang C, Liu H, *et al*. Perinatal depressive and anxiety symptoms of pregnant women during the coronavirus disease 2019 outbreak in China. *Am J Obstet Gynecol* 2020;223:240.e1–240.e9.

49 Ostacoli L, Cosma S, Bevilacqua F, *et al*. Psychosocial factors associated with postpartum psychological distress during the Covid-19 pandemic: a cross-sectional study. *BMC Pregnancy Childbirth* 2020;20:703.

50 Sakamoto H, Ishikane M, Ghaznavi C, *et al*. Assessment of suicide in Japan during the COVID-19 pandemic vs previous years. *JAMA Netw Open* 2021;4:e2037378.

51 Duan W, Bu H, Chen Z. COVID-19-related stigma profiles and risk factors among people who are at high risk of contagion. *Soc Sci Med* 2020;266:113425.

52 Koshimizu H, Nogawa S, Asano S, *et al*. Genome-Wide association study identifies a novel locus associated with psychological distress in the Japanese population. *Transl Psychiatry* 2019;9:52.