

# Loneliness and COVID-19 preventive behaviours among Japanese adults

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## ABSTRACT

**Background** There is some evidence that loneliness may be linked to poorer health behaviours. Despite this, there has been little research to date on the relationship between loneliness and COVID-19 preventive behaviours. We studied these associations in a sample of the Japanese population.

**Methods** Data were analysed from an online survey of 2000 adults undertaken in April and May 2020. Loneliness was assessed with the Three-Item Loneliness Scale. Information was also collected on 13 COVID-19 preventive behaviours. Regression analyses were used to examine associations.

**Results** In linear regression models adjusted for demographic and mental health variables, both dichotomous and continuous loneliness measures were negatively associated with engaging in COVID-19 preventive behaviours. Logistic regression analyses further showed that loneliness was also associated with reduced odds for a variety of individual preventive behaviours including wearing a mask (odds ratio [OR]: 0.77, 95% confidence interval [CI]: 0.62–0.95), disinfecting hands (OR: 0.80, 95% CI: 0.67–0.94) and social distancing when outdoors (OR: 0.75, 95% CI: 0.61–0.92).

**Conclusions** Loneliness is associated with lower engagement in COVID-19 preventive behaviours. Interventions to prevent or ameliorate loneliness during the ongoing pandemic may be important in combating the spread of the coronavirus.

**Keywords** COVID-19, hygiene, Japan, lonely, social distancing

## Introduction

The emergence and rapid spread of the novel coronavirus disease (COVID-19) from Wuhan, China in late 2019 to countries across the world, has resulted in a growing body of research focusing on the psychological effects of the pandemic. In particular, both cross-sectional and longitudinal studies have indicated that the prevalence of common mental disorders (anxiety, depression) may be elevated in populations when compared with results obtained in the pre-pandemic period,<sup>1,2</sup> while a recent large-scale study from the United Kingdom (UK) reported that approximately 18% of respondents had thoughts of suicide/self-harm during the early phase (March–April) of the pandemic.<sup>3</sup>

There is also some evidence that measures taken to slow/prevent the transmission of COVID-19 such as social

and physical distancing and stay-at-home orders may be associated with another potentially detrimental psychological outcome, loneliness,<sup>4</sup> that is, the unpleasant experience resulting from a perceived deficiency in the quantity/quality of one's social relationships.<sup>5</sup> Studies from the UK have suggested that loneliness may be prevalent in the general population during the pandemic with between 18–27% of individuals being often lonely or having the highest loneliness scores, respectively,<sup>6,7</sup> while other research from the United States has shown that the prevalence of loneliness may be extremely high in specific subpopulations such as younger adults, with the figure ranging from 43% to 61.5%

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in individuals aged 18–35.<sup>8,9</sup> Evidence suggests that the trajectory of loneliness may have remained stable during the early phase of the pandemic but at a high level for many people,<sup>10</sup> while a number of studies have linked feeling lonely to worse mental health including depression, anxiety and posttraumatic stress disorder (PTSD).<sup>9,11</sup>

The current study will examine the association between loneliness and COVID-19 preventive behaviours among adults in Japan. As yet, there has been little focus on the relationship between loneliness and COVID-19 preventive strategies<sup>12</sup> or on the association with preventive behaviours more generally.<sup>13</sup> This may be an important omission. Recent research has linked worse psychological health (anxiety, depression) to poorer COVID-19 preventive behaviours,<sup>14</sup> while earlier studies have shown an association between loneliness and lower medical adherence.<sup>15,16</sup> Importantly, a recent study from Poland has indicated that loneliness may be negatively linked to COVID-19 preventive behaviours but that study did not examine the relation with individual preventive behaviours.<sup>12</sup> Although it is uncertain how loneliness might be associated with preventive behaviours several pathways might be involved. For example, a study that examined sub-optimal antiretroviral therapy (ART) in women with HIV reported that interconnected psychological mechanisms including stigma, loneliness and depression might be important in this regard.<sup>17</sup>

A focus on the loneliness-COVID-19 preventive behaviour association in Japan may have important public health implications. Although Japan seemingly avoided the worst of the effects of the pandemic in its early stages after implementing a range of public health measures in March through to May 2020,<sup>18</sup> the ending of a nationwide State of Emergency on 25 May was followed by an upsurge in cases – in particular, in Tokyo and other cities from early-mid July.<sup>19</sup> While the specific factors underlying this growth in infections are uncertain, it may be linked to the fact that some individuals are unwilling to use preventive measures – with a recent study indicating that as many as 1 in 5 Japanese adults aged 20–64 may be reluctant to do so.<sup>20</sup> Given this, an increased understanding of the factors linked to the use or non-use of COVID-19 preventive measures may help with future public health efforts to stem the spread of the virus in the country.

## Methods

### Study participants

Information was obtained from respondents in an online survey. Specifically, two rounds of an online survey of the Japanese adult population (aged 18 and above) were

administered between April 16 and April 18, 2020 (1<sup>st</sup> round) and May 15 and May 17 (2<sup>nd</sup> round). The Survey Research Centre, a commercial survey company, sent out a set of screening questions to approximately 10,000 respondents from its commercial web panel. It then constructed a sample of 1,000 respondents based on their demographic characteristics in each round. A new set of respondents was drawn in the second round. The final sample comprised respondents who were representative of the Japanese general population in terms of the area of their residency, sex, and age distribution. The respondents in the final sample answered online questions about their psychological health, personal economic situation, and preventive behaviour regarding COVID-19, among others. The final sample size was 2000 people.

### Ethics

This study was approved by the Ethics Committee of Waseda University (approval case number: 2020–050) and Osaka School of International Public Policy, Osaka University. The survey participants were informed of the purpose of the study prior to their participation and had the option to quit the survey at any time. The respondents provided explicit consent that the information they provided could be used for the purpose of this study. The data are completely anonymous.

### Measures

*Loneliness* was measured using the Three-Item Loneliness Scale that was adapted from the Revised UCLA Loneliness Scale.<sup>21</sup> The three items assess a lack of companionship, feeling left out, and feeling isolated from others. Each item has three possible answers, ‘Hardly Ever’ (scored 1), ‘Some of the Time’ (2), and ‘Often’ (3). The summed responses give a score that can range between 3 and 9 with higher scores indicating greater loneliness. The Three-Item Loneliness Scale has been found to have satisfactory reliability as well as concurrent and discriminant validity.<sup>21</sup> Recent research has indicated that the Japanese version of the Three-Item Loneliness Scale is similarly valid and reliable.<sup>22,23</sup> Two loneliness measures were analysed. Following the lead of previous studies,<sup>24,25</sup> a dummy variable was created where a score of  $\geq 6$  was categorised as lonely. The full scale score (3–9) was also used as a continuous variable in the analysis. The internal consistency of the scale was good ( $\alpha = 0.83$ ).

Information was collected on 13 *COVID-19 preventive behaviours* (listed in Table 3). These items, with ‘yes’ and ‘no’ answer options, covered a range of social distancing measures (e.g. avoiding crowds and staying at home as much as possible, keeping a distance of 2 metres from people when outside), as

well as basic hygiene procedures that have been recommended by the World Health Organisation (WHO) to help prevent the spread of the coronavirus (e.g. washing hands, covering your mouth and nose with your bent elbow/tissue when coughing/sneezing).<sup>26</sup>

Data on a variety of *demographic factors* were also included in the analysis. *Sex* was examined using a dummy variable for ‘male’, while *age* was categorised using three categories (1) 18–39 years (young age); (2) 40–59 years (middle age); (3) 60 years and above (old age). Educational attainment was also assessed with a dummy variable for “college-educated”. Respondents’ *employment status* was categorised into five mutually exclusive categories: (1) employed as a permanent employee; (2) employed as a short-term contractor, part-time or dispatch worker; (3) self-employed; (4) currently not working but in the labour force; and (5) not working—not economically active. Those in the fourth category were either looking for a job, had been laid off, or were taking time off from work (i.e. they were still economically active). The fifth category included homemakers, students, and retired individuals. *Household income* was divided into four categories based on annual household income in 2019: (1) less than 4 million yen (Low income); (2) equal to or greater than 4 million yen and less than 8 million yen (Middle income); (3) equal to or greater than 8 million yen (High income); (4) no information. The last category captured respondents who refused to answer or who did not know their annual household income. As this final category included a large number of respondents (N = 354, 17.7%), we created a dummy variable that included these respondents and included it in the analysis in order to maximise statistical power. On April 16, 1 JPY = 0.009255 USD. A variable was also included that assessed the respondent’s *household financial situation* by asking them how they would rate their household’s current financial situation compared to one year ago. Those who answered, “Somewhat worse” or “Severely worse” were categorised as having “Worse household finances”. This was included in the analysis as a dummy variable. Depressive symptoms were assessed with the Patient Health Questionnaire (PHQ-9).<sup>27</sup> The PHQ-9 is a self-report questionnaire with nine items that assesses past two-week depressive symptoms. Items are rated on a 4-point scale from 0 (“Not at all”) to 3 (“Nearly every day”) with higher scores representing increased levels of depression (the total score ranges between 0–27). A score of 10 or above (“moderate”, “moderately severe”, and “severe” cases) was categorised as indicating depressive symptomatology.<sup>28</sup> The Cronbach’s alpha value for the scale was 0.90. Finally, a dummy variable was also included to control for the effects of the specific survey round the data were collected in.

## Statistical analysis

We first calculated descriptive statistics for the sample stratified by the presence of loneliness. Next, linear regression analysis was used to assess the association between both loneliness measures (independent variables) and a combined COVID-19 preventive behaviours score (dependent variable). Two analyses were undertaken. In the first analysis (Model 1) the bivariate association between loneliness and the combined COVID-19 preventive behaviours score (ranging from 0–13) was assessed. In the second analysis (Model 2) the associations between the loneliness measures and the preventive behaviours were examined while controlling for other covariates. Specifically, the model was adjusted for the respondent’s sex (reference category: female), age (ref. old), educational attainment (ref. not college educated), income level (four categories, ref. high [data for the missing category is not shown in the tabulated results]), household financial situation (ref. unchanged/better household finances), employment status (five categories, ref. not working—not economically active), depressive symptoms (ref. no depressive symptoms).

In addition, binomial logistic regression analysis was used to examine the association between the loneliness measures and each individual preventive behaviour (No = 0, Yes = 1) in multivariable analyses that were adjusted for the same covariates as in the analyses examining the combined preventive behaviours score. In all the analyses the study period (ref.: April 2020) was adjusted for in all models. The results are presented as coefficients (coef.) and odds ratios (OR), with 95% confidence intervals (CI). The standard errors were heteroskedasticity-robust, and clustered by prefecture. The analysis was conducted using STATA/MP (version 16, Stata Corporation, College Station, TX). The level of statistical significance was set at  $p < 0.05$  (two-tailed).

## Results

When a score of  $\geq 6$  was used to categorise loneliness, over 40% (41.4%) of the respondents were lonely (Table 1). Individuals, who were younger, had a lower income, whose household finances were worse compared to in the previous year, were unemployed, laid off or on leave and who had depressive symptoms were lonelier.

In bivariate linear regression analyses both the dichotomous (coef: -0.85, 95%CI: -1.15, -0.54) and continuous loneliness variables (coef: -0.23, 95%CI: -0.33, -0.13) were negatively associated with engaging in COVID-19 preventive behaviours (Table 2). Adjusting for demographic and mental health covariates attenuated these associations, although both

**Table 1** Sample characteristics by the prevalence of loneliness

	<i>Loneliness (N)</i>		<i>Loneliness (%)</i>	
	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>
Total sample	1171	829	58.6	41.4
<b>Variable</b>				
<b>Age</b>				
Young (18–39 years)	321	283	53.1	46.9
Middle (40–59 years)	377	345	52.2	47.8
Old ( $\geq$ 60 years)	473	201	70.2	29.8
<b>Sex</b>				
Female	603	405	59.8	40.2
Male	568	424	57.3	42.7
<b>Education</b>				
No college degree	649	458	58.6	41.4
College degree	522	371	58.5	41.5
<b>Household income</b>				
<4 million yen	356	294	54.8	45.2
4 $\geq$ and < 8 million yen	411	261	61.2	38.8
8 million or higher	205	119	63.3	36.7
No information	199	155	56.2	43.8
<b>Household finances</b>				
Unchanged/better off	964	617	61.0	39.0
Worse off	207	212	49.4	50.6
<b>Employment status</b>				
Permanent employee	406	336	54.7	45.3
Part-time, temporary worker	115	99	53.7	46.3
Self-employed	57	29	66.3	33.7
Unemployed, laid off, or on leave	66	72	47.8	52.2
Not working – not economically active	527	293	64.3	35.7
<b>Deressive symptoms</b>				
No	1090	563	65.9	34.1
Yes	81	266	23.3	76.7

loneliness measures continued to be negatively and significantly associated with using preventive behaviours.

When logistic regression analyses were performed being lonely was associated with negative odds for various individual COVID-19 preventive behaviours regardless of how loneliness was categorised. When a dichotomised loneliness measure was used, lonely individuals had significantly reduced odds for 7 of the 13 preventive behaviours including wearing a mask, keeping a distance of 2 metres from people when outside, and disinfecting hands, with ORs ranging from 0.63 (95%CI: 0.46–0.86 [cancel planned events]) to 0.80 (95%CI: 0.67–0.94 [disinfect hands/things that are touched often]) (Table 3). When a continuous loneliness score was analysed, it was associated with significantly reduced odds

for 5 of the 7 above-mentioned preventive behaviours with ORs ranging from 0.87 (95%CI: 0.80–0.94 [cancel planned events]) to 0.94 (95%CI: 0.88–1.00/0.89–1.00 [cancel going out/travelling, avoid engaging in gatherings]). In addition, keeping a distance of 2 metres away from people when outside was of borderline statistical significance (OR: 0.94, 95%CI: 0.88–1.00).

## Discussion

This study used data from 2000 Japanese adults collected in the early phase of the ongoing pandemic to examine the association between loneliness and the use of COVID-19

**Table 2** Association between loneliness and COVID-19 preventive behaviours (combined score)

Variable	Loneliness ( $\geq 6$ )	Loneliness (Continuous)
	Model 1 Coef. (95% CI)	Model 1 Coef. (95% CI)
Loneliness	-0.85 (-1.15, -0.54)**	-0.23 (-0.33, -0.13)**
	Model 2 OR (95% CI)	Model 2 OR (95% CI)
Loneliness	-0.54 (-0.83, -0.26)**	-0.14 (-0.24, -0.04)**
Sex (Male)	-1.96 (-2.28, -1.64)**	-1.95 (-2.27, -1.63)**
Age		
Old	Ref.	Ref.
Young	-0.52 (-0.85, -0.18)**	-0.51 (-0.84, -0.17)**
Middle	-0.35 (-0.74, 0.05)	-0.34 (-0.73, 0.05)
Education		
College educated (yes)	0.45 (0.12, 0.77)**	0.45 (0.12, 0.78)**
Income		
High	Ref.	Ref.
Low	-0.62 (-1.12, -0.11)*	-0.61 (-1.12, -0.09)*
Middle	0.18 (-0.27, 0.62)	0.18 (-0.27, 0.63)
Worse household finances	0.62 (0.27, 0.97)**	0.63 (0.29, 0.97)**
Employment status		
Not working – not economically active	Ref.	Ref.
Permanent employee	-0.31 (-0.73, 0.11)	-0.33 (-0.75, 0.08)
Part-time, temporary worker	-0.64 (-1.15, -0.12)*	-0.65 (-1.16, -0.14)*
Self-employed	-0.06 (-0.83, 0.70)	-0.04 (-0.80, 0.72)
Unemployed, laid off, on leave	0.19 (-0.63, 1.01)	0.19 (-0.62, 1.01)
Depressive symptoms (yes)	-0.62 (-1.11, -0.12)*	-0.58 (-1.09, -0.06)*
	N = 2000	N = 2000

OR: odds ratio; CI: confidence interval; Ref: reference category

\*\*p < 0.01, \*p < 0.05

preventive behaviours. Loneliness was common in this sample with more than 40% of adults being categorised as lonely. Loneliness was negatively associated with engaging in preventive behaviours when a combined preventive behaviours score variable was used as the outcome—regardless of how loneliness was categorised (dichotomous/continuous variable). Being lonely was also associated with lower odds for engaging in a number of individual preventive behaviours ranging from wearing a mask through to not social distancing from people when outside. Indeed, both loneliness measures were linked to reduced odds for the same 5 individual preventive behaviours including disinfecting hands and avoiding contacts except family members when having cold symptoms (although the dichotomous measure was associated with two additional preventive behaviours).

As yet, there has been little focus on the association between loneliness and COVID-19 preventive behaviours. This is a surprising gap in the research for several reasons. First, a number of authors have hypothesised that the social/physical distancing measures being implemented to prevent the spread of coronavirus disease may lead to increased loneliness.<sup>29</sup> Second, some evidence suggests that loneliness may be prevalent in many populations during the early phase of the pandemic.<sup>6–9</sup> Third, previous studies have linked loneliness to the failure to engage in a range of health/preventive behaviours including lower adherence to a healthy diet,<sup>30</sup> and medical non-adherence.<sup>15,16</sup> Importantly, the results of this study build on the findings of a recent Japanese study that looked at factors associated with not social distancing,<sup>20</sup> by not only indicating that loneliness may

**Table 3** Association between loneliness and individual COVID-19 preventive behaviours among Japanese adults<sup>†</sup>

Preventive Behaviour <sup>‡</sup>	Prevalence (%) of those engaged in preventive behaviour	Loneliness ( $\geq 6$ ) OR (95% CI)	Loneliness (Continuous score) OR (95% CI)
Wash hands after going out/before meal	75.0	0.84 (0.70–1.02)	0.97 (0.91–1.02)
Wear a mask	87.1	0.77 (0.62–0.95)*	0.97 (0.91–1.03)
Gargle	56.2	0.93 (0.80–1.08)	0.97 (0.92–1.03)
Use tissue/sleeve when cough/sneeze	52.7	0.87 (0.73–1.03)	0.97 (0.91–1.02)
Avoid touching face after touching objects (e.g. door handle)	51.0	0.91 (0.78–1.07)	0.97 (0.91–1.02)
Disinfect hands/things that are touched often	55.4	0.80 (0.67–0.94)**	0.92 (0.87–0.96)**
Cancel going out/travelling	65.8	0.74 (0.58–0.94)*	0.94 (0.88–1.00)*
Cancel planned events	18.5	0.63 (0.46–0.86)**	0.87 (0.80–0.94)**
Avoid crowds/try and stay home as much as possible	76.5	0.91 (0.72–1.14)	0.96 (0.89–1.04)
Avoid engaging in gatherings/parties even if few people	56.6	0.77 (0.62–0.95)*	0.94 (0.89–1.00)*
Avoid contact with the sick/elderly	33.7	0.90 (0.74–1.10)	0.97 (0.90–1.04)
If cold symptoms avoid contacts except family members	31.9	0.72 (0.62–0.85)**	0.93 (0.87–0.98)*
Keep a distance of 2 metres from people when outside	42.7	0.75 (0.61–0.92)**	0.94 (0.88–1.00)

<sup>†</sup>The loneliness measures were the exposures; the individual COVID-19 preventive behaviours were the outcomes examined in 13 separate analyses

<sup>‡</sup>The respondents were asked “Which of the following things do you routinely do regarding the novel coronavirus? Please select all that are applicable.” Respondents were allowed to select any number of items. The order of the items was randomized.

OR: odds ratio; CI: confidence interval

All analyses were adjusted for age (ref. old), sex (ref. female), education (ref. less than college), income (ref. high income), household financial situation (ref. unchanged/better off than in previous year), employment (ref. not working—not economically active), depressive symptoms (ref. no), data survey round (ref. round 1).

\*\* $p < .01$ ; \* $p < .05$

be prevalent in Japan in the early stages of the pandemic, but by showing that it is also associated with non-adherence to COVID-19 preventive behaviours. In addition, our results also accord with those of a recent study from Poland which tentatively suggested a negative link between loneliness and the use of COVID-19 preventive strategies.<sup>12</sup> However, besides showing that loneliness was associated with lower engagement in preventive behaviours overall, our study also revealed that loneliness was linked to non-adherence to both social distancing measures and other basic forms of hygiene such as disinfecting hands, as well as wearing a mask, which a recent rapid systematic review has suggested may be beneficial against the spread of coronavirus in the community.<sup>31</sup>

It is uncertain how loneliness might be linked to a lower level of adherence to COVID-19 preventive behaviours. An earlier study suggested that depression might lie on the path-

way from loneliness to ART non-adherence in women with HIV.<sup>17</sup> However, in the current study, loneliness was linked to the total preventive behaviour score and a number of individual preventive behaviours even after adjusting for depressive symptoms, which indicates that other mechanisms may be involved. For example, an earlier review study that examined demographic and attitudinal determinants of protective behaviours during several pandemics, reported that a high level of trust in authorities was linked to greater avoidant, preventive and management behaviours, possibly because it accords with individuals assigning more credibility to the health messages/warnings that the authorities provide.<sup>32</sup> In terms of the present study this might have been important as some research has shown that loneliness may be linked to lower levels of interpersonal and general trust.<sup>33,34</sup> Alternatively, other factors might also play a role. Loneliness has been associated with reduced efforts to manage

stressors (behavioural disengagement), as well as cognitive features such as a perceived lack of control<sup>35</sup> – that might also be relevant for (non-) engagement in health/preventive behaviours.<sup>36</sup>

The results of this study should be considered in light of several limitations. First, the data in the study were cross-sectional and so we were not able to establish causality or the direction of the associations. It is possible for example, that initial engagement in social distancing measures might have resulted in loneliness. However, as loneliness was linked to other preventive behaviours besides social distancing measures, such as not wearing a face mask, it is possible that this association may be bidirectional. Similarly, we could not determine if a failure to undertake certain social distancing measures such as cancelling planned events and avoiding social gatherings was simply linked to lonely individuals having fewer/no opportunities to engage in these activities. Second, we were not able to control for a range of variables that might have been important for preventive behaviour. An earlier study from Spain showed for instance, that the perceived effectiveness of the measures recommended by the Spanish government during the 2009 influenza A (H1N1) virus pandemic was associated with their uptake.<sup>37</sup> We also had no information on marital status, which has not only been linked to loneliness in previous studies,<sup>38</sup> but which has recently been associated with not engaging in preventive behaviour (social distancing) in Japan during the ongoing pandemic.<sup>20</sup> Finally, our respondents were recruited from an online panel. Although their distribution matched the Japanese population in terms of their main attributes (age, sex, residential location), we cannot discount the possibility that their recruitment into the study may have been linked to different forms of bias.<sup>20</sup>

As yet, there has been little research on the association between loneliness and COVID-19 preventive behaviours. Thus, the finding that loneliness is associated with an increased risk for not engaging in COVID-19 preventive behaviours may have important public health implications. In particular, it highlights the necessity of interventions to both prevent and ameliorate loneliness during the ongoing pandemic. These might take a variety of forms ranging from screening for loneliness among potentially vulnerable populations, to promoting the use of technology to maintain social connections during the ongoing pandemic,<sup>39</sup> such as the creation of telehealth groups to prevent loneliness among older adults.<sup>40</sup> Moreover, a recent pilot randomised controlled trial has also highlighted the potential utility of the internet to deliver cognitive behavioural therapy (CBT) to combat loneliness,<sup>41</sup> which might be especially useful while pandemic-related social and physical distancing is still ongoing.

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## Data Availability

The data underlying this article cannot be shared publicly due to the terms and conditions of the data collection.

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