The psychological impact of ‘mild lockdown’ in Japan during the COVID-19 pandemic: a nationwide survey under a declared state of emergency

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Abstract

This study examined the psychological distress caused by non-coercive lockdown (mild lockdown) in Japan. An online survey was conducted with 11,333 people (52.4% women; mean age = 46.3 ± 14.6 years, range = 18-89 years) during the mild lockdown in the seven prefectures most affected by COVID-19 infection. Over one-third (36.6%) of participants experienced mild-to-moderate psychological distress (Kessler Psychological Distress Scale [K6] score 5-12), while 11.5% reported serious psychological distress (K6 score ≥ 13). The estimated prevalence of depression (Patient Health Questionnaire-9 score ≥ 10) was 17.9%. Regarding the distribution of K6 scores, the proportion of those with psychological distress in this study was significantly higher when compared with the previous national survey data from 2010, 2013, and 2016. Healthcare workers, those with a history of treatment for mental illness, and younger participants (aged 18-19 or 20-39 years) were particularly vulnerable. Psychological distress severity was influenced by specific interactional structures of risk factors: high loneliness, poor interpersonal relationships, COVID-19-related sleeplessness and anxiety, deterioration of household economy, and work and academic difficulties. Flexible approaches that are optimised for the difficulties specific to each individual through cross-disciplinary public-private initiatives are important to combat lockdown-induced mental health problems.

Keywords: COVID-19, pandemic, lockdown, psychological distress, depression, K6, PHQ-9

Introduction

Given the spread of the coronavirus disease 2019 (COVID-19) infection, as of June 2020, the number of infected people worldwide is still increasing 1. Although outbreaks have subsided in some areas of Europe and East Asia, the threat of a new wave of infections remains a serious problem. Therefore, there is an urgent need to accumulate research on the effects of lockdowns (urban blockades), which should be used as a reference in policymaking during the spread of infection. While the lockdowns that have been
implemented so far have been effective in limiting the spread of infection, many negative psychological effects of lockdowns (e.g., stress, loneliness) exist \(^2\text{-}^6\) and there is room for improvement in lockdown implementation.

Under these circumstances, it may be useful to examine the impact of a ‘mildly enforceable lockdown’ in Japan. A total of 4,111 infections and 97 deaths were confirmed in Japan by 6 April 2020 \(^7\). On 7 April 2020, the Japanese government declared a state of emergency for the first time ever. This authorises prefectural governors to ‘request’ (or ‘instruct’ if residents do not comply) residents to (1) refrain from going out of their homes for non-essential reasons and (2) restrict the use of stores and facilities, after specifying the period and area. Enforceable measures are extremely limited in Japan’s emergency declarations and are much less restrictive than the ‘lockdowns’ introduced in some areas of Europe and the United States and there are no penalties for disobedience. Therefore, citizens are obliged to try to cooperate with measures taken by prefectures, such as voluntarily taking time off work and refraining from going out. In this study, we defined ‘mild lockdown’ as a state of lockdown specific to Japan that is based on the public’s voluntary cooperation.

A high prevalence of psychological symptoms such as depression and anxiety has been reported among people who experienced lockdown during the COVID-19 pandemic \(^2\text{-}^6\), and containment measures against such a pandemic can have a strong impact on the daily lives of the population and have a negative impact on their psychological well-being \(^8\). However, in studies examining the psychological effects of lockdowns reported to date, lockdowns have been accompanied by coercive forces, and the effects of mild lockdown remain unclear. With the current state of alert for further spread of COVID-19 and the potential for a second wave, it is vital to clarify the effects of mild lockdown on people’s mental health to consider future prevention policies and appropriate intervention strategies. Therefore, this study was designed to identify psychological distress severity and its risk and protective factors in mild lockdown situations.

The timing of data collection and the selection of target areas are important in examining the effects of mild lockdown, which change daily. We selected the data collection as the period from the start of mild lockdown—based on the declaration of a state of emergency—until mild lockdown began to be phased out (i.e. 7 April 2020 to 12 May 2020). After our data collection was completed, the mild lockdown was phased out on 14 May 2020, and it was fully lifted on 25 May 2020. Therefore, our data collection period was in the middle of the mild lockdown—a period of great distress and less susceptible to recall bias. Furthermore, due to regional differences in the spread of infection, we included residents from the seven prefectures initially subject to the declaration of a state of emergency (Tokyo, Kanagawa, Osaka, Saitama, Chiba, Hyogo, and Fukuoka). These cities were all in heavily populated and heavily affected areas. We examined the impact of mild lockdown on the population by identifying the distribution of psychological distress severity in the target areas during these periods and comparing it with prior data collected by the government.

There is also an urgent need to determine the impact on those considered vulnerable (e.g. healthcare workers and older people) to consider how best to respond to the difficulties faced by vulnerable populations during these pandemics \(^8\text{-}^9\). While previous studies report higher negative mental health risks among healthcare workers \(^8\text{-}^1^0\text{-}^1^1\), inconsistencies have been shown for the psychological impact on
young and older adults; thus, more research is needed. We therefore, examined psychological distress severity caused by mild lockdown, focusing on healthcare workers, family members of healthcare workers, those undergoing treatment for, or with a history of, physical or mental illness, and older adults (aged ≥ 65 years) and younger adults (18-19 years) who have been identified as potentially vulnerable in a previous study.

It is important to consider psychosocial variables, such as stressors and stress management strategies specific to lockdown, in identifying factors that influence the impact of mild lockdown. Given that such variables have not been adequately considered in previous studies we examined the risk and protective factors for psychological distress, including psychosocial variables such as life changes due to lockdown and lifestyle habits during lockdown.

Additionally, we assumed that various risk and protective factors are intricately related and that people may have diverse backgrounds of psychological distress in lockdown situations. It is important to understand the background of psychological distress to consider approaches tailored to people’s difficulties. However, no previous studies have elaborated on this. Therefore, we used non-parametric Bayesian co-clustering—a method of unsupervised learning. This method allows for the exhaustive visualisation of the underlying interaction structure among many variables. Therefore, it was expected to elucidate various problem structures that cause psychological distress during mild lockdown.

In sum, given that there are currently no research findings that specifically address the impact of mild lockdown, this study is useful in that it clarifies the impact of mild lockdown on various populations and provides basic data that will be useful in formulating optimal strategies during future periods of infection spread and pandemics.

Methods

Participants and data collection

A total of 11,333 participants (mean age = 46.3 ± 14.6 years, range = 18 to 89 years) were included in the study. Participants’ socio-demographic characteristics are described in Table 1. The survey was conducted online between 11 May and 12 May 2020 and was designed to assess the psychological impact of the mild lockdown on participants over approximately one month—from the start of the mild lockdown (7 April 2020) to its phasing out in some areas (14 May 2020). Through Macromill.inc., approximately 80,000 people were recruited by email, and data were collected on an online platform. To sensitively detect the impact of mild lockdown, participants were recruited only in the seven prefectures where the emergency declaration was first applied (Tokyo, Kanagawa, Osaka, Saitama, Chiba, Hyogo, and Fukuoka). These cities were assumed to be susceptible to mild lockdown given their large populations and the large number of cases reported in these cities.

The number of people collected in each prefecture was determined according to the ratio of the number of people living in each: Tokyo (n = 2,783, 24.6%), Kanagawa (n = 1,863, 16.4%), Osaka (n = 1,794, 15.8%), Saitama (n = 1,484, 13.1%), Chiba (n = 1,263, 11.1%), Hyogo (n = 1,119, 9.9%), and Fukuoka (n = 1,027, 9.1%). The exclusion criteria for participants were (a) aged < 18 years, (b) high school
students, and (c) living outside the seven prefectures. The online survey was completed on the second day after link distribution. All participants voluntarily responded to the anonymous survey and provided informed consent online before the survey. The survey procedure was clearly explained, and participants could interrupt or terminate the survey at any time without explanation. This study was approved by the Research Ethics Committee at the Graduate School of Social and Industrial Science and Technology, Tokushima University (no. 212) and has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

We used published data from a previous Comprehensive Survey of Living Conditions (CSLC)\(^\text{28}\) to examine changes in psychological distress severity due to mild lockdown. The CSLC is a national survey conducted by the Ministry of Health, Labour and Welfare to assess the health status of the Japanese population. In the CSLC, the Kessler Psychological Distress Scale (K6)\(^\text{29}\) was used to measure psychological distress. Based on their score classification (0–4, 5–9, 10–14, over 15), the percentages of people in that classification for 2010, 2013, and 2016 are now publicly available\(^\text{28}\). These results were used to compare to the survey data in this study. The CSLC data were compiled from a sample of 228,864 households in 2010, 234,383 households in 2013, and 224,208 households in 2016.

**Measurements**

**Psychological distress**

Psychological distress was measured by the Japanese version of the K6\(^\text{30}\), a six-item screening scale of nonspecific psychological stress in the past 30 days. Each question was rated on a scale of 0 (none of the time) to 4 (all of the time); total scores range from 0 to 24. Given its brevity and high accuracy, the K6 is considered an ideal scale for screening for mental disorders in population-based health surveys\(^\text{30–32}\). Additionally, because the duration of symptoms examined by this scale (the past 30 days) corresponds to the period between the start of mild lockdown and the implementation of the survey (approximately 1 month), we assumed the scale could sensitively reflect the influence of psychological distress caused by mild lockdown.

We adopted a threshold of five points commonly used to screen for mild-to-moderate mood/anxiety disorders\(^\text{33}\). K6 scores ranging from 5 to 12 were defined as mild-to-moderate psychological distress (MMPD). This threshold is the optimal lower threshold cut-point for screening for moderate psychological distress\(^\text{33}\). MMPD is a target for consideration because of the risk of progression to more severe disability as well as current distress and disability\(^\text{34}\). Additionally, to screen for severe mood/anxiety disorders, we adopted a threshold score of 13, a criterion traditionally used\(^\text{31,35}\). A score of \(\geq 13\) was defined as serious psychological distress (SPD). Additionally, a score of four or less was defined as no or low psychological distress (NPD). Based on 3 years of published data concerning K6 from the Ministry of Health, Labour and Welfare\(^\text{28}\), we defined MMPD or SPD (K6 \(\geq 5\)) as ‘psychological distress’ together, to make comparisons corresponding to the cut-point of K6 severity.

We also used the Japanese version of the Patient Health Questionnaire-9 (PHQ-9)\(^\text{36}\) to collect other basic information on mental health. The PHQ-9 consists of nine questions, and depressive symptoms during the past four weeks were reported by the participants, with a score of 0 (not at all) to 3 (nearly every day)\(^\text{37}\). We defined a score of \(\geq 10\), previously recommended\(^\text{36}\), as a cut-point, meaning that a
person is more likely to have major depression. The PHQ-9 has been widely used internationally as a screening scale for depression \(^{38}\) and is highly reliable and valid \(^{36}\).

**Loneliness and social networks**

Loneliness and social networks are key factors associated with mental health \(^{39-41}\) and may affect people’s mental health in mild lockdown \(^{9,11}\). We measured loneliness and social networks using the Japanese version of the UCLA loneliness scale version 3 (UCLA-LS3) \(^{42}\) and the Japanese version of the abbreviated Lubben Social Network Scale (LSNS-6) \(^{43}\), respectively.

The UCLA-LS3 consists of 10 items, each of which is rated from 1 (never) to 4 (always) \(^{44}\). The scores range from 10-40, with higher scores indicating higher levels of loneliness. The UCLA-LS3 is highly reliable and valid \(^{42}\) and is internationally used for measuring loneliness \(^{45-47}\). The LSNS-6 consists of three items related to family networks and three items related to friendship networks, and the number of people in the network is calculated using a six-point scale (0 = none to 5 = nine or more) for each item \(^{48}\). Scores range from 0-30 points, with higher scores indicating a larger social network and less than 12 points indicating social isolation. The LSNS-6 is highly reliable and valid \(^{43}\) and has been used in many countries \(^{49-51}\).

**Socio-demographic data**

Socio-demographic information was collected including age, sex, occupation, marital status, and income. To compare the impact on the group assumed to be vulnerable to the effects of lockdown in previous studies \(^{6,8,9,11}\), information was collected on whether the individual or a family member was a healthcare worker, whether the individual was currently being treated for a psychiatric or physical illness, and whether the individual had a history of previous treatment for psychiatric or physical illness.

**Lifestyle, stress management, and stressors related to mild lockdown**

With extensive reference to the literature related to the COVID-19 pandemic \(^{3,6,8,11}\), we developed eight lifestyle and stress management items (e.g. exercise; ‘I exercised for my health (whether indoors or outdoors)’) and seven stressors (e.g. deterioration of household economy; ‘The family budget has tightened’) that were assumed to be associated with mild lockdown (Table 2). We asked participants to rate the frequency of implementation and experience of these items from the start of the mild lockdown to the time of the survey on a scale of 1 (not at all) to 7 (extremely).

**Statistical analyses**

To determine the socio-demographic and psychological characteristics of groups classified by psychological distress severity (NPD (K6 score ≤ 4), MMPD (K6 score 5-12), and SPD (K6 score ≥ 13)), we compared these characteristics using Pearson’s \(\chi^2\) tests for categorical variables and analyses of variance (ANOVAs) for continuous variables. Hochberg’s GT2 method was used for multiple comparisons of ANOVAs to account for differences between groups. We also used Pearson’s \(\chi^2\) tests against published CSLC data and data from this study to compare the change in the proportion of those with mental illness (K6 ≥ 5) before and during the mild lockdown (2010, 2013, 2016, and 2020).

To elaborate on psychological distress severity in the group assumed to be vulnerable based on previous studies, we conducted ANOVAs with K6 scores as the dependent variable for each of the
following categories: healthcare worker (individual, family, individual and family, and none), psychiatric illness (currently treated, previously treated, both, and none), physical illness (currently treated, previously treated, both, and none), and age in years (18-19, 20-39, 40-64, and ≥ 65).

Hochberg’s GT2 method was used for multiple comparisons to account for differences in numbers between groups.

Multinomial logistic regression analyses were conducted to examine the effects on psychological distress of socio-demographic characteristics (age, sex, healthcare workers, and history of treatment for mental and physical illness) that previous studies suggest increase vulnerability, and psychosocial variables related to mild lockdown, including loneliness and social networks. Based on Field 52, the model was examined using the forward entry method, and the final model was constructed by employing variables that significantly contribute to the explanation of the model. Multicollinearity among the independent variables of the final model was checked to assess potential bias in the results due to collinearity. Multicollinearity among the independent variables in the final model was checked to see if there was any bias that could affect the results owing to collinearity.

Non-parametric Bayesian co-clustering 14 was used to visualise the exhaustive interaction structure between the psychosocial variables that were significant in multinomial logistic regression and psychological distress during mild lockdown. Iterations based on the Bayesian optimisation principle were performed 10,000 times to calculate the log marginal likelihood, which indicates the goodness-of-fit of the model. The log marginal likelihoods were competed among the models, and finally the model with the highest log marginal likelihood was adopted.

For all tests, significance was set at $\alpha = 0.05$ (two-tailed). Analyses and figures were drawn using SPSS version 22.0 (SPSS Japan Inc., Tokyo, Japan), MATLAB R2017a (Mathworks Inc.), and RStudio version 1.1.442 53,54.

Results

Socio-demographic characteristics by psychological distress severity

The socio-demographic characteristics by severity of psychological distress, as measured by the K6, are shown in Table 1. In total, 4,146 participants (36.6%) had MMPD (K6 score 5-12) and 1,303 participants (11.5%) had SPD (K6 score ≥ 13). The estimated prevalence of depression (PHQ-9 score ≥ 10) was 2,034 (17.9%).

In the MMPD group, significantly more participants were aged 20-39 years ($p < 0.001$), women ($p < 0.001$), employed ($p = 0.045$), homemakers ($p = 0.020$), healthcare worker ($p < 0.001$), single ($p = 0.001$), currently being treated for psychological problems ($p = 0.001$), and had received treatment for psychological problems in the past ($p < 0.001$) as compared to their counterparts.

In the SPD group, the following characteristics were observed to be significantly more prevalent: aged 18-19 years or 20-39 years, women, students, unmarried, income of less than 2 million yen, currently being treated for psychological problems, and having been treated for psychological problems in the past (all $p$s < 0.001).
| Characteristics, n (%) | Total   | No or low | Mild-to-moderate | Serious | $\chi^2$ | df | p   |
|------------------------|---------|-----------|------------------|---------|----------|----|-----|
| Overall                | 11333   | 5884 (51.9)| 4146 (36.6)      | 1303 (11.5)| 2831.00 | 2  | <0.001 |
| Age                    |         |           |                  |         |          |    |     |
| 18-19                  | 143     | 62 (43.4) | 50 (35.0)        | 31 (21.7)|          |    |     |
| 20-39                  | 3745    | 1633 (43.6)| 1508 (40.3)     | 604 (16.1)| 428.66  | 6  | <0.001 |
| 40-64                  | 6024    | 3157 (52.4)| 2230 (37.0)     | 637 (10.6)|          |    |     |
| ≥ 65                   | 1421    | 1032 (72.6)| 358 (25.2)      | 31 (2.2) |          |    |     |
| Gender                 |         |           |                  |         |          |    |     |
| Male                   | 5391    | 3098 (57.5)| 1789 (33.2)     | 504 (9.3) | 134.68  | 2  | <0.001 |
| Female                 | 5942    | 2786 (46.9)| 2357 (39.7)     | 799 (13.4)|          |    |     |
| Occupation category    |         |           |                  |         |          |    |     |
| Employed               | 7685    | 3948 (51.4)| 2852 (37.1)     | 885 (11.5)|          |    |     |
| Homemaker              | 1806    | 919 (50.9) | 699 (38.7)      | 188 (10.4)|          |    |     |
| Student                | 407     | 175 (43.0) | 158 (38.8)      | 74 (18.2) | 75.60   | 8  | <0.001 |
| Unemployed             | 1068    | 662 (62.0) | 304 (28.5)      | 102 (9.6) |          |    |     |
| Other                  | 367     | 180 (49.0) | 133 (36.2)      | 54 (14.7) |          |    |     |
| Healthcare worker(self)|         |           |                  |         |          |    |     |
| Yes                    | 661     | 299 (45.2) | 288 (43.6)      | 74 (11.2) | 15.46   | 2  | <0.001 |
| No                     | 10672   | 5585 (52.3)| 3858 (36.2)     | 1229 (11.5)|          |    |     |
| Healthcare worker(family)|       |           |                  |         |          |    |     |
| Yes                    | 991     | 493 (49.7) | 373 (37.6)      | 125 (12.6)| 2.49    | 2  | 0.2874 |
| No                     | 10342   | 5391 (52.1)| 3773 (36.5)     | 1178 (11.4)|          |    |     |
| Marital status         |         |           |                  |         |          |    |     |
| Married                | 7043    | 3933 (55.8)| 2500 (35.5)     | 610 (8.7) | 191.36  | 2  | <0.001 |
| Unmarried              | 4290    | 1951 (45.5)| 1646 (38.4)     | 693 (16.2)|          |    |     |
| Annual household income (JPY) |       |           |                  |         |          |    |     |
| < 2.0 million          | 633     | 273 (43.1) | 233 (36.8)      | 127 (20.1)|          |    |     |
| 2.0-3.9 million        | 1990    | 1020 (51.3)| 739 (37.1)      | 231 (11.6)|          |    |     |
| 4.0-5.9 million        | 2214    | 1174 (53.0)| 797 (36.0)      | 243 (11.0)| 149.24  | 10 | <0.001 |
| 6.0-7.9 million        | 1495    | 817 (54.6) | 529 (35.4)      | 149 (10.0)|          |    |     |
| ≥ 8.0 million          | 2130    | 1267 (59.5)| 694 (32.6)      | 169 (7.9) |          |    |     |
| Unknown                | 2871    | 1333 (46.4)| 1154 (40.2)     | 384 (13.4)|          |    |     |
| Current treatment of severe physical diseases |         |           |                  |         |          |    |     |
| Yes                    | 482     | 248 (51.5) | 166 (34.9)      | 66 (13.7) | 1.85    | 2  | 0.3972 |
| No                     | 10851   | 5636 (51.9)| 3978 (36.7)     | 1237 (11.4)|          |    |     |
| Previous treatment of severe physical diseases |         |           |                  |         |          |    |     |
| Yes                    | 851     | 440 (51.7) | 304 (35.7)      | 107 (12.6)| 1.12    | 2  | 0.5709 |
| No                     | 10482   | 5444 (51.9)| 3842 (36.7)     | 1196 (11.4)|          |    |     |
| Current treatment of psychological problems |         |           |                  |         |          |    |     |
| Yes                    | 641     | 110 (17.2) | 271 (42.3)      | 260 (40.6)| 663.31  | 2  | <0.001 |
| No                     | 10692   | 5774 (54.0)| 3875 (36.2)     | 1043 (9.8)|          |    |     |
| Previous treatment of psychological problems |         |           |                  |         |          |    |     |
| Yes                    | 1366    | 383 (28.0) | 600 (43.9)      | 383 (28.0)| 563.09  | 2  | <0.001 |
| No                     | 9967    | 5501 (55.2)| 3546 (35.6)     | 920 (9.2) |          |    |     |
Psychometric characteristics by psychological distress severity

Psychological characteristics by psychological distress severity are shown in Table 2. Psychosocial variables that were significantly greater in the MMPD group than in the NPD group (K6 score ≤ 4) included loneliness (UCLA score), deterioration of household economy, deterioration of relationships with familiar people, frustration, COVID-19-related anxiety, COVID-19-related sleeplessness, difficulties due to a lack of daily necessities, and difficulties in work or schoolwork (all ps < 0.001). In contrast, psychosocial variables that were significantly less prevalent in the MMPD group than in the NPD group were social network size (LSNS-6 score), exercise, healthy eating habits, healthy sleep habits, activity, offline interaction with family or friends, altruistically motivated preventive behaviours, and optimism (all ps < 0.001). Similar results were observed in the SPD group, with the difference being that there was less online interaction with family or friends (p = 0.004), and altruistically motivated preventive behaviours were not different from those in the NPD group.
### Table 2. Participants’ psychometric characteristics

| Psychometric data, M (SD)                        | Total   | No or low | Mild-to-moderate | Serious   | F       | df      | p       |
|------------------------------------------------|---------|-----------|------------------|-----------|---------|---------|---------|
| Psychological distress, loneliness and social network |         |           |                  |           |         |         |         |
| K6                                             | 5.58 (5.43) | 1.39 (1.45) | 8.07b (2.30) | 16.58b (3.19) | 34224.57 (2,11330) | <0.001 |
| PHQ-9                                          | 4.90 (5.53) | 1.71 (2.50) | 6.49b (4.41) | 14.27b (5.84) | 6468.81 (2,11330) | <0.001 |
| UCLA-LS3                                       | 23.46 (5.70) | 21.43 (5.32) | 24.71a (4.82) | 28.63ab (5.50) | 1228.45 (2,11330) | <0.001 |
| LSNS-6                                         | 10.56 (6.17) | 11.41 (6.33) | 10.09a (5.79) | 8.25ab (5.85) | 163.06 (2,11330) | <0.001 |
| **Lifestyle and stress management during mild lockdown** |         |           |                  |           |         |         |         |
| Exercise                                       | 4.17 (1.81) | 4.26 (1.87) | 4.12a (1.69) | 3.90b (1.90) | 22.89 (2,11330) | <0.001 |
| Healthy eating habits                          | 4.34 (1.56) | 4.43 (1.59) | 4.30a (1.44) | 4.01b (1.70) | 41.65 (2,11330) | <0.001 |
| Healthy sleep habits                           | 4.63 (1.79) | 4.94 (1.78) | 4.40a (1.66) | 3.93ab (1.95) | 229.43 (2,11330) | <0.001 |
| Activity                                       | 4.02 (1.67) | 4.17 (1.69) | 3.94a (1.58) | 3.65ab (1.81) | 59.19 (2,11330) | <0.001 |
| Offline interaction with family or friends     | 3.53 (1.88) | 3.62 (1.94) | 3.49a (1.78) | 3.24ab (1.85) | 24.01 (2,11330) | <0.001 |
| Online interaction with family or friends      | 3.27 (2.00) | 3.28 (2.08) | 3.31 (1.89) | 3.11ab (1.98) | 5.10 (2,11330) | 0.006 |
| Altruistically motivated preventive behaviours of COVID-19 | 5.58 (1.67) | 5.62 (1.70) | 5.50a (1.61) | 5.61 (1.67) | 7.05 (2,11330) | <0.001 |
| Optimism                                       | 4.06 (1.57) | 4.35 (1.54) | 3.89a (1.43) | 3.24ab (1.76) | 321.64 (2,11330) | <0.001 |
| **Stressors related to mild lockdown**          |         |           |                  |           |         |         |         |
| Deterioration of household economy             | 3.80 (1.83) | 3.41 (1.80) | 4.04a (1.69) | 4.78b (1.86) | 385.95 (2,11330) | <0.001 |
| Deterioration of relationships with familiar people | 2.38 (1.54) | 1.92 (1.31) | 2.68a (1.51) | 3.47ab (1.82) | 754.72 (2,11330) | <0.001 |
| Frustration                                    | 3.31 (1.75) | 2.59 (1.58) | 3.85a (1.49) | 4.88ab (1.61) | 1554.34 (2,11330) | <0.001 |
| COVID-19-related anxiety                       | 4.04 (1.70) | 3.50 (1.70) | 4.47a (1.42) | 5.11ab (1.62) | 780.16 (2,11330) | <0.001 |
| COVID-19-related sleeplessness                 | 2.44 (1.54) | 1.92 (1.25) | 2.84a (1.48) | 3.53b (1.90) | 925.94 (2,11330) | <0.001 |
| Difficulties owing to the lack of daily necessities | 3.63 (1.85) | 3.16 (1.84) | 3.97a (1.66) | 4.65ab (1.81) | 500.75 (2,11330) | <0.001 |
| Difficulties in work or schoolwork             | 3.82 (2.05) | 3.37 (2.07) | 4.14a (1.88) | 4.84ab (1.94) | 374.40 (2,11330) | <0.001 |

COVID-19, coronavirus disease 2019; K6, Kessler Psychological Distress Scale-6; PHQ-9, Patient Health Questionnaire-9; UCLA-LS3, UCLA Loneliness Scale (version 3); LSNS-6, Lubben Social Network Scale (abbreviated version)

a Significant difference from the no distress group (p < .05)

b Significant difference from the mild-to-moderate distress group (p < .05)
Chronological comparison of psychological distress

There was a significant difference in the proportion of those with psychological distress (K6 score ≥ 5) in 2010, 2013, 2016, and 2020 ($\chi^2(6) = 38.3$, $p < 0.001$). A residuals analysis revealed that, in 2020, the percentage of NPD and unknown groups was significantly lower ($p = 0.012; p < 0.001$, respectively) and the percentage of psychological distress group was significantly higher ($p < 0.001$; Figure 1).

Additionally, in 2010, the percentage of people with psychological distress was significantly lower ($p = 0.024$), with a significantly higher proportion of unknowns in the same year ($p < 0.001$).

![Figure 1. Chronological comparison of the distribution of psychological distress in Japan](image)

**Figure 1.** Chronological comparison of the distribution of psychological distress in Japan

COVID-19, coronavirus disease 2019; GEJE, the Great East Japan Earthquake; NPD, no or low psychological distress; PD, psychological distress

*a Significantly smaller percentage ($p<.05$); *b* Significantly larger percentage ($p<.05$).

Psychological distress in vulnerable groups

The distribution of psychological distress (K6 score) in each group is shown in Figure 2. A one-way ANOVA revealed a significant difference between groups related to the healthcare workers ($F(3, 11,329) = 3.50$, $p = 0.015, \eta^2_p = 0.001$) and those who were healthcare workers had significantly more psychological distress than those who were not healthcare workers ($p = 0.049$; Figure 2A).

There was also a significant difference between the groups related to the treatment of psychiatric disorders ($F(3, 11,329) = 359.32$, $p < 0.001, \eta^2_p = 0.087$). Significantly more psychological distress was reported by those who were currently being treated for psychological problems, had ever been treated for
psychological problems, or both, than by those who had not been treated for psychological problems (all \( p < 0.001 \); Figure 2B).

There was also a significant difference among age group \( (F(3, 11,329) = 159.22, p < 0.001, \eta_p^2 = 0.040) \): psychological distress was higher for those aged 18-19, 20-39, and 40-64 years than those aged \( \geq 65 \) years (all \( p < 0.001 \); Figure 2C). Psychological distress was also higher in those aged 18-19 and 20-39 years than in those aged 40-64 years (\( p = 0.010 \) and < 0.001, respectively; Figure 2C). There was no significant difference in psychological distress between the groups concerning the treatment of physical diseases \( (F(3, 11,329) = 1.51, p = 0.210, \eta_p^2 = 0.000) \); Figure 2D).

Figure 2. The distribution of psychological distress in the vulnerable groups

MMPD, mild-to-moderate psychological distress; SPD, serious psychological distress

The red dotted line indicates the cut-point for SPD (K6 score \( \geq 13 \)) and the blue dotted line indicates the cut-point for MMPD (K6 score 5-12).

* \( p < 0.05 \), two-tailed.
Risk and preventive factors for psychological distress

The results of the final multinomial logistic regression model are shown in Table 3. No multicollinearity problems were found among the independent variables (all variance inflation factors < 1.87).

First, the prominent risk factors (all odds ratios [ORs] > 1.30) that predicted MMPD included being aged 20-39 years, a healthcare worker, currently being treated for a psychiatric disorder, and having been treated for a psychiatric disorder in the past. In contrast, the protective factors were optimism (OR = 0.89, 95% confidence interval [CI] = 0.86-0.92, p < 0.001) and healthy sleep habits (OR = 0.92, 95% CI = 0.90-0.95, p < 0.001).

Next, the prominent risk factors (all ORs ≥ 1.30) that predicted SPD were indicated as follows: aged 18-19, 20-39, or 40-64 years; female; currently being treated for psychological problems; past treatment for psychological problems; past treatment for physical diseases; and loneliness, frustration, COVID-19-related anxiety, or COVID-19-sleepless. In contrast, the protective factors were optimism (OR = 0.76, 95% CI = 0.71-0.80, p < 0.001) and healthy sleep habits (OR = 0.87, 95% CI = 0.83-0.91, p < 0.001).
Table 3. Multinominal logistic regression analysis between psychological distress and related factors

| Predictor | $\beta$ (SE) | OR [95% CI] | $p$ |
|-----------|--------------|-------------|-----|
| **Mild to Moderate Psychological Distress** |  |  |  |
| Age       |  |  |  |
| >65 (ref.) | 0 | | |
| 18-19     | 0.34 (0.23) | 1.40 [0.89 - 2.20] | 0.141 |
| 20-39     | 0.31 (0.09) | 1.36 [1.14 - 1.62] | 0.001 |
| 40-64     | 0.11 (0.08) | 1.11 [0.95 - 1.30] | 0.179 |
| Gender    |  |  |  |
| Male (ref.) | 0 | | |
| Female    | 0.23 (0.05) | 1.25 [1.13 - 1.39] | <0.001 |
| Healthcare worker (self) |  |  |  |
| No (ref.) | 0 | | |
| Yes       | 0.27 (0.10) | 1.31 [1.07 - 1.59] | 0.009 |
| Previous treatment of severe physical diseases |  |  |  |
| No (ref.) | 0 | | |
| Yes       | 0.24 (0.10) | 1.27 [1.06 - 1.53] | 0.012 |
| Current treatment of psychological problems |  |  |  |
| No (ref.) | 0 | | |
| Yes       | 0.95 (0.14) | 2.59 [1.96 - 3.41] | <0.001 |
| Previous treatment of psychological problems |  |  |  |
| No (ref.) | 0 | | |
| Yes       | 0.57 (0.09) | 1.77 [1.50 - 2.10] | <0.001 |
| Psychosocial variables |  |  |  |
| UCLA-LS3  | 0.12 (0.01) | 1.13 [1.12 - 1.14] | <0.001 |
| LSNS-6    | 0.02 (0.01) | 1.02 [1.01 - 1.03] | <0.001 |
| Online interaction with family or friends | 0.03 (0.01) | 1.03 [1.01 - 1.06] | 0.017 |
| Optimism  | -0.12 (0.02) | 0.89 [0.86 - 0.92] | <0.001 |
| Healthy sleep habits | -0.08 (0.02) | 0.92 [0.90 - 0.95] | <0.001 |
| Deterioration of household economy | 0.04 (0.02) | 1.04 [1.01 - 1.07] | 0.018 |
| Deterioration of relationships with familiar people | 0.06 (0.02) | 1.07 [1.03 - 1.11] | 0.001 |
| Frustration | 0.26 (0.02) | 1.30 [1.26 - 1.35] | <0.001 |
| COVID-19-related anxiety | 0.23 (0.02) | 1.26 [1.22 - 1.30] | <0.001 |
| COVID-19-related sleeplessness | 0.20 (0.02) | 1.22 [1.17 - 1.27] | <0.001 |
| Difficulties in work or schoolwork | 0.04 (0.01) | 1.04 [1.01 - 1.07] | 0.007 |
Table 3. Cont.

| Serious Psychological Distress |
|--------------------------------|
| **Age**                       |
| >65 (ref.)                    | 0 |
| <20                           | 1.91 (0.36) 6.78 [3.33 - 13.82] <0.001 |
| 20-39                         | 1.25 (0.22) 3.50 [2.29 - 5.36] <0.001 |
| 40-64                         | 0.58 (0.21) 1.79 [1.18 - 2.70] 0.006 |
| **Gender**                    |
| Male (ref.)                   | 0 |
| Female                        | 0.28 (0.09) 1.32 [1.11 - 1.56] 0.002 |
| **Healthcare worker (self)**   |
| No (ref.)                     | 0 |
| Yes                           | -0.07 (0.17) 0.94 [0.67 - 1.32] 0.707 |
| **Previous treatment of severe physical diseases** |
| No (ref.)                     | 0 |
| Yes                           | 0.36 (0.16) 1.43 [1.04 - 1.95] 0.026 |
| **Current treatment of psychological problems** |
| No (ref.)                     | 0 |
| Yes                           | 1.88 (0.17) 6.58 [4.68 - 9.23] <0.001 |
| **Previous treatment of psychological problems** |
| No (ref.)                     | 0 |
| Yes                           | 0.98 (0.12) 2.66 [2.10 - 3.37] <0.001 |
| **Psychosocial variables**    |
| UCLA-LS3                      | 0.27 (0.01) 1.30 [1.28 - 1.33] <0.001 |
| LSNS-6                        | 0.03 (0.01) 1.03 [1.02 - 1.05] <0.001 |
| Online interaction with family or friends | 0.08 (0.02) 1.08 [1.03 - 1.13] 0.002 |
| Optimism                      | -0.28 (0.03) 0.76 [0.71 - 0.80] <0.001 |
| Healthy sleep habits          | -0.14 (0.03) 0.87 [0.83 - 0.91] <0.001 |
| Deterioration of household economy | 0.13 (0.03) 1.14 [1.08 - 1.20] <0.001 |
| Deterioration of relationships with familiar people | 0.19 (0.03) 1.21 [1.15 - 1.28] <0.001 |
| Frustration                   | 0.53 (0.03) 1.70 [1.60 - 1.81] <0.001 |
| COVID-19-related anxiety      | 0.40 (0.03) 1.49 [1.40 - 1.60] <0.001 |
| COVID-19-related sleeplessness | 0.33 (0.03) 1.40 [1.32 - 1.48] <0.001 |
| Difficulties in work or schoolwork | 0.10 (0.03) 1.11 [1.05 - 1.16] <0.001 |

Note. $R^2 = 0.41$ (Cox-Snell), 0.48 (Nagelkerke). Model $\chi^2(38) = 5902.04, p < 0.001$

COVID-19, coronavirus disease 2019; UCLA-LS3, UCLA Loneliness Scale (version 3); LSNS-6, Lubben Social Network Scale (abbreviated version)
Comprehensive interaction structure of psychosocial variables associated with psychological distress

The final convergence results of the non-parametric Bayesian co-clustering are shown in Figure 3. Twenty-two psychological distress clusters were extracted, of which six clusters consisted entirely of those with SPD, four clusters consisted entirely of those with MMPD, and seven clusters consisted entirely of those with NPD. The characteristic interaction structures that influence psychological distress severity are summarised below.

First, the largest cluster consisting of the SPD group (SPD-CL1, n = 485, 37.2%) showed particularly severe deterioration of relationships with familiar people and COVID-19-related sleeplessness. The second largest cluster, consisting of the SPD group (SPD-CL2, n = 341, 26.2%), showed particularly high levels of loneliness and frustration, and a lack of online interaction with family or friends and optimism. The third largest cluster, consisting of SPDs (SPD-CL3, n = 215, 16.5%), showed highly pronounced difficulties in work or schoolwork and deterioration of household economy. In the fourth largest cluster composed of SPDs, the high level of COVID-19-related anxiety was pronounced. Frustration was also commonly high in all clusters. Taken together, frustration and the combination between individual factors, such as loneliness and household economy, were associated with more severe psychological distress.

In contrast, the largest cluster in the NPD group (NPD-CL1, n = 1,261, 21.4%) had high levels of difficulties in work or schoolwork, while they were also highly optimistic, engaged in extensive online interactions, and maintained healthy sleep habits. In the fourth largest cluster, composed of the NPD group (NPD-CL2, n = 821, 14.0%), COVID-19-related anxiety and deterioration of household economy were indicated, while high levels of optimism and social networks were characteristic of the cluster. In the NPD-CL3, which consisted of the NPD group (n = 317, 5.4%), there was a pronounced deterioration of relationships with familiar people and a high level of loneliness, while the cluster was characterised by low difficulties in work or schoolwork and low COVID-19-related anxiety. Taken together, even if risk factors for severe psychological illness were present, a low number of risk factors and the presence of protective factors were associated with lower psychological distress.
Figure 3. Comprehensive interaction structure of psychosocial variables associated with psychological distress

Rows represent the participants data and columns represent the groups of psychological distress and features about COVID19-related psychosocial factor. The magenta dotted or solid lines indicate the division of each cluster. The color bar indicates the z-score of features.

Discussion

The purpose of this study was to report the distribution of psychological distress severity approximately one month after the initiation of mild lockdown by the declaration of a state of emergency (7 April to 12 May 2020), and to elucidate the risk and protective factors for psychological distress.
associated with mild lockdown. The study was conducted before the mild lockdown was phased out, and the seven major cities where the mild lockdown was initially implemented were included in the data collection.

Based on K6 and PHQ-9 scores, approximately half the participants were distressed and nearly one-fifth were depressed. Regarding the distribution of K6 scores, the proportion of those with psychological distress in this study was significantly higher when compared with the previous national survey (CSLC) data from 2010, 2013, and 2016. This suggests that the one-month mild lockdown had an adverse effect on the mental health of the population. This is consistent with previous studies reporting increases in depression, anxiety, and stress during the lockdown\textsuperscript{2,3,5,6}.

The groups most likely to be significantly affected by mild lockdown were healthcare workers, those who were being or had been treated for some psychological disorder, younger adults minors (18-19 years of age) and adolescents/adults (20-39 years of age). In these groups, there was a significantly larger proportion of those with MMPD or SPD and a significantly higher level of psychological distress.

Results of multinomial logistic regression showed that being a healthcare worker resulted in increased psychological distress, especially in MMPD, which is consistent with previous studies reporting a higher risk to healthcare workers\textsuperscript{10,15}. It is assumed that a variety of factors may affect such psychological distress among healthcare workers, including demanding work, fear of infection, moral injury\textsuperscript{16}, and stigma\textsuperscript{8}. Against such psychological distress, it has been suggested that communication, adequate rest, and practical and psychological support in the workplace may be protective factors\textsuperscript{11}. Therefore, it is important for institutions to establish a systematic support system for healthcare workers. Additionally, approaches such as providing the public with sufficient reliable information to counter stigma against healthcare workers are necessary.

Next, history of treatment for psychological problems was the most significant risk for psychological distress severity. In China and Italy, exacerbations of psychological distress, such as stress and depressive symptoms, have also been reported in patients with psychiatric disorders during lockdown\textsuperscript{17,18}, and these results suggest that mild lockdown may lead to exacerbation or recurrence of psychological symptoms. A variety of factors can be attributed to this, including excessive fear of infection, lack of access to healthcare services such as home isolation and the closure of daycare facilities, and increased economic hardship\textsuperscript{17,19}. Therefore, especially for patients who have been treated for psychiatric disorders, the attending physician should pay special attention to the psychological health of the patient and provide prophylactic support to prevent exacerbation of psychological distress and psychiatric symptoms. For this purpose, it is important to establish a system that enables remote support, including medical treatment, psychological assessment, psychotherapy, and health guidance, using online and telephone services.

Comparing age groups, younger adults were at particularly high risk. These results are consistent with those reported in studies from China\textsuperscript{20} and Spain\textsuperscript{4}. For these individuals, psychological distress may be influenced by the loss of various academic opportunities; anxiety about schooling, graduation, and future prospects; financial difficulties due to the lack of part-time work; and high exposure to social media. Considering the significantly larger proportion of students in the SPD group, it is important for educational institutions to compensate students for their educational opportunities and to pay particular
attention to their mental health. In addition, it is important for the government and stakeholders to provide information and other support to students to dispel their concerns about employment. The logistic regression analyses showed that difficulties owing to changes in work and frustration contributed to distress severity. Therefore, employers should be proactive in their approach to younger-aged professionals to relieve such barriers and promote their mental health.

In contrast, those aged 65 years and older had the lowest psychological distress compared to all age groups. This can be attributed to the fact that the elderly maintained the best lifestyle habits, such as exercise, healthy eating, and sleep, and they had the lowest levels of frustration and anxiety about COVID-19 compared to other age groups (Supplementary Table 1). Since Japan has the highest proportion of elderly population worldwide, health education on lifestyle for the elderly is popular in the country, and this education may have played a preventive role. Additionally, many older adults do not have access to social media, and these results may have contributed to reducing the increase in anxiety about COVID-19. Furthermore, because Japanese people have traditionally refrained from acting out in consideration of their surroundings, the elderly, especially those with such cultural considerations, may have been less susceptible to the frustrating effects of mild lockdown. Since previous studies have shown inconsistencies in the effects of lockdown across age groups, future research should take into account lifestyle, social media usage, and cultural background.

Based on the proportion of the distribution of psychological distress, other populations that require consideration are women, singles, and low-income individuals. Consistent with this study, previous research has shown that being a woman and single are risk factors for poor mental health during lockdown, and among those experiencing quarantine participants with a relatively low total household income have significantly higher post-traumatic stress and depressive symptoms than their counterparts. A variety of factors can be assumed to underlie the high risk of these populations (e.g. difficulties in living with single mothers). Therefore, it is important to understand these individuals’ difficulties in detail during mild lockdown, and additional social support, such as help from social workers, should be considered.

Psychological risk factors for psychological distress included COVID-19-related sleeplessness, COVID-19-related anxiety, and frustration. In contrast, this study revealed that healthy sleep habits and high levels of optimism were protective factors against psychological distress. Sleep problems are widely known to affect mental health, and this study also indicated that sleep can be both a risk and protective factor for psychological distress. Therefore, establishing stable and healthy sleep habits first may be important as a preventive approach to psychological distress.

Furthermore, because COVID-19-related sleeplessness is also closely linked to COVID-19-related anxiety, an approach aimed at anxiety reduction may be useful in improving both sleep and anxiety. Since higher levels of satisfaction with information about COVID-19 are associated with lower levels of anxiety regarding COVID-19, it would be useful to disclose appropriate information to people.

Interestingly, previous studies have not focused on the usefulness of optimism as a protective factor. As an approach to increasing optimism as a protective factor, it is important for governments and social media to first communicate the prospects, based on scientific and objective information. In addition, governments should implement rapid and extensive support policies for people, businesses, and
institutions in difficult situations. Furthermore, cognitive-behavioural therapy may be useful for people with excessive anxiety and pessimism. These approaches are expected to reduce anxiety caused by uncertainty about the future, which is expected to contribute to increased optimism and, consequently, to be a protective factor against psychological distress.

A comprehensive mapping of psychological distress severity and the structure of interactions between psychosocial variables revealed that there are various dynamics of difficulties behind psychological distress. In particular, factors such as high levels of loneliness, deterioration of relationships with familiar people, COVID-19-related sleeplessness, increased COVID-19-related anxiety, deterioration of household economy, and work and academic difficulties characterised the main SPD clusters. In contrast, although these risk factors were present, the absence of overlapping risk factors and the presence of protective factors were characteristic of the main NPD clusters. The results suggest the importance of an approach that reduces the variety of psychosocial risk factors faced by each individual and also fosters protective factors.

Given the diverse backgrounds of psychological distress caused by mild lockdown, a collaborative and cross-disciplinary approach by a variety of agencies is crucial to provide optimal support for individuals’ difficulties. In other words, it is essential for federal and local government agencies and institutions in the fields of industry, medicine, welfare, and education to work together in a flexible manner to focus on the difficulties of the individual. For instance, for people with significant loneliness and deterioration of household finances, it is necessary to establish a support system that can alleviate these concerns; for example, strengthening social support in communities, workplaces, and medical institutions as well as guaranteeing wages. To address these diverse difficulties, creating a cross-disciplinary support agencies/online platform that provides easy access to all information regarding support during a mild lockdown can be useful. This could allow for the rapid provision of support tailored to individuals’ problems.

This study had some limitations. Given that we employed a cross-sectional design, it is difficult to examine the long-term impact of mild lockdown and the causal effect of risk and preventive factors. Longer-term follow-up is needed to clarify the evolution of prevalence and causal relationships, such as what variables mitigate or exacerbate the effects of mild lockdown. Additionally, while the results indicate demographic characteristics that may be risk factors for psychological distress, the analysis remains at an exploratory level because this study provides a preliminary report of the effects of mild lockdown. Considering that different psychological burdens among healthcare workers depend on their job duties, further elaboration with specific groups is needed. Considering the stressful situations and problems specific to each group would allow us to propose strategies optimised for each group to effectively alleviate psychological distress. Moreover, because we obtained data only from an online survey, the psychological distress of those without online access has not been examined. Therefore, it is necessary to combine other methods besides online research to improve the generalisability of the results. Finally, it is difficult to make a simple comparison of the magnitude of the impact of lockdown with coercion and mild lockdown. To make a detailed comparison, it is necessary to consider various differences between studies, such as the human suffering caused by COVID-19, the timing of the survey, and the extent and duration of the lockdown. Therefore, it is desirable to accumulate further research and
to implement an integrated research approach that examines the differences in the effects of lockdown with and without coercion.

Despite these limitations, this study provides ample data from seven major cities where the highest numbers of cases were reported during the implementation period of mild lockdown following the declaration of a state of emergency. Given that retrospective studies are exposed to the effects of recall bias, the current data—collected during the implementation of the mild lockdown and examined approximately one month from implementation to just before the lockdown was lifted—may prove useful in clarifying the impact of the mild lockdown. The findings could be used during future periods of infection spread to inform how to help vulnerable populations. Specifically, this study sheds light on how to protect people’s mental health during lockdown situations and on the effective implementation of various evidence-based policies and approaches.

In conclusion, approximately half the people in major cities in Japan reported mild or greater psychological distress during their one-month mild lockdown experience, and this percentage was larger than that seen in previous national surveys. The effects were particularly pronounced among healthcare workers, those with a history of treatment for psychiatric disorders, and younger adults. It was also indicated that support should be considered for women, students, singles, and low-income individuals. Among the psychological variables, COVID-19-related sleeplessness, COVID-19-related anxiety, and frustration were risk factors for increased psychological distress, while healthy sleep habits and optimism were protective factors. Mapping the structure of the interaction of psychosocial variables revealed that there were various backgrounds of psychological distress, which indicates the need for specific intervention strategies tailored to each individual’s problem structure. The results suggest that cross-disciplinary public-private sector efforts are important to address individuals’ mental health issues arising from lockdown.

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Authors’ contributions

Conceived and designed the study: TY CU NS. Performed the study: TY NS. Analyzed the data: TY NS. Wrote the paper, contributed to and have approved the final manuscript: TY CU NS JY EM.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Supplementary Table 1. Psychometric characteristics by age group

| Psychometric data, $M \ (SD)$ | Total | 18-19 | 20-39 | 40-64 | $\geq 65$ | $F$  | df   | $p$  |
|-------------------------------|-------|-------|-------|-------|---------|------|------|------|
| **Psychological distress, loneliness and social network** |       |       |       |       |         |      |      |      |
| K6                            | 5.58 (5.43) | 6.87$^a$ (5.97) | 6.67$^a$ (5.76) | 5.46$^a$ (5.35) | 3.09 (3.65) | 159.22 (3.11329) | <0.001 |
| PHQ-9                         | 4.90 (5.53) | 6.44$^a$ (6.25) | 5.95$^a$ (5.79) | 4.79$^a$ (5.53) | 2.45 (3.66) | 147.82 (3.11329) | <0.001 |
| UCLA-LS3                      | 23.5 (5.70) | 23.70$^a$ (5.54) | 23.54$^a$ (5.70) | 23.94$^a$ (5.66) | 21.18 (5.32) | 92.81 (3.11329) | <0.001 |
| LSNS-6                        | 10.6 (6.17) | 13.13$^a$ (6.48) | 11.31 (6.01) | 9.83$^a$ (6.11) | 11.39 (6.38) | 64.33 (3.11329) | <0.001 |
| **Lifestyle and stress management during mild lockdown** |       |       |       |       |         |      |      |      |
| Exercise                      | 4.17 (1.81) | 4.26 (1.92) | 4.21$^a$ (1.79) | 4.04$^a$ (1.82) | 4.59 (1.76) | 37.68 (3.11329) | <0.001 |
| Healthy eating habits         | 4.34 (1.56) | 4.01$^a$ (1.68) | 4.25$^a$ (1.57) | 4.28$^a$ (1.55) | 4.82 (1.43) | 54.95 (3.11329) | <0.001 |
| Healthy sleep habits          | 4.63 (1.79) | 3.82$^a$ (2.00) | 4.24$^a$ (1.84) | 4.70$^a$ (1.74) | 5.40 (1.54) | 165.38 (3.11329) | <0.001 |
| Activity                      | 4.03 (1.67) | 4.73 (1.73) | 4.10$^a$ (1.70) | 3.88$^a$ (1.66) | 4.38 (1.59) | 46.77 (3.11329) | <0.001 |
| Offline interaction with family or friends | 3.53 (1.88) | 4.17$^a$ (2.02) | 3.52 (1.95) | 3.50 (1.84) | 3.61 (1.79) | 6.99 (3.11329) | <0.001 |
| Online interaction with family or friends | 3.27 (2.00) | 4.34$^a$ (2.14) | 3.85$^a$ (2.05) | 2.91$^a$ (1.88) | 3.17 (1.98) | 193.29 (3.11329) | <0.001 |
| Altruistically motivated preventive behaviours of COVID-19 | 5.58 (1.66) | 5.87 (1.45) | 5.72$^a$ (1.60) | 5.48 (1.70) | 5.57 (1.67) | 16.84 (3.11329) | <0.001 |
| Optimism                      | 4.06 (1.57) | 4.26 (1.74) | 4.08$^a$ (1.65) | 3.94$^a$ (1.54) | 4.45 (1.39) | 41.27 (3.11329) | <0.001 |
| **Stressors related to mild lockdown** |       |       |       |       |         |      |      |      |
| Deterioration of household economy | 3.80 (1.83) | 3.95$^a$ (1.93) | 3.92$^a$ (1.89) | 3.85$^a$ (1.80) | 3.24 (1.66) | 51.41 (3.11329) | <0.001 |
| Deterioration of relationships with familiar people | 2.38 (1.54) | 2.45$^a$ (1.66) | 2.36$^a$ (1.58) | 2.47$^a$ (1.55) | 2.00 (1.33) | 36.13 (3.11329) | <0.001 |
| Frustration                   | 3.31 (1.75) | 3.52$^a$ (1.84) | 3.65$^a$ (1.80) | 3.28$^a$ (1.71) | 2.54 (1.54) | 143.69 (3.11329) | <0.001 |
| COVID-19-related anxiety      | 4.04 (1.70) | 3.98$^a$ (1.75) | 4.26$^a$ (1.69) | 4.01$^a$ (1.68) | 3.57 (1.69) | 59.97 (3.11329) | <0.001 |
| COVID-19-related sleeplessness | 2.44 (1.54) | 2.17 (1.55) | 2.47$^a$ (1.61) | 2.51$^a$ (1.53) | 2.12 (1.32) | 26.68 (3.11329) | <0.001 |
| Difficulties due to the lack of daily necessities | 3.63 (1.85) | 3.39$^a$ (1.92) | 3.84$^a$ (1.90) | 3.68$^a$ (1.80) | 2.86 (1.71) | 103.62 (3.11329) | <0.001 |
| Difficulties in work or schoolwork | 3.82 (2.05) | 4.94$^a$ (1.97) | 4.23$^a$ (2.07) | 3.84$^a$ (1.97) | 2.56 (1.79) | 260.75 (3.11329) | <0.001 |

COVID-19, coronavirus disease 2019; K6, Kessler Psychological Distress Scale-6; PHQ-9, Patient Health Questionnaire-9; UCLA-LS3, UCLA Loneliness Scale (version 3); LSNS-6, Lubben Social Network Scale (abbreviated version)

$^a$ Significant difference from the aged 65 ≥ years group ($p$<.05)