

Impact of Sequelae Resulting From the COVID-19 Pandemic on Mental Health: a Cross-sectional Study in Japan and Sweden

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Research Article

Keywords: Coronavirus disease 2019 (COVID-19), COVID-19 pandemic, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), SARS-CoV-2, depression, anxiety, mental health, sequelae

Posted Date: October 8th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-798323/v1>

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The title

Impact of sequelae resulting from the COVID-19 pandemic on mental health: A cross-sectional study in Japan and Sweden

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Abstract (301 within 350 words)

Background: Due to the coronavirus disease 2019 (COVID-19) pandemic, people have undermined their mental health. It has been reported that sequelae resulting from COVID-19 occur at a certain rate. However, information on the mental health of people with sequelae is limited. Thus, this study investigated the relationship between sequelae resulting from COVID-19 and mental health.

Methods: Design of the present study was an International and collaborative cross-sectional study in Japan and Sweden from March 18 to June 15, 2021. The analyzed data included 763 adults who participated in online surveys in Japan and Sweden and submitted complete data. In addition to demographic data including terms related to COVID-19, psychiatric symptoms such as depression, anxiety, and post-traumatic stress were measured by using the fear of COVID-19 scale (FCV-19S), Patient Health Questionnaire-9 (PHQ-9), General Anxiety Disorder-7 item (GAD-7), and Impact of Event Scale-Revised (IES-R).

Results: of the 135 COVID-19 survivors among the 763 total participants, 40.7% had COVID-19-related sequelae. First, the results of the Bonferroni-corrected Mann Whitney U test showed that the group infected SARS-CoV-2 with sequelae scored significantly higher than those without sequelae and the non-infected group on all clinical symptom scales ($P \leq .001$). Next, there was a significant difference that incidence rates of clinical-significant psychiatric symptoms among each group from the results of the Chi-squared test ($P \leq .001$). Finally, the results of the multivariate logistic model revealed that the risk of having more severe clinical symptoms were 2.48–4.64 times higher among participants with sequelae.

Conclusion: The results showed that approximately half had sequelae after COVID-19 and that the sequelae of COVID-19 may lead to the onset of mental disorders.

Trial registration: The ethics committee of Chiba University approved this cross-sectional study (approval number: 4129). However, as no medical intervention was conducted, a clinical trial registration was not necessary.

Keywords

Coronavirus disease 2019 (COVID-19), COVID-19 pandemic, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), SARS-CoV-2, depression, anxiety, mental health, sequelae

Background

Coronavirus disease 2019 (COVID-2019) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is an ongoing global pandemic. The clinical outcome of COVID-19 ranges from mild respiratory failure to severe disease with high risk of fatality.¹ As of July 26, 2021, the global COVID-19 dashboard shows 194,723,719 coronavirus case patients, 4,167,618 deaths.² Recent studies have reported that at least the one in four COVID-19 recoverees suffer long-term impairments such as fatigue and taste/smell disorders.³ A decrease in the ability of the lungs to diffuse carbon monoxide was often found in patients who recovered from COVID-19,⁴ suggesting that respiratory dysfunction may remain after recovery.⁵ A recent study by Ballan and colleagues followed up patients three to four months after COVID-19 recovery and reported the following long-term sequelae: 13 (5.5%) Dyspnea, 12 (5.0%) ageusia, 11 (4.6%)

anosmia, 14 (5.9%) arthralgia, 14 (5.9%) myalgia, and 53 (22.3%) limited mobility and 113 (51.6%) decreased vital capacity.⁶

Additionally, there is also a need to focus on mental health problems as a sequela of COVID-19. Mental health problems such as symptoms of post-traumatic stress disorder (PTSD), depression, or anxiety has been observed in people who recovered from COVID-19.^{6,7} Anxiety and depression may be common six months after COVID-19 recovery, and people who present a more serious condition in the acute phase of COVID-19 are more likely to develop symptoms of depression and anxiety.⁸ Those long-term effects are in line with the previous severe acute respiratory syndrome (SARS).⁹ It has been reported that sequelae and mental disorders occur after COVID-19, though the relationship between them has been not insufficiently investigated. Somatic diseases are often related to symptoms of mental disorders, including major depressive disorder¹⁰ and the relationship between respiratory symptoms as sequelae after COVID-19 and mental health are strong.¹¹ Thus, identifying COVID-19 patients who are most likely to need assistance due to physical and psychiatric symptoms can have implications for long-term support policies for COVID-19-infected individuals.

The objectives of the present study were to investigate the prevalence of sequelae after COVID-19, and clinical associations between post-recovery physical function and psychosocial disorders in individuals who had been infected with SARS-CoV-2. We report the results of COVID-19 sequelae and their effects on the mental health of study participants in Japan and Sweden.

Methods

Study Design

We conducted a cross-sectional study in Japan and Sweden from March 18 to June 15, 2021 and collected the data through an online survey. The only eligibility criterion was that the age of the participants should be at least 18 years old. Data collection was outsourced to Asmark companies in Japan and Prolific in Sweden, and data collection was carried out through each company's online research platform. Participants answered the questions by accessing the websites. They were informed in the first half of the questionnaire that the survey content included information about the COVID-19 hospitalization experience and sequelae, so participants could withdraw their participation, if they wished, depending on the degree of psychological distress. A small monetary compensation was paid as a reward to the participants through the research company.

The study was planned and designed by researchers in Japan and Sweden according to the STROBE statement (see the STROBE checklist in the Supplementary File 1 for details).¹² The protocol for the current observational study was reviewed and approved by the Chiba University Graduate School of Medicine Ethics Review Committee (approval number 4129). The online survey was written in the native languages of Japan and Sweden, and it took about 20 minutes to complete.

Setting

We recruited 763 participants from Japan and Sweden, including 200 COVID-19 survivors. Data were collected in Japan from March 18 to 22, 2021 and in Sweden from April 5 to June 15, 2021 (e.g., a slight difference in time).

Outcomes

We collected the following background information about the of the participants: age, gender (woman, male and prefer not to say), race, occupation (regular, non-regular, unemployed, college student), family structure (living with family, living alone, sharing a house with someone other than the family), academic background, financial situation (household annual income of less than 4270,000 JPY (about 38,366 dollars) or more/ 380,000 SEK (about 44,408 dollars or more), having enough savings to live for about half a year if you lose your current job (yes, no) , living area (up to prefecture), history of mental illness (depression, bipolar disorder, schizophrenia, anxiety, PTSD, obsessive-compulsive disorder, panic disorder, eating disorder, substance use disorder, etc.; free description), presence or absence of history of physical illness (high blood pressure, asthma, diabetes, etc.; free description). We collected information about COVID-19 (presence of infection, time of infection, time required for recovery, acute symptoms, physical sequelae, and vaccination). Mental health was evaluated using the following measures: the fear of COVID-19 scale (FCV-19S);^{13, 14} Patient Health Questionnaire-9 (PHQ-9);^{15, 16} General Anxiety Disorder-7 -item (GAD-7);^{17, 18} Impact of Event Scale-Revised (IES-R).^{19, 20}

Dealing with bias

People who have been recovering for some time may not be able to remember the early aftereffects of recovery following a COVID-19 infection. To address this potential recall bias, we asked about sequelae and mental health at the time of the survey.

Because the data were collected via the internet, there may be a selection bias as the survey only reach those who have access to the internet and are interested in health. To address this selection bias, we conducted the survey in two countries (Japan and Sweden) in which internet usage is extremely high. Internet usage rates have been over

90% in both countries for a long time.²¹ Although there are some regulations in both countries, strict lockdown has never been implemented since the onset of the COVID-19 pandemic. Therefore, we assumed that ordinary people in both countries 2021 would be interested in a survey on COVID-19.

Sample size

The assumed effect size calculated by G*Power was 0.30, two-tail. The power was set at 0.80 and the significance level at .05. The sample size needed to obtain sufficient power by the *F* test was estimated to be 37 people in each group (non-infected group, infected without sequelae, and infected with sequelae). To collect at least 74 infected people, the final total sample size was set to 800 after taking into account the proportion of infected people and missing data.

Statistical analysis

We used SPSS version 26 (IBM Corporation, Armonk, NY, USA) for our statistical analyses. A two-sided P value of $< .05$ was considered statistically significant. First, we conducted the Kruskal-Wallis tests among the uninfected people, the infected people with sequelae, and those without sequelae, before conducting the Bonferroni-corrected Mann–Whitney U test for multiple comparisons to verify if there was a significant difference in clinical symptoms of mental stress. Next, we conducted a Chi-squared test to compare the three groups mentioned above and verify if there was a significant difference in the proportion of people at high risk of clinically significant mental illness. Finally, we conducted logistic regression analyses to evaluate the impact of sequelae on mental health between the participants infected with sequelae and those without. In a logistic regression model, we assessed whether the nine variables (age, country, gender, mental illness, physical illness, days to recovery, hospitalization, sequelae, and

ventilator) were associated with determinants of clinical symptom incidence. In the logistic regression model, we also calculated the adjusted odds ratio (OR) with a 95% confidence interval (CI) for the risk of clinically significant symptoms of depression, anxiety, and post-traumatic stress for the participants with sequelae after COVID-19. We used cutoffs as the criterion for the incidence of each clinical measure. The cutoff for FCV-19S was 18 points or more,^{13, 14} 22 points or more for PHQ-9,^{15, 16} 23 points or more for GAD-7,^{17, 18} and 25 points or more for the IES-R.^{19, 20}

Results

The demographic data of participants

Table 1 presents demographic data. Of the 763 participants, 135 were infected and 628 were not. There were 269 women (35.3%), 487 men (63.8%), and 7 who preferred not to state their gender (0.9%). Table 2 shows the history of mental illness and physical illness, presence or absence of hospitalization, presence or absence of a respirator, number of days until recovery, symptoms at the time of infection, and sequelae. There were 40 (46.0%) Japanese and 15 (31.3%) Swedish participants who still had COVID-19 symptoms (sequelae). Among the Japanese, the main sequelae were olfactory dysfunction (n = 7, 12.6%), dysgeusia (n = 11, 12.6%), fatigue (n = 10, 11.5%), chest pain (n = 6, 6.9%), coughing (n = 6, 6.9%), and palpitations (n = 5, 5.7%). Among the Swedes, the main sequelae were fatigue (n = 9, 18.8%), olfactory dysfunction (n = 5, 10.4%), fever (n = 3, 6.3%), and depression (n = 3, 6.3%).

Table 1. Here.

Table 2. Here.

Result of mental health between the groups

Figure 1 show that the results of the Kruskal-Wallis-test, there were significant differences on the following clinical symptom scales: FCV-19S ($H(2) = 23.8, P \leq .001$), PHQ-9 ($H(2) = 22.4, P \leq .001$), GAD-7 ($H(2) = 25.4, P \leq .001$), and IES-R ($H(2) = 30.8, P \leq .001$). In a comparison between the groups by the Bonferroni-corrected Mann Whitney U test, the group infected SARS-CoV-2 with sequelae scored significantly higher than those without sequelae and the non-infected group on all clinical symptom scales ($P \leq .001$). There was no significant difference between infected group without sequelae and non-infected groups.

Figure 1. Here

Figure 2 shows the incidence of clinically significant psychiatric symptoms in each group. Among the participants, 269 (42.8%) of the non-infected group, 35 (43.8%) of the infected without sequelae group, and 40 (72.7%) of the infected with sequelae group showed significant symptoms of COVID-19 fear, as measured by FCV-19S. Additionally, 190 (30.3%) of the non-infected group, 21 (26.3%) of the infected without sequelae group, and 32 (58.2%) of the infected with sequelae group displayed significant symptoms of depression, as measured by PHQ-9, while 15 (16.1%) of the non-infected group, 9 (11.3%) of the infected without sequelae group, and 24 (43.6%) of the infected with sequelae group displayed significant symptoms of anxiety, as measured by GAD-7. In terms of posttraumatic stress, 192 (30.6%) of the non-infected group, 31 (38.8%) of the infected without sequelae group, and 37 (67.3%) of the infected with sequelae group displayed significant symptoms, as measured by ISE-R. Regarding the incidence of clinically significant psychiatric symptoms between the

three groups, the results of the Chi-squared test showed a significant difference in all of the above scales ($P \leq .001$).

Figure 2. Here.

Impact of COVID-19 sequelae on mental health

The results of the multivariate logistic model revealed that the risks of having more severe scores on all clinical scales (FCV-19S, PHQ-9, GAD-7, and ISE-R) were 2.476 to 4.638 times higher among patients with sequelae: FCV-19S: 4.06 (95% CI: -1.565-10.560); PHQ-9: 3.380 (95% CI: 1.541-7.412); GAD-7: 4.638 (95% CI: 1.72-12.509); ISE-R: 2.476 (95% CI: 1.147-5.342) (see Table 3).

Table 3. Here.

Discussion

The principal findings

The objective of the present study was to identify the sequelae after COVID-19 and investigate the relationship between sequelae and mental health status. We conducted an online survey in two countries and collected valid responses from a total of 763 participants, including 135 with a history of COVID-19. Of the 135 participants after COVID-19, 40.7% ($n = 55/135$) had some sequelae of COVID-19. The major physical sequelae of COVID-19 reported were olfactory disorder (10.4 to 12.6%), dysgeusia (4.2% to 12.6%), and malaise (11.5% to 18.8%). The COVID-19-infected respondents showed greater incidence of all mental health symptoms investigated in this study, including symptoms of COVID-19-related anxiety, depression, generalized anxiety, and post-traumatic stress. Greater impairment of mental health was observed in COVID-19 infected respondents with sequelae than in those without sequelae. Furthermore, the

results of our logistic regression analysis suggested that mental health was impaired in the presence of sequelae after COVID-19.

The implications of the findings

In the study, 43.0% (n = 58/135) of the participants after COVID-19 scored in the psychopathological range on the self-assessed psychological scales suggesting that they may meet the criteria for a mental disorder; 39.3% (n=53/135) may have had depression, 24.4% (n=33/135), anxiety disorder, and 50.4% (n = 68/135), PTSD. The participants infected SARS-CoV-2 had significant psychiatric symptoms compared to the participants had not be infected. The results are consistent with those of (i) a cohort study of inpatients with COVID-19 for a one-month period in Helsinki,²⁵ (ii) a British community cohort study,²⁶ and (iii) an American electronic health record network cohort study.²⁷ The latest systematic review shows that the incidence of depressive symptoms is 10.0–68.5%, that of clinically significant anxiety is 5.0–55.2%, acute and post-traumatic stress is 7.0–36.4%, and fatigue is 12.7–88.6%.²⁸ The evidence indicates that SARS-CoV-2 infection may increase the risk of developing mental disorders such as depression, anxiety disorders, and PTSD.²⁷

The incidence of long-term COVID-19 health hazards was 40.7% (n = 55/135) after COVID-19 among Japanese and Swedish participants in the present study; relatively common sequelae were cough (40.1%), malaise (14.1%), dysgeusia (9.6%), and olfactory disorder (8.9%). The most frequently observed sequela of COVID-19 in our study is cough. These results are consistent with previous studies in which most patients had abnormal respiratory function at 3 months,²⁹ meaning that patients with acute symptoms of COVID-19 that were severe enough to require occasional ventilation

may have impaired long-term respiratory function. Fatigue was reported at 14.1% in infected respondents in this study. Fatigue after COVID-19 may be associated with lung, cardiovascular, liver, kidney, cognitive, and neural function in some SARS-CoV-2 infected individuals experiencing serious complications during the acute phase.³⁰⁻³⁴

Furthermore, the logistic regression analysis showed that the participants with sequelae after COVID-19 were at a higher risk of developing mental disorders than those without sequelae. Historically, non-major symptoms of infectious diseases have been neglected; a COVID-19 long-hauler reported that his medical doctor/practitioners disbelieved his physiological distress.³⁵ The results from our study can provide practitioners and clinicians with evidence of late-onset long-term symptoms in SARS-CoV-2 infected individuals and suggestions for the risk of subsequent development of mental disorders. The findings also contain information that will help medical policymakers make decisions, highlighting the need to provide long-term medical-psychosocial support services to patients infected SARS-CoV-2.

Of the non-infected people in the present study, 30.3% exceeded the PHQ-9 cutoff. Our finding is similar to the results of the latest meta-analysis that reported that the pooled prevalence of depression during the COVID-19 pandemic was 25% (ranging from 7.45% to 48.3%).³⁶ Therefore, although caution is required in the interpretation due to the non-random sampling procedure, our results indicate that clinically significant depressive symptoms in the general population in Japan and Sweden might be common during the COVID-19 pandemic. In the United States, Ettman et al. (2020) reported that the prevalence of clinical significantly depressive symptoms (the total PHQ-9 score ≥ 10) in the general population increased from 8.5% to 27.8% during the COVID-19 pandemic.³⁷ Without public health crises such as the COVID-19 pandemic,

the ratio of PHQ-9 scores above this threshold for the general adult population has been approximately 6%: 6.5% in South Korea, 5.7% in Japan, and 6.4% in 27 European countries.³⁸ A recent meta-analysis also suggested a one-year prevalence of depression of 7.2% in 30 countries around the world.³⁹ Hence, our results add to previous studies by suggesting a significant impact on mental health in the general population from the COVID-19 pandemic.

Strengths, Limitations, and directions for future research

The present research has four strengths. First, our results suggest that COVID-19 sequelae represent a risk for mental illness, and they have deepened our knowledge of the relationship between sequelae of COVID-19 and mental disorders. Second, participants in the present study also included data on patients with relatively mild COVID-19 who have not been hospitalized. Thus, the findings of this study may be applicable to patients with differing severities of COVID-19. Third, the present study population was diverse because this study was conducted in two geographical regions, Eastern Asia and Northern Europe (Table 1). The fourth strength is that the participants have not been intentionally exposed and treated by a particular medical facility because the present research was an online study of cross-sectional study design (Wang and Cheng, 2020).⁴⁰

The limitations of the present study include the nature of the sample, the test format, and accessibility. First, in the survey most respondents were adults in their 20s and 30s in the Swedish data set. In contrast, there were few respondents aged 50 years or older. Elderly people, who often have chronic physical illnesses, are a group that demonstrate more serious symptoms of COVID-19,^{41, 42} which can be more detrimental

to sequelae and mental health.⁴³ In future studies, conducting research with a larger sample size and analyzing them by age group is necessary. Second, all mental health measures were rated on a self-rating scale. Although the data collected was well-validated and the severity of clinical symptoms was credible, clinical symptoms alone do not confirm any mental disorders. In the future, cross-sectional populations should be assessed using telephone interview and using diagnostic classification tests conducted in semi-structured interviews by trained clinicians. The final limitation was that the population may have belonged to a relatively wealthy social class with a high degree of education, information and communication technology (ICT) literacy, and possession of an internet environment and devices. Populations who have access to the current online research will probably have more opportunities to learn about coping strategies and receive medical services for sequelae, as they will also have access to appropriate medical information via the internet. The prognosis of COVID-19 may be worse than the results of this study when a population sample with low ICT literacy and low education level is included. That is, the results of this study may have provided more optimistic data. For future research, it is recommended to include community samples through face-to-face assessment.

Conclusions

The result of our research suggests that sequelae occur in about 40% after COVID-19. The SARS-CoV-2 infection may cause long- and short-term health hazards and increase the risk of mental disorders. Therefore, medical policy regarding COVID-19 should include long-term clinical practice to address long-term symptoms and mental health risks.

List of abbreviations

COVID-19: Coronavirus disease 2019

FCV-19S:: Fear of COVID-19 Scale

GAD-7: General Anxiety Disorder-7 -item

ICT: Information and Communication Technology

IES-R: Impact of Event Scale-Revised

PHQ-9: Patient Health Questionnaire-9

PTSD: Post-Traumatic Stress Disorder

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2

(i) Disclosure statement

Ethics approval and consent to participate

The protocol for the current observational study was reviewed and approved by the Chiba University Graduate School of Medicine Ethics Review Committee (approval number 4129). The current research was conducted in accordance with the “Ethical Guidelines for Life Science and Medical Research for Human,” which is guideline for clinical research in Japan and the provisions of the Declaration of Helsinki. Participants were explained in an online survey that answering questions would be considered consent. Participants have effective discernment because they are adults over the age of 18 and ICT skills are required to response questions on the website. Therefore, in the current research, consent was obtained only from the individual, even if he / she had a mental illness; the Institutional Review Board determined that consent from a guardian

or guardian was not required. In addition, the need for ethics approval was deemed unnecessary according to national Swedish regulations as no identifiable sensitive personal data were collected "Law (2003:460) on ethics review of research involving humans".

Consent for publication

NOT APPLICABLE.

Availability of data and materials

The datasets analysed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare no conflicts of interest associated with this manuscript.

Funding

The present research was supported by the Daiwa Securities Health Foundation Ordinance 2nd Year Coronavirus Infectious Diseases (COVID-19) Research Grant "COVID-19 International Comparative Study on Mental Health of Infected Persons".

Authors' contributions

Author Contributions

KM, SH, ES, and GA contributed to the concept and design. KM, SH, and AK performed acquisition and interpretation of data. KM and SH drafted the manuscript. SH performed statistical analysis and obtained funding for the present study. ES, and GA supervised the overall conduct of the study. All authors contributed to critical revision of the manuscript for important intellectual content.

Acknowledgements

We would like to express our utmost gratitude to the participants. We wish to thank George Vlaescu for his role as webmaster in the survey.

(ii) Figure legends

Figure 1. The results of the Kruskal-Wallis test

Figure 2. The incidence of clinically significant psychiatric symptoms

(iii) References

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(ixi) A list of supporting information if relevant

None.

(iv) Tables

Table 1. Demographic data of the participants

	Overview			Japanese			Swedish		
	Total (n = 763)	Non-infected people (n = 628)	Infected people (n = 135)	Total (n = 387)	Non-infected people (n = 300)	Infected people (n = 87)	Total (n = 376)	Non-infected people (n = 338)	Infected people (n = 48)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Gender									
Women	269 (35.3)	402 (64.0)	50 (37.0)	138 (35.7)	107 (35.7)	31 (35.6)	131 (34.8)	112 (34.1)	19 (39.6)
Men	487 (63.8)	219 (34.9)	85 (63.0)	249 (64.3)	193 (64.3)	56 (64.4)	238 (63.3)	209 (63.7)	29 (60.4)
Prefer not to say	7 (0.9)	7 (1.1)	-	-	-	-	7 (1.9)	7 (2.1)	-
Age^a	36.7 ± 15.1	36.4 ± 15.0	38.3 ± 15.7	43.9 ± 16.6	43.9 ± 16.8	43.8 ± 15.9	29.3 ± 8.6	29.5 ± 8.6	28.2 ± 9.1
Education									
Junior high school graduate	36 (4.7)	30 (4.8)	6 (4.4)	10 (2.6)	8 (2.7)	2 (2.3)	26 (6.9)	22 (6.7)	4 (8.3)
High school graduate	274 (35.9)	231 (36.8)	43 (31.9)	98 (25.3)	81 (27.0)	17 (19.5)	176 (46.8)	150 (45.7)	26 (54.2)

Vocational school/junior college graduate	83 (10.9)	68 (10.8)	15 (11.1)	53 (13.7)	40 (13.3)	13 (14.9)	30 (8.0)	28 (8.5)	2 (4.2)
University graduate or above	370 (48.5)	299 (47.6)	71 (52.6)	226 (58.4)	171 (57.0)	55 (63.2)	144 (38.3)	128 (39.0)	16 (33.3)
Household income									
≤ 4270,000 JPY or ≤ 380,000 SEK	367 (48.1)	308 (49.0)	59 (43.7)	162 (41.9)	130 (43.3)	32 (36.8)	205 (54.5)	178 (54.3)	27 (56.3)
> 4270,000 JPY or > 380 000 SEK	396 (51.9)	320 (51.0)	76 (56.3)	225 (58.1)	170 (56.7)	55 (63.2)	171 (45.5)	150 (45.7)	21 (43.8)
Worker status									
Full time	371 (48.6)	291 (46.3)	80 (59.3)	208 (53.7)	148 (49.3)	60 (69.0)	163 (43.4)	143 (43.6)	20 (41.7)
Part time	76 (10.0)	63 (10.0)	13 (9.6)	59 (15.2)	48 (16.0)	11 (12.6)	17 (4.5)	15 (4.6)	2 (4.2)
Unemployed	155 (20.3)	137 (21.8)	18 (13.3)	88 (22.7)	75 (25.0)	13 (14.9)	67 (17.8)	62 (18.9)	5 (10.4)
Student	161 (21.1)	137 (21.8)	24 (17.8)	32 (8.3)	29 (9.7)	3 (3.4)	129 (34.3)	108 (32.9)	21 (43.8)
Living status									
Alone	202 (26.5)	165 (26.3)	37 (27.4)	94 (24.3)	72 (24.0)	22 (25.3)	108 (28.7)	93 (28.4)	15 (31.3)
With family or partner	546 (71.6)	451 (71.8)	95 (70.4)	290 (74.9)	226 (75.3)	64 (73.6)	256 (68.1)	225 (68.6)	31 (64.6)
With others	15 (2.0)	12 (1.9)	3 (2.2)	3 (0.8)	2 (0.7)	1 (1.1)	12 (3.2)	10 (3.0)	2 (4.2)

Diagnosed mental disorders									
Yes	226 (29.6)	168 (26.8)	58 (43.0)	92 (23.8)	53 (17.7)	39 (44.8)	134 (35.6)	115 (35.1)	19 (39.6)
No	537 (70.4)	460 (73.2)	77 (57.0)	295 (76.2)	247 (82.3)	48 (55.2)	242 (64.4)	213 (64.9)	29(60.4%)
Physical illness									
Yes	192 (25.2)	138 (22.0)	54 (40.0)	115 (29.7)	68 (22.7)	47 (54.0)	77 (20.5)	70 (21.3)	7 (14.6)
No	571 (74.8)	490 (78.0)	81 (60.0)	272 (70.3)	232 (77.3)	40 (46.0)	299 (79.5)	258 (78.7)	41 (85.4)
Taken vaccine for COVID-19									
Yes	78 (10.2)	37 (5.9)	41 (30.4)	41 (10.6)	4 (1.3)	37 (42.5)	37 (9.8)	33 (10.1)	4 (8.3)
No	685 (89.8)	591 (94.1)	94 (69.6)	346 (89.4)	296 (98.7)	50 (57.5)	339 (90.2)	295 (89.9)	44 (91.7)
Infected with SARS-CoV-2									
Yes	135 (17.7)	-	135 (17.7)	87 (22.5)	-	87 (22.5)	48 (12.8)	-	48 (12.8)
No	628 (82.3)	628 (82.3)	-	300 (77.5)	300 (77.5)	-	328 (87.2)	328 (87.2)	-
a Mean ± SD									

Table 2. Demographic data of participants infected with SARS-CoV-2

	Overview			Japanese			Swedish		
	Non-infected people (n= 628)	Without sequelae (n = 80)	With sequelae (n = 55)	Non-infected people (n = 300)	Without sequelae (n = 47)	With sequelae (n =40)	Non-infected people (n = 328)	Without sequelae (n = 33)	With sequelae (n = 15)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age^b	36.4 ± 15.0	38.0 ± 16.5	38.6 ± 14.7	43.9 ± 16.8	45.28 ± 16.7	42.1 ± 14.9	29.5 ± 8.6	27.6 ± 9.0	29.4 ± 9.4
Diagnosed mental illness (yes)	168 (26.8)	25 (31.3)	33 (60.0)	53 (17.7)	14 (29.8)	25 (62.5)	115 (35.1)	11 (33.3)	8 (53.3)
Depression	129 (20.5)	14 (17.5)	21 (38.2)	40 (13.3)	6 (12.8)	15 (37.5)	89 (27.1)	8 (24.2)	6 (40.0)
Bipolar disorder or schizophrenia	12 (1.9)	4 (5.0)	8 (14.5)	8 (2.7)	2 (4.3)	8 (20.0)	4 (1.2)	2 (6.1)	-
Anxiety disorder	65 (10.4)	6 (7.5)	16 (29.1)	14 (4.7)	3 (6.4)	14 (35.0)	51 (15.5)	3 (9.1)	2 (13.3)
PTSD	11 (1.8)	2 (2.5)	5 (9.1)	2 (0.7)	2 (4.3)	5 (12.5)	9 (2.7)	-	-
OCD	10 (1.6)	2 (2.5)	6 (10.9)	1 (0.3)	1 (2.1)	6 (15.0)	9 (2.7)	1 (3.0)	1 (13.3)
Panic disorder	27 (4.3)	5 (6.3)	11 (20.0)	9 (3.0)	4 (8.5)	10 (25.0)	18 (5.5)	1 (3.0)	1 (6.7)

Eating disorders	16 (2.5)	3 (3.8)	6 (10.9)	1 (0.3)	3 (6.4)	4 (10.0)	15 (4.6)	-	2 (13.3)
Substance Use Disorder	4 (0.6)	3 (3.8)	6 (10.9)	-	3 (6.4)	5 (12.5)	4 (1.2)	-	1 (6.7)
ADHD	5 (0.8)	1(1.3)	1 (1.8)	-	-	-	5 (1.5)	1 (3.0)	1 (6.7)
ADD	1 (0.2)	-	-	-	-	-	1 (0.3)		
ASD	5 (0.8)	-	-	1 (0.3)	-	-	4 (1.2)	-	-
Schizophrenia personality disorder	1 (0.2)	-	-		-	-	1 (0.3)		
Borderline personality disorder	1 (0.2)	-	-		-	-	1 (0.3)		
Physical illness (yes)	138 (22.0)	21 (26.3)	33 (60.0)	68 (22.7)	17 (36.2)	30 (75.0)	70 (21.3)	4 (12.1)	3 (20.0)
High blood pressure	51 (8.1)	12 (15.0)	25 (45.5)	43 (14.3)	11 (23.4)	25 (62.5)	8 (2.4)	1 (3.0)	-
Asthma	48 (7.6)	6 (7.5)	12 (21.8)	13 (4.3)	3 (6.4)	9 (22.5)	35 (10.7)	3 (9.1)	3 (20.0)
Diabetes	23 (3.7)	6 (7.5)	11 (20.0)	15 (5.0)	5 (10.6)	11 (27.5)	8 (2.4)	1 (3.0)	-
Cancer		2 (2.6)		-	2 (4.2)	-	-	-	-
Renal failure		1 (1.3)	-	-	1 (2.1)	-	-	-	-
Chronic nephritis		1 (1.3)	-	-	1 (2.1)	-	-	-	-
Other	28 (4.5)			8 (2.7)			20 (6.1)		
Hospitalization (yes)	-	21 (26.3)	27 (49.1)	-	21 (44.7)	27 (67.5)	-	-	-

Ventilator	-	9 (11.3)	14 (25.5)	-	9 (19.1)	14 (35.0)	-	-	-
Days to recovery ^b	-	24.1 ± 31.2	33.8 ± 37.7	-	31.7 ± 35.0	33.9 ± 32.2	-	15.8 ± 16.3	33.3 ± 50.8
Infectious symptoms (yes)	-	65 (81.3)	55 (100.0)	-	35 (74.5)	40 (100)	-	30 (90.9)	15 (100.0)
Heat	-	43 (53.8)	40 (72.7)	-	26 (55.3)	28 (70.0)	-	17 (51.5)	12 (80.0)
Cough	-	26 (32.5)	27 (49.1)	-	10 (21.3)	19 (47.5)	-	16 (48.5)	8 (53.3)
Fatigue, tiredness	-	37 (46.3)	28 (50.9)	-	13 (27.7)	17 (42.5)	-	24 (72.7)	11 (73.3)
Dyspnea	-	5 (6.3)	11 (20.0)	-	3 (6.4)	10 (25.0)	-	2 (6.1)	1 (6.7)
Smell disorder	-	13 (16.3)	19 (34.5)	-	3 (6.4)	11 (27.5)	-	10 (30.3)	8 (53.3)
Dysgeusia	-	18 (22.5)	19 (34.5)	-	6 (12.8)	12 (30.0)	-	12 (36.4)	7 (46.7)
Increased sputum	-	8 (10.0)	9 (16.4)	-	2 (4.3)	5 (12.5)	-	6 (18.2)	4 (26.7)
Chest pain	-	4 (5.0)	11 (20.0)	-	2 (4.3)	9 (22.5)	-	2 (6.1)	2 (13.3)
Joint pain	-	10 (12.5)	17 (30.9)	-	2 (4.3)	8 (20.0)	-	8 (24.2)	9 (60.0)
Muscle pain	-	10 (12.5)	13 (23.6)	-	1 (2.1)	8 (20.0)	-	9 (27.3)	5 (33.3)
Headache	-	22 (27.5)	17 (30.9)	-	3 (6.4)	9 (22.5)	-	19 (57.6)	8 (53.3)
Palpitations	-	1 (1.3)	9 (16.4)	-	1 (2.1)	5 (12.5)	-	-	4 (26.7)
Hair loss	-	1 (1.3)	3 (5.5)	-	1 (2.1)	3 (7.5)	-	-	-

Insomnia	-	4 (5.0)	4 (7.3)	-	1 (2.1)	2 (5.0)	-	3 (9.1)	2 (13.3)
Anxiety	-	4 (5.0)	7 (12.7)	-	3 (6.4)	5 (12.5)	-	1 (3.0)	2 (13.3)
Depression	-	3 (3.8)	6 (10.9)	-	2 (4.3)	4 (10.0)	-	1 (3.0)	2 (13.3)
Sore throat	-	4 (5.0)	3 (5.5)	-	2 (4.3)	2 (5.0)	-	2 (6.1)	1 (6.7)
Urination disorder	-	1 (1.3)	-	-	1 (1.1)	-	-	-	-
Nasal congestion	-	-	1 (1.8)	-	-	1 (2.5)	-	-	-
Chills	-	1 (1.3)	-	-	1 (1.1)	-	-	-	-
Diarrhea	-	-	1 (1.8)	-	-	-	-	-	1 (6.7)
Nosebleed	-	1 (1.3)	-	-	-	-	-	1 (3.0)	-
Herpes labialis	-	1 (1.3)	-	-	-	-	-	1 (3.0)	-
Common cold	-	1 (1.3)	-	-	-	-	-	1 (3.0)	-
Respiratory tract infection	-	1 (1.3)	-	-	-	-	-	1 (3.0)	-
Sequelae(yes)	-	-	-	-	-	-	-	-	-
Heat	-	-	7 (12.7)	-	-	4 (10.0)	-	-	3 (20.0)
Cough	-	-	8 (14.5)	-	-	6 (15.0)	-	-	2 (13.3)
Fatigue, tiredness	-	-	19 (34.5)	-	-	10 (25.0)	-	-	9 (60.0)
Dyspnea	-	-	5 (9.1)	-	-	4 (10.0)	-	-	1 (6.7)

Smell disorder	-	-	12 (21.8)	-	-	7 (17.5)	-	-	5 (33.3)
Dysgeusia	-	-	13 (23.6)	-	-	11 (27.5)	-	-	2 (13.3)
Increased sputum	-	-	6 (10.9)	-	-	4 (10.0)	-	-	2 (13.3)
Chest pain	-	-	7 (12.7)	-	-	6 (15.0)	-	-	1 (6.7)
Joint pain	-	-	5 (9.1)	-	-	3 (7.5)	-	-	2 (13.3)
Muscle pain	-	-	6 (10.9)	-	-	4 (10.0)	-	-	2 (13.3)
Headache	-	-	5 (9.1)	-	-	3 (7.5)	-	-	2 (13.3)
Palpitations	-	-	6 (10.9)	-	-	5 (12.5)	-	-	1 (6.7)
Hair loss	-	-	5 (9.1)	-	-	4 (10.0)	-	-	1 (6.7)
Insomnia	-	-	5 (9.1)	-	-	3 (7.5)	-	-	2 (13.3)
Anxiety	-	-	9 (16.4)	-	-	7 (17.5)	-	-	2 (13.3)
Depression	-	-	7 (12.7)	-	-	4 (10.0)	-	-	3 (20.0)
Sore throat	-	-	1 (1.8)	-	-	1 (2.5)	-	-	-
Feeling like stinging in your left hand	-	-	1 (1.8)	-	-	-	-	-	1 (6.7)
Clinical scales							-	-	
FCV-19S \geq 18	269 (42.8)	35 (43.8)	40 (72.7)	191 (63.7)	31 (66.0)	36 (90.0)	78 (23.8)	4 (12.1)	4 (26.7)

FCV-19S < 17	359 (57.2)	45 (56.3)	15 (19.5)	109 (36.3)	16 (34.0)	4 (10.0)	250 (76.2)	29 (87.9)	11 (73.3)
PHQ ≥10	190 (30.3)	21 (26.3)	32 (58.2)	72 (24.0)	14 (30.0)	25 (62.5)	118 (36.0)	7 (21.2)	7 (46.7)
PHQ < 9	438 (69.7)	59 (73.8)	23 (41.8)	228 (76.0)	33 (70.2)	15 (37.5)	210 (64.0)	26 (78.8)	8 (53.3)
GAD ≥10	15 (16.7)	9 (11.3)	24 (43.6)	45 (15.0)	7 (14.9)	20 (50.0)	60 (18.3)	2 (6.1)	4 (26.7)
GAD < 9	523 (83.3)	71 (88.8)	31 (56.4)	255 (85.0)	40 (85.1)	20 (50.0)	268 (81.7)	31 (93.9)	11 (73.3)
IES-R ≥ 25	192 (30.6)	31 (38.8)	37 (67.3)	95 (31.7)	21 (44.7)	30 (75.0)	97 (29.6)	10 (30.3)	7 (46.7)
IES-R < 24	436 (69.4)	49 (61.3)	18 (32.7)	205 (68.3)	26 (55.3)	10 (25.0)	231 (70.4)	23 (69.7)	8 (53.3)
b Mean ± SD									

Note. ADD, attention deficit disorder; ADHD, attention deficit hyperactivity disorder; ASD, autism spectrum disorder; COVID-19, coronavirus disease 2019; IES-R, impact of events scale-revised; FCV-19S, fear of COVID-19 scales; GAD-7, generalized anxiety disorder-7 items; OCD, obsessive-compulsive disorder; PHQ-9, patients health questionnar-9 items; PTSD, post-traumatic stress disorder

Table 3. The results of the logistic regression model

Variable		β	<i>SE</i>	Odd ratios	95%CI		<i>P-value</i>
Dependent	Independent						
FCV-19S	Country	3.08	0.53	21.73	7.74	61.01	< .001
	Sequelae	1.40	0.49	4.07	1.57	10.56	.004
	Gender	1.14	0.51	3.11	1.15	8.45	.026
PHQ-9	Sequelae	1.22	0.40	3.38	1.54	7.41	.002
	Gender	1.03	0.42	2.80	1.22	6.44	.015
	Mental illness	0.94	0.40	2.55	1.17	5.56	.018
GAD-7	Country	1.79	0.61	5.96	1.79	19.86	.004
	Sequelae	1.53	0.51	4.64	1.72	12.51	.002
	Mental illness	1.41	0.51	4.10	1.52	11.09	.005
	Age	-0.05	0.02	0.95	0.91	0.99	.009
IES-R	Ventilator	-0.90	0.28	4.88	1.48	16.08	.009
	Sequelae	1.58	0.61	2.48	1.15	5.34	.021
	Mental illness	0.91	0.39	2.16	1.01	4.61	.048

Note. CI, confidence interval; FCV-19S, fear of COVID-19 scale; GAD-7, deneralised anxiety disorder 7-item scale ; IES-R, impact of event scale-revised; ; PHQ-9, patient health questionnaire 9-item scale; SE, standard error.

Figures

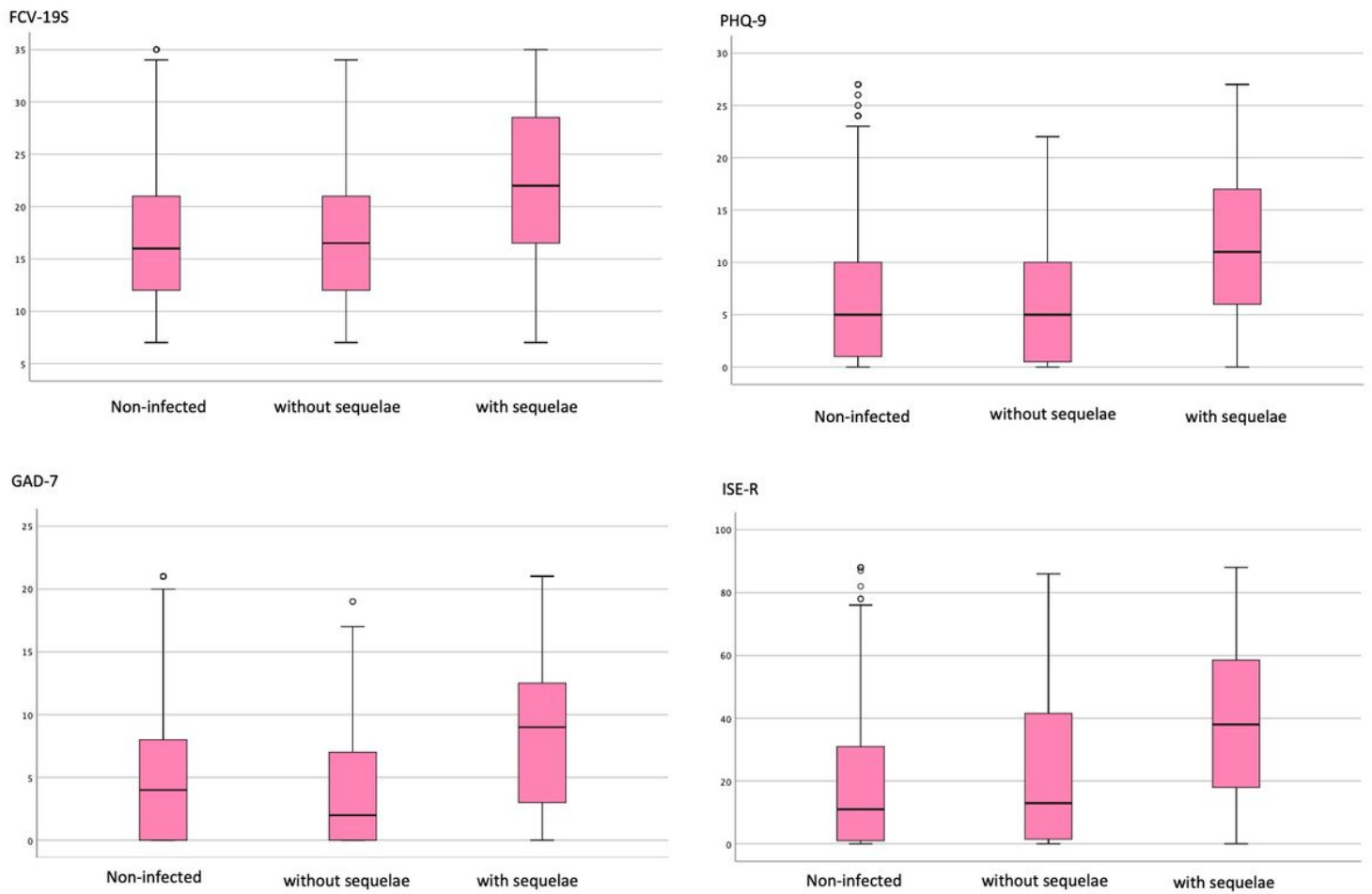


Figure 1

The results of the Kruskal-Wallis test

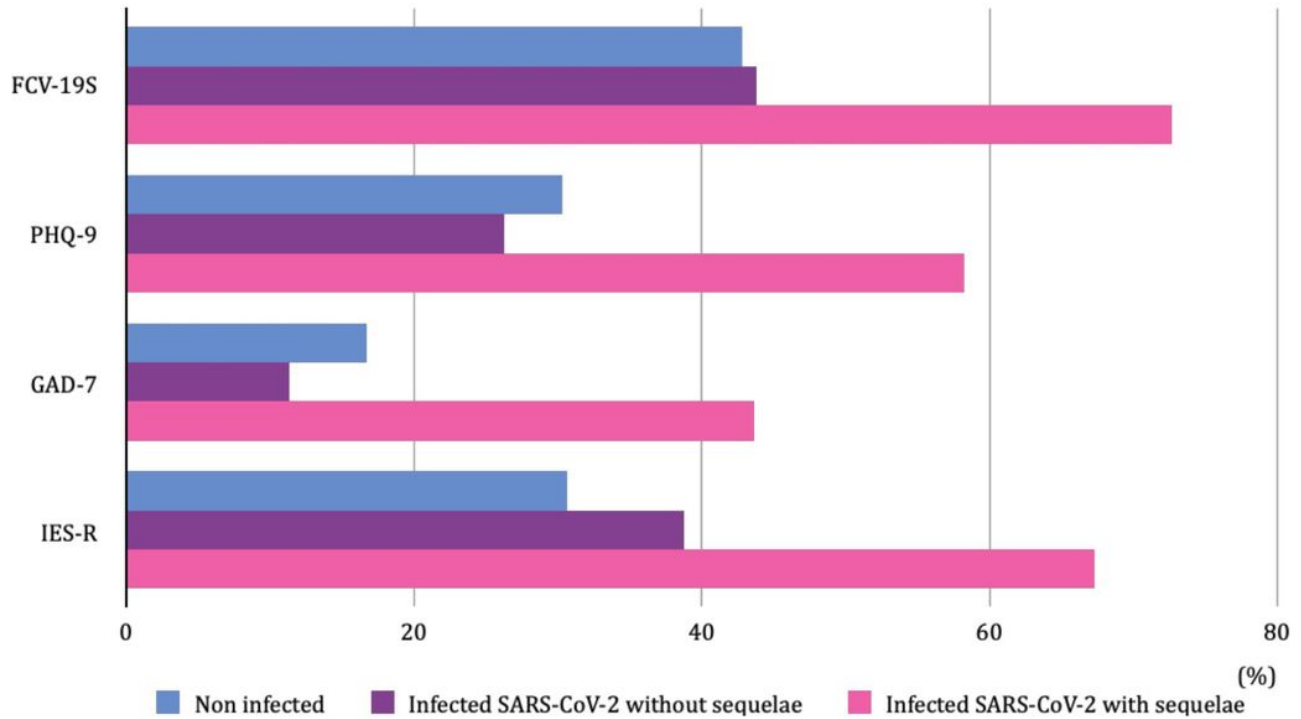


Figure 2

The incidence of clinically significant psychiatric symptoms

Supplementary Files

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