

Comparison of Mental Health among Japanese Healthcare Workers at Two Points during the COVID-19 Pandemic

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Background: The prolonged pandemic of coronavirus disease 2019 (COVID-19) has resulted in mental burden among healthcare workers (HCWs). This study aimed to conduct a repeated study to assess changes in psychological concerns among Japanese HCWs.

Methods: This study is the second survey involving HCWs at the Japanese Red Cross Medical Center conducted between November 20, 2020 and December 4, 2020. The degree of symptoms of anxiety, depression, and resilience was assessed using the Japanese versions of the 7-item Generalized Anxiety Disorder Scale, Center for Epidemiologic Studies Depression Scale, and 10-item Connor-Davidson Resilience Scale, respectively.

Results: The survey included 594 HCWs, comprising 95 physicians, 261 nurses, 150 other co-medical staff, and 88 office workers. Among them, 46 (7.7%) and 152 (25.6%) developed moderate-to-severe symptoms of anxiety and depression, respectively. Compared with those in the initial survey conducted 6 months earlier, the resilience score did not change, whereas the anxiety and depression scores improved significantly ($P < 0.001$, $P = 0.033$, respectively). However, the frequency of HCWs developing moderate-to-severe symptoms of anxiety or depression did not significantly improve. Multivariable logistic regression analysis showed that having higher anxiety symptoms was a risk factor for depression symptoms, while older HCWs and those with higher resilience were less likely to develop depression symptoms.

Conclusions: Many HCWs still suffer from psychological concerns during the COVID-19 pandemic. (J Nippon Med Sch 2022; 89: 328–336)

Key words: anxiety, coronavirus disease 2019, depression, healthcare worker, resilience

Introduction

Coronavirus disease 2019 (COVID-19) has spread exponentially worldwide¹. In Japan, more than 800,000 infected patients and 15,000 deaths were recorded as of mid-July 2021². Numerous countries have taken various preventive measures, and effective treatment methods have been reported^{3,4}. Vaccinations have also been initiated⁵. However, the pandemic has not yet been totally

controlled.

Since February 2020, more than 400 patients with COVID-19 have been treated at our hospital located in the center of Tokyo. Medical healthcare workers (HCWs) involved in the treatment of patients with COVID-19 have been greatly affected both physically and mentally. HCWs would be suffering from severe mental and physical fatigue because of the fear of being infected, of infect-

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ing their families and colleagues, and of the death of many patients not only in the workplace but also in their daily lives. In April and May of 2020, all HCWs in our hospital participated in a survey, which revealed that 10.0% of them developed moderate-to-severe symptoms of anxiety and 27.9% had symptoms of depression⁶. Similarly, a systematic review reported on mental disorders among HCWs during the COVID-19 pandemic and found that the prevalence of anxiety was 33%, whereas that of depression was 28%⁷. Another meta-analysis conducted on COVID-19 HCWs in Asian countries showed that the pooled prevalence for anxiety, depression, and insomnia was 23.20%, 22.8%, and 34.32%, respectively⁸. Indeed, numerous HCWs from various countries affected with COVID-19 suffer from heavy psychological distress. As the COVID-19 pandemic prolongs, long-term mental health problems, post-traumatic stress disorder (PTSD), and burnout among HCWs could become serious problems. Hence, HCWs need psychological intervention to alleviate such symptoms.

Although many cross-sectional studies on psychological concerns among HCWs during the COVID-19 outbreak period have been conducted, only few repeated studies have been reported. Therefore, we conducted a second in-hospital survey to investigate changes in the mental health of HCWs over time.

Materials and Methods

Participants

This second in-hospital survey was conducted between November 20, 2020 and December 4, 2020, involving all HCWs employed at the Japanese Red Cross Medical Center. A total of 1,964 workers were targeted, consisting of 411 physicians, 1,024 nurses, 328 other co-medical staff (such as pharmacists, laboratory technologists, radiological technologists, nutritionists, physical therapists, clinical psychologists, medical engineers, public health nurses, nursing assistants, and medical social workers), and 201 office workers. Those who were directly engaged in the treatment of patients with COVID-19 were defined as frontline workers.

Questionnaire

As in the first survey, the present survey was conducted on the institute website using an electronic medical record, maintaining anonymity. The content of the questionnaire was exactly the same as in the first survey. The questionnaire items included the occupation type, age, sex, and presence or absence of direct engagement in the treatment of patients with COVID-19. To assess the

mental health of HCWs, we used the Japanese versions of the 7-item Generalized Anxiety Disorder Scale (GAD-7), the Center for Epidemiologic Studies Depression Scale (CES-D), and the 10-item Connor-Davidson Resilience Scale (CD-RISC 10), which are all useful for assessing anxiety symptoms, depression, and resilience, respectively; they are also reliable and available to the Japanese population⁹⁻¹⁴. The GAD-7 measured the frequency of seven anxiety symptoms occurring in the previous 2 weeks (range: 0-21). The CES-D, which comprises 20 items, assessed depression symptoms according to the total score obtained (range: 0-60). The total scores of these scales were interpreted as follows: no/minimal (0-4), mild (5-9), moderate (10-14), and severe (15-21) anxiety for GAD-7, and normal (0-15) and depression (16-60) for CES-D^{9,10}. Meanwhile, the CD-RISC 10 measure the level of self-perceived resilience and consists of 10 items which are rated on a 5-point Likert scale (range: 0-40). The cut-off value for this scale depends on multiple factors and higher scores are interpreted as higher resilience^{13,14}. Jonathan R.T. Davidson permitted us to use the CD-RISC 10. As in the first survey, we added the original questionnaires in Japanese to investigate the following three factors: (i) anxiety and fear of infection and death (10 items); (ii) isolation and unreasonable treatment (5 items); and (iii) motivation and escape behavior at work (3 items) (**Supplementary Table 1**; https://doi.org/10.1272/jnms.JNMS.2022_89-308)⁶. Each question had four possible answers interpreted as follows: 0 (Not applicable at all), 1 (A little applicable), 2 (Almost applicable), and 3 (Applicable).

Statistical Analysis

Continuous variables are expressed as medians with interquartile ranges (IQRs). In addition, we compared continuous variables between two or more groups by using the Mann-Whitney U test and Kruskal-Wallis test. Meanwhile, categorical variables were analyzed by chi-squared test. Multivariable logistic regression analysis was performed to determine the potential risk factors of depression symptoms (total CES-D score ≥ 16 points). The association between risk factors and outcomes was presented as odds ratios (ORs) and 95% confidence intervals (CIs). All statistical data were analyzed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria). A two-tailed $P < 0.05$ denoted a statistically significant difference.

Table 1 Demographic characteristics of the participants of the second survey

	Overall	Physicians	Nurses	Other co-medical staff*	Office workers
Workers, n	1,964	411	1,024	328	201
Participants, n (%)	594 (30.2)	95 (23.1)	261 (25.5)	150 (45.7)	88 (43.8)
Age, median (IQR), years	40 (31–50)	41 (34–49)	38 (30–46)	43 (33–53)	43 (32–51)
Males, n	175	66	14	68	27
Frontline workers, n	215	58	122	32	3

Continuous variables are presented as the median with interquartile range (IQR).

IQR: interquartile range

* pharmacists, laboratory technologists, radiological technologists, nutritionists, physical therapists, clinical psychologists, medical engineers, public health nurses, nursing assistants, and medical social workers

Ethics Statement

The Ethics Committee for Clinical Studies in Japanese Red Cross Medical Center approved our study (No. 1123; May 20, 2020). In accordance with the principles of the Declaration of Helsinki, all participants provided informed consent.

Results

Demographic Characteristics

Table 1 summarizes the demographic characteristics of the participants. Among the 1964 HCWs who received the questionnaire, 594 (30.2%) participated in the survey, comprising 95 physicians, 261 nurses, 150 other co-medical staff, and 88 office workers, with response rates of 23.1%, 25.5%, 45.7%, and 43.8%, respectively. The median age of all participants was 40 years, with 175 males and 419 females. A total of 215 participants were frontline workers, and most of them were nurses (122 nurses).

Supplementary Table 2 (https://doi.org/10.1272/jnms.JNMS.2022_89-308) lists the characteristics of the respondents of the first survey, while **Supplementary Table 3** (https://doi.org/10.1272/jnms.JNMS.2022_89-308) compares the respondents between the first and second surveys. The overall response rate decreased from 43.2% to 30.2%. In particular, the response rate of nurses, younger workers, and non-frontline workers decreased significantly ($P = 0.001$, $P < 0.001$, and $P < 0.001$, respectively).

Measurement Scores

Table 2 presents the questionnaire answers. The median GAD-7 score for all participants was 3 (IQR: 1-5); specifically, 548 workers (92.3%) had no or mild anxiety, and 46 workers (7.7%) had moderate-to-severe anxiety. The total GAD-7 score was significantly lower in physicians than in other HCWs ($P = 0.02$). Furthermore, fe-

males scored higher than males ($P < 0.001$).

The median CES-D score was 11 (IQR: 6-16), and 152 HCWs (25.6%) developed depression symptoms. Physicians were less likely to develop depression symptoms than other HCWs ($P = 0.022$). The total CES-D score was significantly high among younger workers ($P = 0.014$) and females ($P = 0.032$) but not significantly different between frontline workers and non-frontline workers ($P = 0.69$).

The total CD-RISC 10 score was significantly high among physicians ($P = 0.002$) and older workers ($P = 0.001$).

In all participants, the median scores of the original questionnaires concerning the three factors, namely, anxiety and fear of infection and death, isolation and unreasonable treatment, and motivation and escape behavior at work, were 10 (IQR: 7-18), 0 (IQR: 0-1), and 1 (IQR: 0-3), respectively. The scores for questionnaires on anxiety and fear of infection and death were lower in physicians, older workers, and males than in other populations. However, all populations obtained tremendously low scores for questionnaires on isolation and unreasonable treatment and on motivation and escape behavior at work.

The potential risk factors of depression symptoms (total CES-D score ≥ 16 points) were examined using multi-variable logistic regression analysis (**Table 3**). The original questionnaire scores were not adopted as explanatory factors because their reliability and validity were not guaranteed. Having high total GAD-7 scores was significantly associated with symptoms of depression (OR: 1.52; 95% CI: 1.40-1.65; $P < 0.001$). On the other hand, older workers and those with high total CD-RISC 10 scores were significantly less likely to develop symptoms of depression (OR: 0.96; 95% CI: 0.94-0.98; $P < 0.001$ and OR: 0.94; 95% CI: 0.91-0.97; $P < 0.001$, respectively).

Table 2 Mental health measurements in the total cohort and subgroups of the second survey

	Occupation type					P-value
	Overall (n = 594)	Physicians (n = 95)	Nurses (n = 261)	Other co-medical staff* (n = 150)	Office workers (n = 88)	
Total GAD-7 score, median (IQR)	3 (1–5)	2 (0–4)	3 (1–5)	3 (1–6)	3 (0–6)	0.002
No/minimal and mild anxiety (0–9 points), n (%)	548 (92.3)	90 (94.7)	241 (92.3)	134 (89.3)	83 (94.3)	0.42
Moderate and severe anxiety (10–21 points), n (%)	46 (7.7)	5 (5.3)	20 (7.7)	16 (10.7)	5 (5.7)	
Total CES-D score, median (IQR)	11 (6–16)	7 (4–12)	11 (6–16)	11 (6–16)	12 (7–17)	0.001
Normal (<16 points), n (%)	442 (74.4)	82 (88.3)	189 (72.4)	110 (73.3)	61 (69.3)	0.022
Depression (≥16 points), n (%)	152 (25.6)	13 (13.7)	72 (27.6)	40 (26.7)	27 (30.7)	
Total CD-RISC 10 score, median (IQR)	22 (17–28)	25 (20–31)	22 (17–27)	22 (17–28)	21 (16–29)	0.002
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	10 (7–18)	8 (5–12)	11 (8–18)	11 (7–18)	11 (8–19)	<0.001
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–0)	0 (0–1)	0 (0–1)	0 (0–1)	0.18
Questions on motivation and escape behavior at work	1 (0–3)	0 (0–2)	2 (0–3)	1 (0–3)	1 (0–3)	<0.001

	Age			Sex		
	Younger workers (<38 years) (n = 256)	Older workers (≥38 years) (n = 338)	P-value	Males (n = 175)	Females (n = 419)	P-value
Total GAD-7 score, median (IQR)	2 (1–5)	3 (1–6)	0.14	2 (0–5)	3 (1–6)	<0.001
No/minimal and mild anxiety (0–9 points), n (%)	242 (94.5)	306 (90.5)	0.059	161 (92.0)	387 (92.4)	0.87
Moderate and severe anxiety (10–21 points), n (%)	14 (5.5)	32 (9.5)		14 (8.0)	32 (7.6)	
Total CES-D score, median (IQR)	12 (7–17)	9 (5–15)	0.014	9 (5–15)	11 (6–16)	0.032
Normal (<16 points), n (%)	184 (71.9)	258 (76.3)	0.22	138 (78.9)	304 (72.6)	0.12
Depression (≥16 points), n (%)	72 (28.1)	80 (23.7)		37 (21.1)	115 (27.4)	
Total CD-RISC 10 score, median (IQR)	21 (17–26)	23 (18–29)	0.001	23 (17–30)	22 (17–27)	0.083
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	12 (7–19)	10 (7–17)	0.06	10 (6–16)	11 (8–19)	0.001
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–1)	0.77	0 (0–1)	0 (0–1)	0.71
Questions on motivation and escape behavior at work	2 (0–3)	1 (0–2)	<0.001	1 (0–3)	1 (0–3)	0.010

	Working position		
	Frontline workers (n = 215)	Non-frontline workers (n = 379)	P-value
Total GAD-7 score, median (IQR)	3 (1–6)	3 (1–5)	0.16
No/minimal and mild anxiety (0–9 points), n (%)	197 (91.6)	351 (92.6)	0.75
Moderate and severe anxiety (10–21 points), n (%)	18 (8.4)	28 (7.4)	
Total CES-D score, median (IQR)	10 (5–15)	11 (6–16)	0.69
Normal (<16 points), n (%)	162 (75.3)	280 (73.9)	0.77
Depression (≥16 points), n (%)	53 (24.7)	99 (26.1)	
Total CD-RISC 10 score, median (IQR)	22 (18–28)	22 (17–28)	0.13
Original questionnaires, median (IQR)			
Questions on anxiety and fear of infection and death	11 (8–18)	10 (7–18)	0.24
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–1)	0.47
Questions on motivation and escape behavior at work	1 (0–3)	1 (0–3)	0.35

Continuous variables are presented as the median with interquartile range (IQR).

GAD-7: 7-item Generalized Anxiety Disorder Scale, IQR: interquartile range, CES-D: Center for Epidemiologic Studies Depression Scale, CD-RISC 10: 10-item Connor–Davidson Resilience Scale

*pharmacists, laboratory technologists, radiological technologists, nutritionists, physical therapists, clinical psychologists, medical engineers, public health nurses, nursing assistants, and medical social workers

Table 3 Risk factors for developing symptoms of depression (total CES-D score \geq 16 points) identified by multivariable logistic regression analysis

	OR	95% CI	P-value
Occupation type			
Physicians	Reference		
Nurses	1.76	0.71–4.35	0.22
Other co-medical staff*	1.66	0.66–4.19	0.28
Office workers	2.40	0.87–6.67	0.093
Age, years	0.96	0.94–0.98	<0.001
Females	0.86	0.46–1.65	0.68
Frontline workers	0.76	0.44–1.33	0.33
Total GAD-7 score	1.52	1.40–1.65	<0.001
Total CD-RISC 10 score	0.94	0.91–0.97	<0.001

CES-D: Center for Epidemiologic Studies Depression Scale, GAD-7: 7-item Generalized Anxiety Disorder Scale, CD-RISC 10: 10-item Connor–Davidson Resilience Scale, OR: odds ratio, CI: confidence interval

*pharmacists, laboratory technologists, radiological technologists, nutritionists, physical therapists, clinical psychologists, medical engineers, public health nurses, nursing assistants, and medical social workers

Supplementary Table 4 (https://doi.org/10.1272/jnms.JNMS.2022_89-308) shows the questionnaire answers in the first survey, and **Table 4** compares the results between the first and second surveys. The scores of total GAD-7, total CES-D, and the original questionnaires in all participants improved in the second survey compared with those in the first survey; however, the total CD-RISC 10 score remained unchanged. The total GAD-7 score was significantly decreased in physicians, nurses, younger workers, older workers, males, females, frontline workers, and non-frontline workers. In addition, the total CES-D score was significantly improved in nurses, younger workers, females, and frontline workers. Although the frequency of HCWs suffering from moderate-to-severe symptoms of anxiety was 10.0% in the first survey and then decreased to 7.7% in the second survey, the improvement was insignificant ($P = 0.16$). Likewise, the frequency of HCWs who developed depression symptoms was 27.9% in the first survey and lowered to 25.6% in the second survey, but the improvement remained insignificant ($P = 0.34$).

Discussion

The present study is the first repeated study to examine psychological concerns among HCWs during the COVID-19 pandemic in Japan. Among the 594 participants, 46 (7.7%) developed moderate-to-severe symptoms of anxiety, while 152 (25.6%) developed depression symptoms.

Having high total GAD-7 scores was a risk factor for depression symptoms, while older HCWs and those with higher resilience were less likely to develop depression symptoms. Younger workers and females were more likely to suffer from psychological problems, consistent with the first survey. The second survey demonstrated improvement in the total scores of GAD-7, CES-D, and the original questionnaire compared with the first survey. However, the frequency of HCWs suffering from moderate-to-severe symptoms of anxiety or depression did not significantly decrease.

The COVID-19 pandemic has caused a heavy psychological impact on HCWs. The fear of being infected, lack of effective social support systems, and heavy workloads could escalate the psychological concerns of HCWs. In fact, during the period of the first and second surveys, a total of 42 HCWs (2.1%) in our hospital left their jobs for a variety of reasons. The present study showed that younger workers and females are more likely to develop anxiety and depression symptoms. These findings are consistent with those reported in previous studies^{15–17}. Furthermore, a report from Japan showed that more than 40% of nurses and 30% of radiologists and pharmacists were burned out during the COVID-19 pandemic¹⁸. For non-physician occupations, anxiety caused by unfamiliarity with personal protective equipment and desire for reduced workload were the main factors associated with burnout development. The risk factors of depression

Table 4 Comparison of mental health measurements in the first and second surveys

Survey Participants	Overall		
	First (n = 848)	Second (n = 594)	P-value
Total GAD-7 score, median (IQR)	4 (1–7)	3 (1–5)	<0.001
Total CES-D score, median (IQR)	12 (7–16)	11 (6–16)	0.033
Total CD-RISC 10 score, median (IQR)	22 (18–27)	22 (17–28)	0.48
Original questionnaires, median (IQR)			
Questions on anxiety and fear of infection and death	12 (8–19)	10 (7–18)	0.003
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–1)	0.047
Questions on motivation and escape behavior at work	2 (0–3)	1 (0–3)	0.038

Survey Participants	Occupation type					
	Physician			Nurse		
	First (n = 104)	Second (n = 95)	P-value	First (n = 461)	Second (n = 261)	P-value
Total GAD-7 score, median (IQR)	3 (2–5)	2 (0–4)	0.002	4 (2–7)	3 (1–5)	0.014
Total CES-D score, median (IQR)	8 (3–12)	7 (4–12)	0.72	13 (9–18)	11 (6–16)	0.003
Total CD-RISC 10 score, median (IQR)	28 (20–31)	25 (20–31)	0.38	23 (19–28)	22 (17–27)	0.98
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	9 (6–19)	8 (5–12)	0.044	12 (8–19)	11 (8–18)	0.13
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–0)	0.44	0 (0–1)	0 (0–1)	0.056
Questions on motivation and escape behavior at work	0 (0–2)	0 (0–2)	0.91	2 (0–3)	2 (0–3)	0.29

Survey Participants	Occupation type					
	Other co-medical staff*			Office worker		
	First (n = 184)	Second (n = 151)	P-value	First (n = 99)	Second (n = 88)	P-value
Total GAD-7 score, median (IQR)	4 (2–6)	3 (1–6)	0.093	3 (1–6)	3 (0–6)	0.31
Total CES-D score, median (IQR)	10 (6–15)	11 (6–16)	0.43	12 (7–15)	12 (7–17)	0.86
Total CD-RISC 10 score, median (IQR)	19 (14–23)	22 (17–28)	0.48	18 (14–23)	21 (16–29)	0.59
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	12 (9–21)	11 (7–18)	0.11	11 (8–20)	11 (8–19)	0.71
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–1)	0.99	0 (0–1)	0 (0–1)	0.92
Questions on motivation and escape behavior at work	2 (0–3)	1 (0–3)	0.26	1 (0–3)	1 (0–3)	0.64

Survey Participants	Age					
	Younger worker (<38)			Older worker (≥38)		
	First (n = 446)	Second (n = 256)	P-value	First (n = 402)	Second (n = 338)	P-value
Total GAD-7 score, median (IQR)	3 (1–6)	2 (1–5)	0.002	4 (2–7)	3 (1–6)	0.001
Total CES-D score, median (IQR)	12 (8–18)	12 (7–17)	0.025	10 (6–15)	9 (5–15)	0.60
Total CD-RISC 10 score, median (IQR)	20 (16–26)	21 (17–26)	0.48	23 (19–29)	23 (18–29)	0.69
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	13 (9–21)	12 (7–19)	0.022	10 (8–17)	10 (7–17)	0.13
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–1)	0.026	0 (0–1)	0 (0–1)	0.73
Questions on motivation and escape behavior at work	2 (0–3)	2 (0–3)	0.22	1 (0–3)	1 (0–2)	0.30

Table 4 Comparison of mental health measurements in the first and second surveys (continued)

Survey Participants	Sex					
	Male			Female		
	First (n = 213)	Second (n = 175)	P-value	First (n = 635)	Second (n = 419)	P-value
Total GAD-7 score, median (IQR)	3 (2–6)	2 (0–5)	<0.001	4 (1–7)	3 (1–6)	0.013
Total CES-D score, median (IQR)	10 (5–14)	9 (5–15)	0.91	12 (8–18)	11 (6–16)	0.022
Total CD-RISC 10 score, median (IQR)	23 (18–29)	23 (17–30)	0.87	21 (18–27)	22 (17–27)	0.60
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	11 (7–19)	10 (6–16)	0.009	12 (9–19)	11 (8–19)	0.094
Questions on isolation and unreasonable treatment	0 (0–1)	0 (0–1)	0.11	0 (0–1)	0 (0–1)	0.18
Questions on motivation and escape behavior at work	1 (0–3)	1 (0–3)	0.66	2 (0–3)	1 (0–3)	0.067
Survey Participants	Working position					
	Frontline worker			Non-frontline worker		
	First (n = 232)	Second (n = 215)	P-value	First (n = 616)	Second (n = 379)	P-value
Total GAD-7 score, median (IQR)	4 (2–8)	3 (1–6)	<0.001	3 (1–6)	3 (1–5)	0.002
Total CES-D score, median (IQR)	12 (8–19)	10 (5–15)	0.008	11.5 (7–16)	11 (6–16)	0.29
Total CD-RISC 10 score, median (IQR)	18 (13–22)	22 (18–28)	0.37	23 (19–29)	22 (17–28)	0.98
Original questionnaires, median (IQR)						
Questions on anxiety and fear of infection and death	13 (8–19)	11 (8–18)	0.090	11 (8–19)	10 (7–18)	0.007
Questions on isolation and unreasonable treatment	0 (0–2)	0 (0–1)	0.011	0 (0–1)	0 (0–1)	0.35
Questions on motivation and escape behavior at work	2 (0–3)	1 (0–3)	0.17	1.5 (0–3)	1 (0–3)	0.078

Continuous variables are presented as the median with interquartile range (IQR).

GAD-7: 7-item Generalized Anxiety Disorder Scale, IQR: interquartile range, CES-D: Center for Epidemiologic Studies Depression Scale, CD-RISC 10: 10-item Connor–Davidson Resilience Scale

*pharmacists, laboratory technologists, radiological technologists, nutritionists, physical therapists, clinical psychologists, medical engineers, public health nurses, nursing assistants, and medical social workers

symptoms in the present study were similar to those in the first survey⁶. However, being a nurse was a risk factor of depression symptoms in the first survey, whereas it was not in the present study. This may have been due to the significant decrease in the response rate of nurses. In a short-term longitudinal study conducted on the general public in mainland China, the anxiety and depression scores did not significantly change¹⁹. In the present study, the anxiety and depression scores among HCWs in the second survey significantly improved statistically compared with those in the first survey, but many HCWs still suffer from psychological concerns.

During the period of the first and second surveys, Tokyo, where our hospital is located, had the highest number of patients with COVID-19 in Japan. A state of emergency was declared in Tokyo from April 7, 2020 to May 25, 2020, which greatly restricted going out, eating out, commuting to work, and going to school². The number of patients with COVID-19, which had increased rapidly prior to the declaration, decreased dramatically after the declaration was issued. Since July 2020, the number of

patients with COVID-19 had increased and decreased repeatedly, but the number of new patients infected during the second survey period was higher than that during the first survey period. Since February 2020, we have been treating a large number of patients with COVID-19 by reducing the number of scheduled operations and changing half of the intensive care unit to be dedicated to patients with COVID-19. At the end of the first and second surveys, the total number of patients with COVID-19 treated at our hospital was 55 and 302, respectively. These differences may have had an impact on the mental health of HCWs. Furthermore, the improvement in anxiety and depression scores in this survey could be attributed to reassurance from the reported development of treatment and vaccine for COVID-19, familiarity with the coping strategies of patients with COVID-19, and adaptation to lifestyle changes^{3–5}. During the severe acute respiratory syndrome outbreak, psychological intervention reduced mental disorders such as anxiety, depression, and PTSD of HCWs²⁰. After the COVID-19 pandemic, many guidelines regarding psychological inter-

vention for HCWs have been established²¹⁻²⁶. These guidelines emphasize the importance of providing a peer support system, assigning professional psychotherapy teams, providing online psychological services, encouraging HCWs to engage in relaxation techniques, ensuring sufficient protective equipment, considering regular rest breaks, and providing psychological and mental health education.

After the severe acute respiratory syndrome outbreak, symptoms of PTSD as well as anxiety and depression were reported²⁷. Approximately 10% of HCWs had experienced high PTSD levels after the outbreak²⁸. Notably, 56.6% of HCWs exhibited PTSD symptoms during the COVID-19 pandemic¹⁷. Resilience, which is defined as the individual's ability to adapt successfully in the face of stress and adversity and maintain normal psychological and physical functioning, reduces the impact of traumatic events, decreasing the likelihood of developing PTSD²⁹. Both of our surveys showed that HCWs with higher resilience were less likely to develop depression symptoms. In the present study, CD-RISC 10 scores did not change, and resilience did not improve compared with those in the initial survey. Immediate psychological interventions are also essential to enhance resilience³⁰. In addition, continuous surveillance of psychological concerns and long-term interventions are fundamental to support the mental health of HCWs.

This study has several limitations. First, owing to the low response rate (30.2%), response bias could exist. Especially, the response rates of nurses, younger workers, and non-frontline workers were lower in this survey than in the first survey. HCWs who were not directly involved in the treatment of patients with COVID-19 may not have been interested in this survey. Second, this study included HCWs who were employed in a single institution in Tokyo; thus, the results may not represent all institutions in Japan. Larger studies are required to verify our findings.

In conclusion, this study showed that in the second survey, the anxiety and depression scores of HCWs during the COVID-19 pandemic improved compared with those in the first survey. However, many HCWs still suffer from psychological concerns. Considering that the fight against COVID-19 will continue for a long time, continuing surveillance of psychological concerns and providing adequate psychological interventions are essential to protect the mental health of HCWs.

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