Transitional Changes in Job Stress and Psychological Adjustment of Hospital Workers During the COVID-19 Pandemic in Japan

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Objectives: The aim of the present study was to longitudinally evaluate job stress and burnout before and after the third wave of in Japan and identify transitional changes in the mental health status of a cohort of employees at a coronavirus disease 2019 (COVID-19)-dedicated hospital.
Methods: The same surveys were conducted in October 2020 and March 2021. 151 subjects who responded to both surveys were included. The Maslach Burnout Inventory-General Survey was used to evaluate burnout. Multiple logistic regression analyses were performed to determine odds ratios for factors associated with burnout using a non-burnout group as a reference.
Results: In the cohort, 31.1% of employees showed dropout intention and 13.2% of employees were experiencing burnout in March 2021. Hospital workers were more motivated by a sense of contribution and accomplishment, which could balance increased exhaustion in March 2021. The following factors associated with burnout remained to be solved: self-quarantine, unfavorable patient prognosis, poor communication of information, lack of sleep in comparison to the pre-COVID-19 period, and desire for good communication of information.
Conclusion: It is important to continuously evaluate the mental health status of employees and to provide targeted prevention and intervention in order to mitigate psychological distress and avoid burnout and resignation.

Key words: Coronavirus disease 2019 (COVID-19), job stress, burnout, medical worker, non-medical worker

INTRODUCTION

As of December 2019, coronavirus disease 2019 (COVID-19) had spread throughout the world, leading to an ongoing pandemic that has affected millions of lives. In addition to healthcare professionals, various other workers play important roles in the provision of medical services in relation to COVID-19, such as infection control, isolation, containment, vaccination and treatment [1, 2]. Despite advances in the prevention and treatment of COVID-19, this pandemic has persisted for a long time and it is necessary to protect COVID-19-related workers from psychological distress [3–5].

High rates of mental health problems, such as generalized anxiety, stress disorder, depression, and insomnia have been reported among healthcare workers [6–10]. The persistence of these psychological burdens may lead to burnout and resignation of workers [9–13]. Burnout is a syndrome characterized by exhaustion, cynicism, and professional inefficacy [14, 15]. We previously reported that both medical and non-medical workers experienced burnout based on a survey conducted at a COVID-19-dedicated hospital in October 2020 [13]. The factors significantly associated with burnout at that time were anxiety in relation to infection with COVID-19, self-quarantine, stress behavior of patients, lack of sleep in comparison to the pre-COVID-19 period, and the desire for more days off, increased staff, hazard pay, and resources for coping with stress [13].

The circumstances surrounding the COVID-19 pandemic are continuously changing. In comparison to the first and second waves in spring to summer in 2020, there was a significant spike in the number of infections in 2021 [16] (Fig. 1), which greatly increased the workload of people engaged in the provision of COVID-19-related medical services. On the other hand, several measures for supporting COVID-19-related workers have been taken, including financial support [17, 18]. In the present study, we performed the longitudinal evaluation of job stress and burnout before and after the third wave of in Japan to find the transitional changes in mental health status using a cohort of employees at Tokai University Tokyo Hospital, the first COVID-19-dedicated hospital in Japan.

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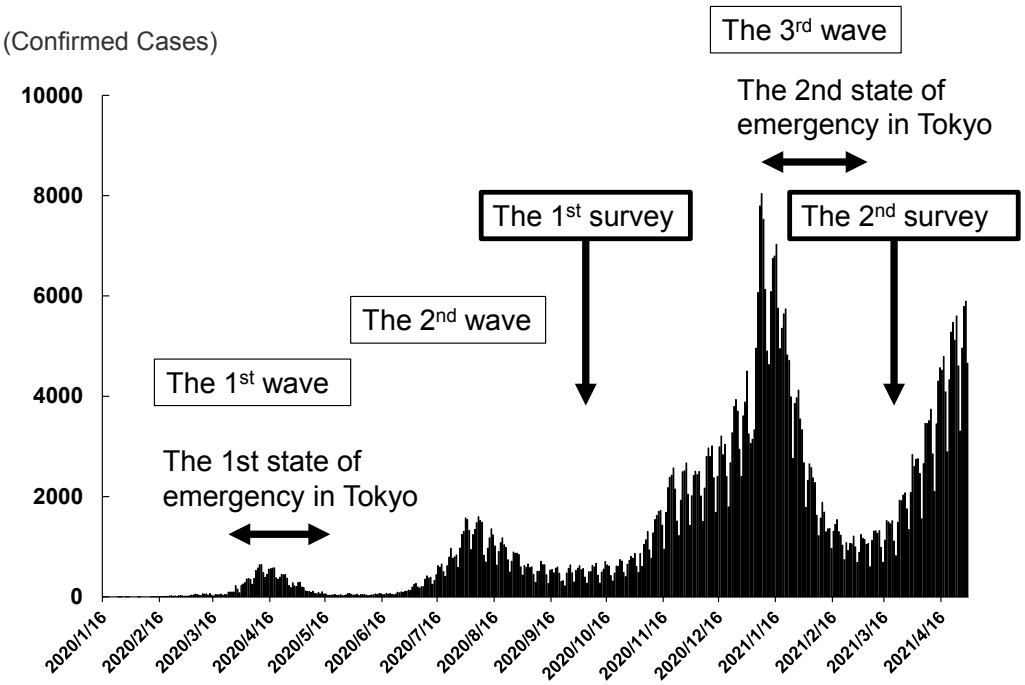

Fig. 1 Trend in the number of newly confirmed cases in Japan.
This figure was drawn based on the data from the Ministry of Health, Labour and Welfare, Japan (https://covid19.mhlw.go.jp/en/. Accessed 13 February 2022). The timings of the 1st and 2nd survey were indicated, along with the pandemic waves and the states of emergency in Tokyo.

METHODS

Subjects

Original surveys were conducted by an industrial doctor as part of the mental health care program for employees of Tokai University Tokyo Hospital. The first survey of job stress and burnout was conducted in October 2020, as previously described [13] (Fig. 1). The second survey was conducted in March 2021 using the same questionnaire (Fig. 1). Among the total of 220 employees, 151 employees (68.6%) who responded to the both surveys and who agreed to the use of their data were included in this study. A part of the result of the 1st survey was reused and analyzed. The employees were categorized into 8 occupations (doctor, nurse, pharmacist, medical technologist, medical clerk, kitchen staff, ward staff, and other hospital staff). Individuals with the following occupations were classed as "medical workers": doctor, nurse, pharmacist and medical technologist. Individuals with other occupations were classified as "non-medical workers". Anonymized data were used for the analysis and the privacy of participants was completely protected by unlinkable anonymization. This study was approved by the Ethics Committee of Tokai University (20R-318) and was conducted in accordance with the Declaration of Helsinki.

Questionnaire survey and definition of burnout

The web-based questionnaire used in this study has been described previously [14]. Briefly, the questionnaire consisted of 50 questions, including the validated Japanese version of the Maslach Burnout Inventory-General Survey (MBI-GS) [19]. The MBI-GS consists of 16 items and measures three dimensions of burnout: exhaustion, cynicism, and professional efficacy. The 16 MBI-GS items are scored on a seven-point scale ranging from "0" (never) to "6" (every day), and the total scores for each subscale are divided by the number of items for the subscale. Individuals with high levels of exhaustion (>4.0) plus either high cynicism (>2.6) or low professional efficacy (PE) (<1.5) were considered to have a high risk of occupational burnout [13, 19].

Statistical analysis

Clinical parameters were compared using the Mann-Whitney U test. The significance of differences in categorical variables was determined using the chi-squared test. The Wilcoxon signed-rank test or McNemar's test was used to compare two paired samples. Multiple logistic regression analyses were performed to calculate the odds ratios for burnout using the non-burnout group as a reference, with adjustment for age, sex, medical or non-medical worker status, presence or absence of work involving direct contact with COVID-19 patients, and presence or absence of work not involving direct contact but which was related to COVID-19 patients. All results of the multiple logistic regression analyses that are reported in the present study were obtained by a forced entry method. A forward-backward stepwise selection method also yielded the same results. Statistical analyses were performed using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). All p values were two-tailed and p values of <0.05 were considered to indicate statistical significance.

RESULTS

The characteristics of the subjects and the data obtained from the 1st and the 2nd surveys are shown in Table 1 and 2, respectively. Among the 151 employees

Table 1 Characteristics of different occupations in the 1st survey

		Medical workers				Non-medical workers				
		Doctor	Nurse	Pharmacist	Medical technologist	Medical clerk	Kitchen staff	Ward staff	Other hospital staff	Overall
Total No.		12	41	6	17	25	10	12	28	151
Sex										
Male	No.	8	5	3	7	5	3	4	9	44
	%	66.7%	12.2%	50.0%	41.2%	20.0%	30.0%	33.3%	32.1%	29.1%
Female	No.	4	36	3	10	20	7	8	19	107
	%	33.3%	87.8%	50.0%	58.8%	80.0%	70.0%	66.7%	67.9%	70.9%
Age, median (IQR), years		50.0 (46.3-58.8)	39.0 (27.5-47.0)	37.0 (30.8-42.3)	46.0 (32.5-54.0)	41.0 (26.0-50.0)	34.5 (28.0-51.0)	44 .0 (30.0-49.8)	43.5 (34.8-56.0)	42.0 (30.0-50.0)
Experience, median (IQR), years		25.0 (15.8-33.8)	12.0 (4.8-24.0)	12.0 (7.5-18.5)	23.0 (9.5-31.0)	6.0 (2.5-27.5)	8.5 (3.4-12.3)	2.0 (1.2-9.0)	8.0 (3.5-12.8)	10.0 (4.0-23.0)
Work hours, median (IQR), hours		9.0 (8.0-10.0)	8.0 (6.0-8.0)	8.0 (5.8-9.5)	8.0 (7.0-8.4)	9.0 (7.3-10.0)	8.0 (8.0-8.6)	7.0 (7.0-8.0)	7.0 (7.0-8.0)	8.0 (7.0-8.5)
Sleep hours, median (IQR), hours		6.0 (5.0-6.0)	6.0 (5.4-7.0)	7.0 (5.0-7.0)	6.0 (5.0-6.8)	5.0 (5.0-6.0)	5.0 (5.0-6.1)	5.8 (5.0-7.0)	6.3 (6.0-7.6)	6.0 (5.0-7.0)
Direct contact with COVID-19 patients										
0 days/week	No.	1	4	3	8	10	8	6	20	60
	%	8.3%	9.8%	50.0%	47.1%	40.0%	80.0%	50.0%	71.4%	39.7%
1-4 days/week	No.	6	27	3	5	9	1	2	8	61
	%	50.0%	65.9%	50.0%	29.4%	36.0%	10.0%	16.7%	28.6%	40.4%
>5 days/week	No.	5	10	0	4	6	1	4	0	30
	%	41.7%	41.7%	0.0%	23.5%	24.0%	10.0%	33.3%	0.0%	19.9%
Job without direct patient contact but related to COVID-19 patients										
0 days/week	No.	0	1	0	4	2	2	2	6	17
	%	0.0%	2.4%	0.0%	23.5%	8.0%	20.0%	16.7%	21.4%	11.3%
1-4 days/week	No.	3	21	2	4	8	1	1	10	50
	%	25.0%	51.2%	33.3%	23.5%	32.0%	10.0%	8.3%	35.7%	33.1%
>5 days/week	No.	9	19	4	9	15	7	9	12	84
	%	75.0%	46.3%	66.7%	52.9%	60.0%	70.0%	75.0%	42.9%	55.6%
Psychological distress										
Dropout intention	No.	4	15	1	4	12	5	0	11	53
	%	33.3%	36.6%	16.7%	23.5%	48.0%	50.0%	0.0%	39.3%	35.1%
Burnout	No.	3	4	0	2	6	0	0	2	17
	%	25.0%	9.8%	0.0%	11.8%	24.0%	0.0%	0.0%	7.1%	11.3%

Abbreviations: IQR, interquartile range; COVID-19, coronavirus disease 2019

Table 2 Characteristics of different occupations in the 2nd survey

		Medical workers				Non-medical workers				
		Doctor	Nurse	Pharmacist	Medical technologist	Medical clerk	Kitchen staff	Ward staff	Other hospital staff	Overall
Total No.		12	41	6	17	25	10	12	28	151
Sex										
Male	No.	8	5	3	7	5	3	4	9	44
	%	66.7%	12.2%	50.0%	41.2%	20.0%	30.0%	33.3%	32.1%	29.1%
Female	No.	4	36	3	10	20	7	8	19	107
	%	33.3%	87.8%	50.0%	58.8%	80.0%	70.0%	66.7%	67.9%	70.9%
Age, median (IQR), years		50.0 (47.3-59.5)	39.1 (28.0-47.5)	37.0 (31.5-43.0)	46.0 (32.5-54.0)	41.0 (26.5-52.0)	35.0 (28.8-51.3)	44 .5 (31.0-49.8)	43.5 (35.5-56.8)	42.0 (31.0-50.0)
Experience, median (IQR), years		25.5 (15.5-34.5)	12.0 (4.8-24.0)	12.0 (8.0-19.0)	24.0 (9.5-31.0)	7.0 (2.4-28.0)	9.0 (3.4-14.3)	3.0 (2.0-9.3)	8.0 (4.3-12.8)	11.0 (5.0-22.0)
Work hours, median (IQR), hours		9.0 (8.0-10.8)	8.0 (6.5-8.0)	8.0 (5.8-10.0)	8.0 (7.0-8.0)	8.0 (7.0-9.0)	8.0 (8.0-8.2)	8.0 (7.0-8.8)	7.0 (7.0-8.0)	8.0 (7.0-8.0)
Sleep hours, median (IQR), hours		6.0 (5.2-6.0)	6.0 (5.3-7.0)	7.0 (4.5-8.5)	6.0 (5.5-6.5)	6.0 (5.0-6.0)	6.0 (4.5-6.0)	6.0 (5.0-6.0)	6.0 (6.0-7.0)	6.0 (5.0-6.5)
Direct contact with COVID-19 patients										
0 days/week	No.	0	3	3	7	7	9	5	20	54
	%	0.0%	7.3%	50.0%	42.2%	28.0%	90.0%	41.7%	71.4%	35.8%
1-4 days/week	No.	7	20	2	5	11	1	3	7	56
	%	58.3%	48.8%	33.3%	29.4%	44.0%	10.0%	25.0%	25.0%	37.1%
>5 days/week	No.	5	18	1	5	7	0	4	1	41
	%	41.7%	43.9%	16.7%	29.4%	28.0%	0.0%	33.3%	3.6%	27.2%
Job without direct patient contact but related to COVID-19 patients										
0 days/week	No.	0	2	1	1	2	0	2	7	15
	%	0.0%	4.9%	16.7%	5.9%	8.0%	0.0%	16.7%	25.0%	9.9%
1-4 days/week	No.	4	15	1	7	8	3	1	13	52
	%	33.3%	36.6%	16.7%	41.2%	32.0%	30.0%	8.3%	46.4%	34.4%
>5 days/week	No.	8	24	4	9	15	7	9	8	84
	%	66.7%	58.5%	66.7%	52.9%	60.0%	70.0%	75.0%	28.6%	55.6%
Psychological distress										
Dropout intention	No.	4	14	1	5	7	7	1	8	47
	%	33.3%	34.1%	16.7%	29.4%	28.0%	70.0%	8.3%	28.6%	31.1%
Burnout	No.	4	6	0	2	4	2	0	2	20
	%	33.3%	14.6%	0.0%	11.8%	16.0%	20.0%	0.0%	7.1%	13.2%

Abbreviations: IQR, interquartile range; COVID-19, coronavirus disease 2019

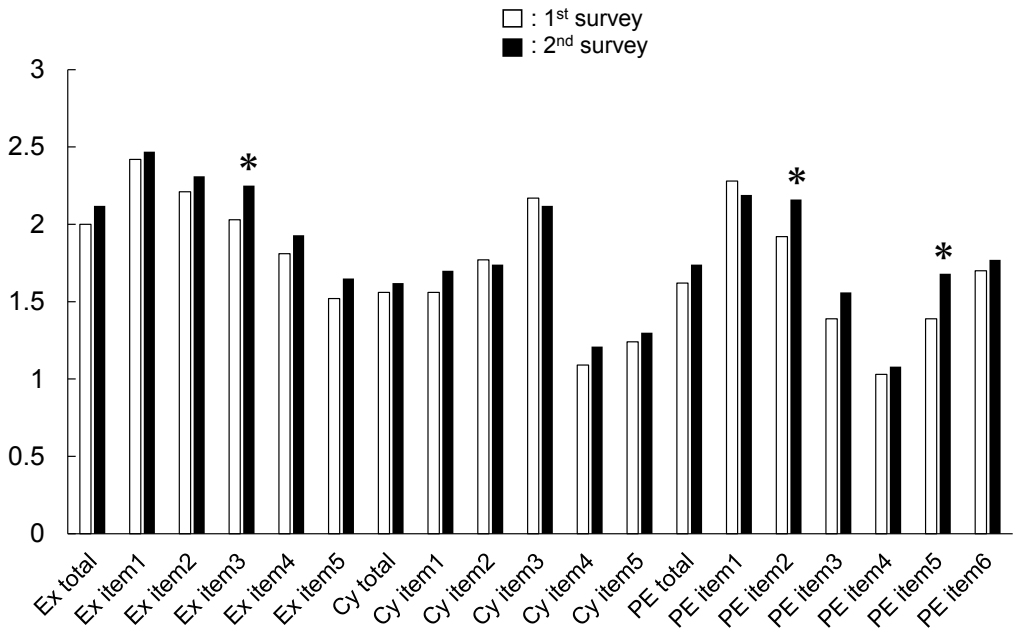

Fig. 2 Comparison of the scores of the MBI-GS items.
Abbreviations: MBI-GS, Maslach Burnout Inventory-General Survey; EX, exhaustion; Cy, cynicism; PE, professional efficacy. The MBI-GS consists of 16 items and measures three dimensions of burnout: exhaustion (Ex), cynicism, (Cy) and professional efficacy (PE). The scores obtained from the 1st and 2nd survey were compared.

enrolled in the present study, 76 (50.3%) were medical workers and 75 (49.7%) were non-medical workers. There was no difference in the sex ratio of the medical and non-medical workers ($p = 0.450$). In the 2nd survey, the median (IQR) of age was 43.0 (32.0–50.0) for medical workers and 41.0 (29.0–53.0) for non-medical workers ($p = 0.958$). The median (IQR) of work hours was 8.0 (7.0–8.0) for medical workers and 8.0 (7.0–8.5) for non-medical workers ($p = 0.850$). Medical workers showed a significantly higher frequency of direct contact with COVID-19 patients (82.9%) in comparison to non-medical workers (45.4%) ($p < 0.001$). Both medical and non-medical workers had jobs without direct patient contact but which were related to COVID-19 patients (94.7% vs. 85.3%, $p = 0.128$). In the 2nd survey, overall 31.1% of the employees showed dropout intention (answered "yes" to the question asking if they had ever wanted to quit their job since the hospital started admitting COVID-19 patients) (Table 2). The percentage of individuals with dropout intention was similar between medical workers (31.6%) and non-medical workers (30.7%) ($p = 0.522$). In the overall study population, 13.2% of the employees were experiencing burnout (Table 2). Among all occupations, doctors showed the highest rate of burnout (33.3%) (Table 2). There was no significant difference in the burnout rate between medical (15.8%) and non-medical (10.7%) workers ($p = 0.246$).

The burnout rate in the 2nd study (13.2%) was higher in comparison to the 1st study (11.3%), though not statistically significant ($p = 0.629$), but we thoroughly investigated the difference in the MBI-GS scores in both surveys (Fig. 2). The average score of exhaustion item 3 (low energy level) was significantly higher in the 2nd survey than in the 1st survey, indicating negative effect on burnout. On the other hand, the average scores of PE item 2 (contribution) and PE item 5 (accomplishment) were significantly higher in the 2nd survey than in the 1st survey, indicating positive effects on burnout. The hospital workers were busier during the 2nd survey than during the 1st survey, and it was natural that they experienced a feeling of exhaustion. However, the hospital workers were more motivated by a sense of contribution and accomplishment in March, which could have balanced the increased exhaustion.

Nest, multiple logistic regression analyses were performed to identify factors significantly associated with burnout, with adjustment for age, sex, medical or non-medical worker status, presence or absence of work involving direct contact with COVID-19 patients, and presence or absence of work without direct patient contact but which was related to COVID-19 patients. Fig. 3 shows the factors associated with burnout using types of anxiety in relation to self and home as independent variables. In contrast to the 1st survey, anxiety in relation to infection with COVID-19 was selected less frequently in the 2nd survey. Self-quarantine was selected as a factor associated with burnout in both the 1st and 2nd surveys. Self-quarantine in this context means the avoidance of socializing. Hospital workers are more restricted in comparison to ordinary people in terms of private eating, drinking, and other non-essential outings, which imposes stress on hospital workers [13]. The factors associated with burnout with types of anxiety in relation to hospital work as independent variables are shown in Fig. 4. Two factors — an unfavorable patient prognosis and poor communication of information — were selected in the 2nd survey. The result was completely different from the results of the 1st survey, where patient stress behavior was related to burnout.

In both the 1st and the 2nd surveys, burnout was sig-

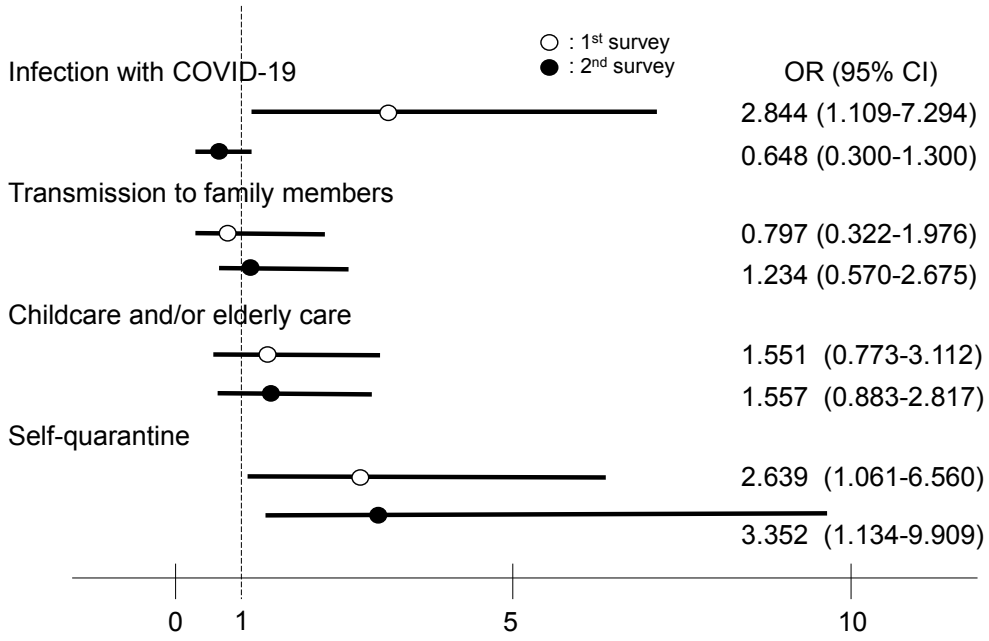

Fig. 3 Comparison of the factors associated with burnout by multiple logistic regression analysis using types of anxiety in relation to self and home as independent variables.
Abbreviations: COVID-19, coronavirus disease 2019; OR, odds ratio, CI, confidence interval.
Multiple logistic regression analysis was performed using non-burnout group as a reference with adjustment for age, sex, medical or non-medical worker status, presence or absence of work involving direct contact with COVID-19 patients, and presence or absence of work without direct patient contact but which was related to COVID-19 patients.

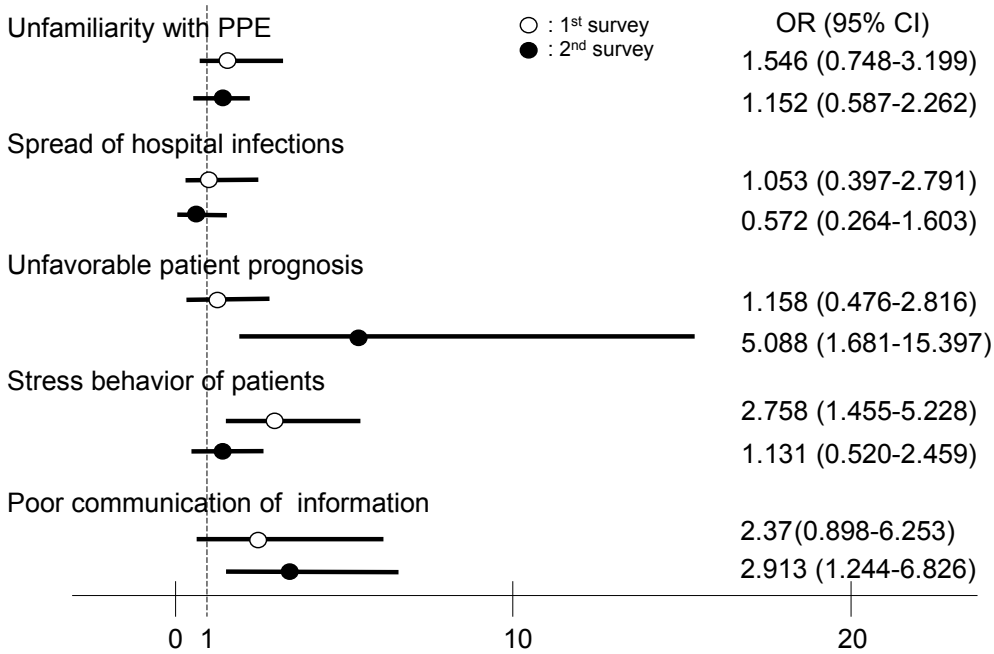

Fig. 4 Comparison of the factors associated with burnout by multiple logistic regression analysis using types of anxiety in relation to hospital work as independent variables.
Abbreviations: PPE, personal protective equipment; OR, odds ratio, CI, confidence interval.
Multiple logistic regression analysis was performed using non-burnout group as a reference with adjustment for age, sex, medical or non-medical worker status, presence or absence of work involving direct contact with COVID-19 patients, and presence or absence of work without direct patient contact but which was related to COVID-19 patients.
Two factors — an unfavorable patient prognosis and poor communication of information — were selected in the 2nd survey, where patient stress behavior was related to burnout in the 1st survey.

nificantly more prevalent in employees with a lack of sleep in comparison to the pre-COVID-19 period (Fig. 5). Other lifestyle changes from the pre-COVID-19 period were not significantly related to burnout. Fig. 6 shows the factors associated with burnout with types of support required as independent variables. Increased staff and good communication of information were selected in the 2nd survey. Increased staff was also selected in the previous study, whereas good communication of information was a new factor. Because the communication of information was found to be poor (Fig. 4), it is reasonable that good communication of information was desired by the employees. On the other hand, the two factors selected in the 1st survey, more days off and resources for coping with stress, were not selected the 2nd survey.

DISCUSSION

In the present study, the longitudinal evaluation of job stress and burnout was conducted to find the transitional changes among employees of a COVID-19-dedicated hospital before and after the third wave of in Japan. In our cohort, 31.1% of the employees showed dropout intention and 13.2% of the employees were experiencing burnout in March 2021. Regarding psychological adjustment, hospital workers were more motivated by a sense of contribution and accomplishment, which could balance increased exhaustion. The following factors were found to be associated with burnout in March 2021: self-quarantine, unfavorable patient prognosis, poor communication of information, lack of sleep in comparison to the pre-COVID-19 period, and desire for good communication of information.

Cumulative psychological distress caused by engagement in COVID-19 medical service increases the risk of burnout and resignation of workers [9–13]. The burnout rate of COVID-19 workers ranges widely from 8.9% to 50%, depending on the background characteristics of workers, and different questionnaires and/or cutoff points [10, 13, 20]. Most studies on COVID-19 related burnout were single and cross-sectional in design. Chen performed a study of mental health status and self-psychological adjustment among frontline nurses who gathered from different regions in China to support Wuhan at two different time points [21]; however, their study is considered cross-sectional due to the anonymity of the study subjects. Although the burnout rate in the 2nd study (13.2%) was not significantly increased in comparison to the 1st study (11.3%), we thoroughly investigated the underlying difference in the MBI-GS scores in both surveys. We found that the hospital workers were more motivated by a sense of contribution and accomplishment, which could balance increased exhaustion. Two relevant aspects have been proposed regarding burnout in COVID-19 healthcare workers: compassion fatigue and compassion satisfaction [22, 23]. Compassion fatigue is an outcome of prolonged exposure to continuous stress, while compassion satisfaction is the pleasure and satisfying feeling that comes from helping others. Compassion satisfaction is an important factor that positively influences the mental health of workers, and our study clearly showed that increased professional efficacy contributed to the prevention of increased burnout of hospital workers.

The following factors were found to be associated with burnout in March 2021: self-quarantine, unfavorable patient prognosis, poor communication of information, lack of sleep in comparison to the pre-COVID-19 period, and desire for good communication of information. Regarding the types of anxiety related to self and home, anxiety in relation to infection with COVID-19 was greatly reduced in the 2nd survey. This was because the hospital staff had acquired adequate knowledge and skills in relation to COVID-19 infection, and because the supply of personal protective equipment (PPE) was sufficient. Self-quarantine was repeatedly selected in both surveys. Unlike many other countries that imposed strict lockdowns or curfews [24–26], the Japanese government simply asked citizens to refrain from non-essential outings or requested shops and restaurants to reduce their operating hours and limit the serving of alcoholic beverages. In order to protect themselves, workers engaged in COVID-19 medical service voluntarily refrained from eating or drinking with many people and other non-essential outings [13], which termed "self-quarantine" in this context. Our study revealed that COVID-19 workers have been feeling stressed.

Regarding the types of anxiety related to hospital work, unfavorable patient prognosis was selected as one of the factors related to burnout in March 2021. Kuhn *et al.* pointed out that high anxiety caused by concern about bad outcomes was the strongest predictor of burnout [27]. The most likely explanation for our result is that SARS-CoV-2 Alpha variant (B.1.1.7) emerged in Japan around the time of the 2nd survey, which was more transmissible and more virulent than the wild-type SARS-CoV-2 [28, 29]. Tokai University Tokyo Hospital admits mild ($SpO_2 \geq 96\%$) to moderate Ⅰ (SpO_2 93% to $< 96\%$) COVID-19 patients according to the grades of severity defined by the Ministry of Health, Labour and Welfare, Japan [30]. Our hospital is not equipped with ventilators or extracorporeal membrane oxygenation (ECMO), and therefore it is reasonable that the staff members were afraid that the condition of patients would deteriorate. Regarding poor communication of information, many staff members felt uneasy at that time because it was unknown whether Tokai University Tokyo Hospital would continue operating as a COVID-19-dedicated hospital. Uncertainty about the future has been known to worsen the psychological condition [5]. According to a study by Sharma *et al.*, poor communication with supervisors was significantly associated with emotional distress/burnout [31]. Our hospital previously provided advanced medical treatment in various fields as one of the university hospitals of Tokai University; however, it became a COVID-19-dedicated hospital and the hospital staff members were therefore forced — irrespective of their wishes — to directly or indirectly engage in work related to COVID-19. Some staff members wanted to pursue their specialties and others resigned themselves to continuing working for a living. Less career satisfaction was considered to be a factor related to burnout in our study, as well as in several other studies [32–35]. Additionally, COVID-19 workers have been facing stigma during the pandemic [31, 36, 37], such as avoidance by family or community, as a result of the fear. This may have disrupted communication

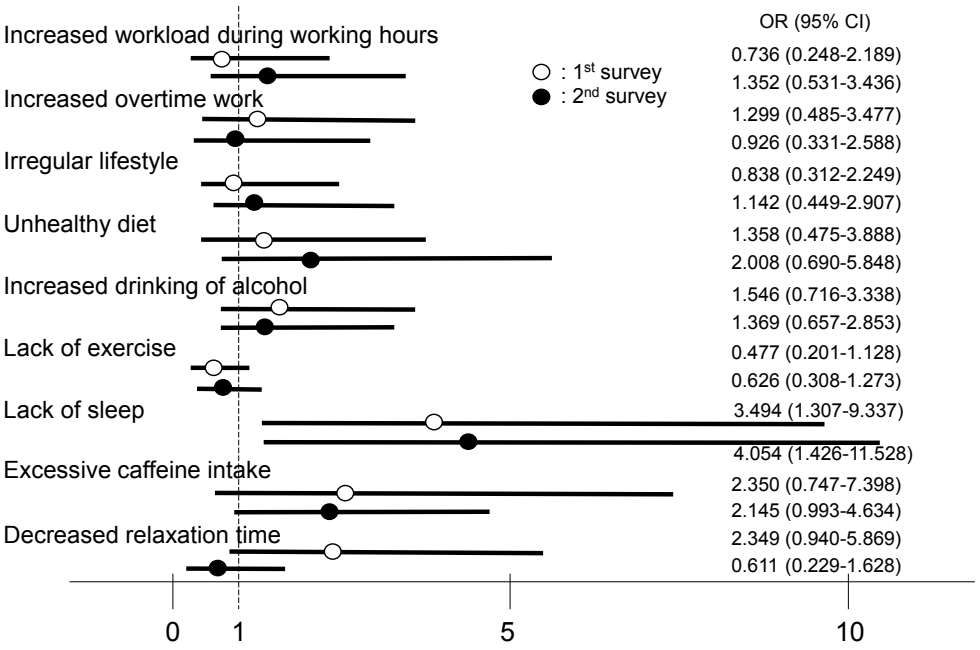

Fig. 5 Comparison of the factors associated with burnout by multiple logistic regression analysis using lifestyle changes in comparison to the pre-COVID-19 period as independent variables.
Abbreviations: COVID-19, coronavirus disease 2019; OR, odds ratio, CI, confidence interval.
Multiple logistic regression analysis was performed using non-burnout group as a reference with adjustment for age, sex, medical or non-medical worker status, presence or absence of work involving direct contact with COVID-19 patients, and presence or absence of work without direct patient contact but which was related to COVID-19 patients.
Lack of sleep in comparison to the pre-COVID-19 period was selected as a factor associated with burnout in both the 1st and 2nd surveys.

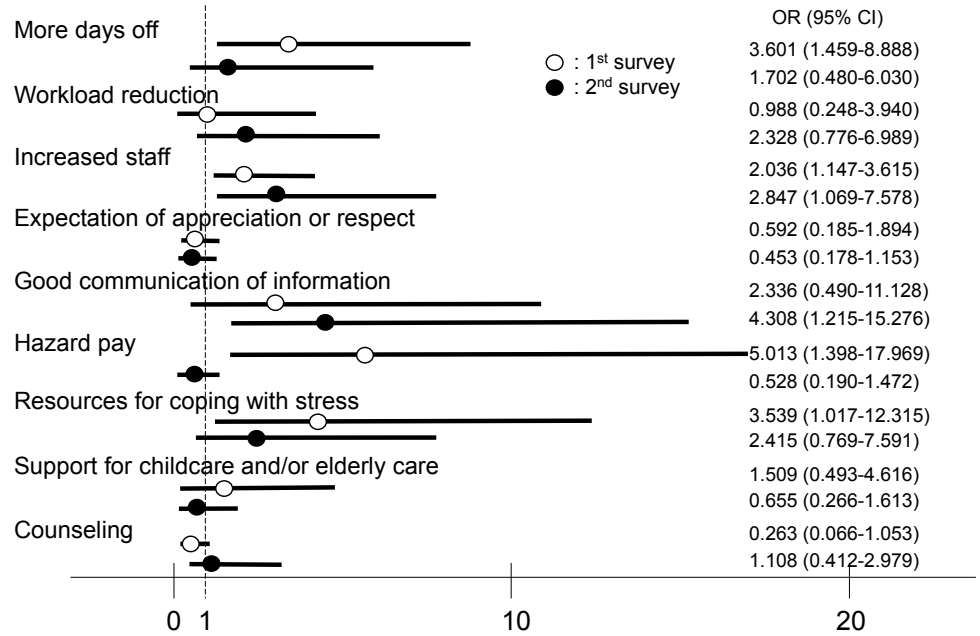

Fig. 6 Comparison of the factors associated with burnout by multiple logistic regression analysis using types of support required as independent variables.
Abbreviations: OR, odds ratio, CI, confidence interval.
Multiple logistic regression analysis was performed using non-burnout group as a reference with adjustment for age, sex, medical or non-medical worker status, presence or absence of work involving direct contact with COVID-19 patients, and presence or absence of work without direct patient contact but which was related to COVID-19 patients.
Increased staff and good communication of information were selected in the 2nd survey.

among workers. Lifestyle factors other than sleep that were related to burnout included pre-existing mental disorder, especially sleep disorder with history of taking medications [38], which we did not examine in our studies. Since lifestyle factors can be modified, advice on lifestyle modification may be effective for preventing burnout among workers.

We then evaluated the types of support needed to improve employee fulfillment and reduce burnout. Responding to the fact that poor communication of information was associated with burnout, good communication of information was identified as type of support that was needed. On the other hand, the need for hazard pay greatly decreased in the 2nd survey in comparison to the 1st survey. To reward healthcare workers, the Japanese government gave a one-time special service bonus of 200,000 yen ($1,757) to the workers with direct contact with COVID-19 patients, and 100,000 yen ($878) to workers without direct contact but whose work was related to COVID-19 patients [39]. Additionally, workers in Tokyo with direct contact with COVID-19 patients received a special work allowance of 5,000 yen/day ($44/day) [40]. This financial compensation from the government was considered to have a positive impact on the satisfaction of COVID-19 workers. The need for resources for coping with stress decreased in the 2nd survey in comparison to the 1st survey. This was partly because the results of the surveys were fed back to workers by the industrial doctor, which provided an opportunity for self-reflection and awareness of mental health problems before the problems became more serious. Some workers spontaneously visited the industrial doctor for counselling. In that regard, our questionnaire survey may well have served as a resource for coping with stress.

The present study was associated with several limitations. The single-center study setting and relatively small sample size could limit the generalizability of this study to other populations. Furthermore, concerns in relation to identification by other staff members may have resulted in a selection bias. The employees were not informed that the surveys were intended to evaluate burnout, but we cannot exclude the possibility that some of them might have noticed the intention in the 2nd survey. Although this study was longitudinal in design, the circumstances surrounding the COVID-19 pandemic are continuously changing and it is important to continue evaluating the mental health status of employees, especially after the explosive surge of the delta variant in the summer of 2021 and the omicron variant in the winter of 2021–2022. Finally, because the MBI asks the respondent to count the frequency of a feeling as far back as a year, it may not be optimal for assessing changes due to interventions or other factors across time periods shorter than 1 year [41].

In conclusion, our longitudinal evaluation of job stress and burnout showed that 31.1% of the employees showed dropout intention and 13.2% of the employees were experiencing burnout in March 2021, and that the hospital workers were more motivated by a sense of contribution and accomplishment which could balance increased exhaustion. The following factors associated with burnout remained to be solved; self-quarantine, unfavorable patient prognosis, poor communication of information, lack of sleep in comparison to the pre-COVID-19 period, and desire for good communication of information. In order to mitigate psychological distress and avoid burnout and resignation, it is important to continuously evaluate employees' mental health status and to provide targeted prevention and intervention.

AUTHOR CONTRIBUTIONS

C.Y. and N.K. conceived and designed the analysis of the obtained data. C.Y. performed the statistical analysis. Y.S. contributed to the analysis and interpretation of data. C.Y. wrote the first draft of the paper. I.K., O.C., A.E., K.S., and Y.N. contributed to critical revision of the manuscript for important intellectual content. Y.N. supervised the study. All authors read and approved the final manuscript.

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CONFLICTS OF INTEREST

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