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## Original Article

## Evaluation of physical and psychological status of health care workers infected with COVID-19 during a hospital outbreak in Japan

Koji Kameyama<sup>a,\*</sup>, Kosuke Mizutani<sup>a</sup>, Yukiko Miyake<sup>b</sup>, Toma Iwase<sup>c</sup>, Yoshio Mizutani<sup>c</sup>, Mikito Yamada<sup>c</sup>, Yoshiki Ito<sup>d</sup>, Satoshi Ishihara<sup>a</sup>, Takashi Deguchi<sup>a</sup><sup>a</sup> Department of Urology, Central Japan International Medical Center, 1-1 Kenkonomati, Minokamo, Gifu, 505-8510, Japan<sup>b</sup> Department of Nursing, Central Japan International Medical Center, 1-1 Kenkonomati, Minokamo, Gifu, 505-8510, Japan<sup>c</sup> Department of Emergency Medicine, Central Japan International Medical Center, 1-1 Kenkonomati, Minokamo, Gifu, 505-8510, Japan<sup>d</sup> Department of Orthopedic Surgery, Central Japan International Medical Center, 1-1 Kenkonomati, Minokamo, Gifu, 505-8510, Japan

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## ABSTRACT

**Purpose:** COVID-19 causes physical and psychological impacts on health care workers (HCWs), especially when it occurs during an outbreak. As there are few reports on outcomes of HCWs infected with COVID-19 during a hospital outbreak, we investigated the physical and psychological impacts on HCWs infected with COVID-19 during an outbreak in our hospital.

**Methods:** During the outbreak in our hospital, 231 people were infected with COVID-19 including patients, HCWs and their families. Among them, 83 HCWs were enrolled in this study. Current quality of life (QOL) was assessed with the EuroQol-visual analogue scales (EQ-VAS), and motivation to keep on working was evaluated by a 10-point analogue scale. Physiological recovery rates including return to work (RTW) period were also analyzed.

**Results:** One nurse quit work due to anxiety regarding re-infection with COVID-19. The median period to RTW from the diagnosis was 14.0 (12.0–17.0) days. Motivation to keep on working was slightly reduced, and the EQ-VAS was 75.0 (65.0–83.6). There were no significant differences in QOL and motivation between male and female HCWs, nurses and other HCWs, treatment and non-treatment group, and supplemental and non-supplemental oxygen group. The most frequent persistent symptoms at 1, 3 and 6 months after infection were anosmia followed by fatigue.

**Conclusion:** Although QOL and motivation to keep on working were slightly reduced, only one HCW quit work. No severe persistent symptoms were observed, and the RTW period was relatively short.

## 1. Introduction

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has led to a worldwide pandemic since late 2019 [1]. In Japan, more than 9 million cases of COVID-19 and about 30 thousand deaths were reported up to August 03, 2022 [2]. All hospitals are at the forefront of the fight against COVID-19, which has had a significant impact on the healthcare system [3]. As healthcare workers (HCWs) are exposed to the hazards of infection of COVID-19 patients, HCWs are at higher risk of the infection [4–10]. A systematic review including 127,480 HCWs showed an 8.7% seroprevalence of SARS-CoV-2 antibodies and indicated the considerable risk to HCWs of contracting COVID-19 [11]. As with other infected patients, infected HCWs are isolated and treated with or without hospitalization,

which results in a reduced number of HCWs in hospital during an outbreak. Eventually, the shortage of HCWs increases the workload and psychological and psychological stresses of other HCWs [8].

COVID-19 causes several symptoms not only in the acute phase but also in the subacute and late phases, which may reduce patient quality of life (QOL) [12–16]. Persistent symptoms after an acute infection are known as “long COVID” [17,18]. As reported previously, various symptoms of long COVID are thought to affect the return to work (RTW) rate of HCWs. Therefore, it is worthwhile to analyze RTW rate as well as symptoms of long COVID in HCWs. Outbreaks of COVID-19 have occurred in many medical facilities, and many HCWs were infected and died in the early phases [19]. Many studies also reported that HCWs exposed to COVID-19 suffered various psychological disorders including depression, acute stress, insomnia, post-traumatic symptoms and burnout [20]. Incidence rates of these symptoms are thought to be

\* Corresponding author. 1-1 Kenkonomati, Minokamo, Gifu, 505-8510, Japan.

E-mail address: [kameyama.koji@cjime-hp.jp](mailto:kameyama.koji@cjime-hp.jp) (K. Kameyama).

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**Abbreviations**

COVID-19	coronavirus disease 2019
EQ-VAS	EuroQol-visual analogue scales
HCWs	health care workers
PPE	personal protective equipment
QOL	quality of life
RTW	return to work
SARS-CoV-2	severe acute respiratory syndrome coronavirus-2
PCR	polymerase chain reaction

higher during an outbreak period. In this context, mental support for COVID-19-infected HCWs during the pandemic phase is thus very important.

Our hospital is a secondary hospital located in Gifu prefecture, Japan. From February to March 2021, an outbreak of 231 COVID-19 that included patients, medical staffs and their families occurred in our hospital. The number of infected people during the outbreak was the highest in this area, and it was officially recognized as an outbreak by the local government. Our hospital tried to control the outbreak with the cooperation of an outbreak management team that was sent from the central government of Japan.

Few studies have reported on HCWs infected with COVID-19 during an outbreak phase in hospital. The purpose of this study is to investigate the physiological and psychological outcomes of HCWs infected with COVID-19 during an outbreak in our hospital.

**2. Methods**

This study was approved by the Institutional Review Board of Kizawa Memorial Hospital (currently Central Japan International Medical Center, approval number: 2021-040). The outbreak in our hospital occurred during the period from February 2, 2022 to March 22, 2022. We conducted a survey using an anonymous questionnaire form from October 1, 2022 to November 10, 2022. Of the 231 people infected during the outbreak, 92 HCWs were enrolled and were surveyed with the anonymous questionnaire. The questionnaire items are shown in the Supplementary table. Eventually, data collected from 83 HCWs were analyzed (Fig. 1). The motivation for continuing to work was evaluated using a scale from 0 to 10, which was defined as the motivation score in this study (Supplementary figure). A scale value of 5 was set if there was no change in motivation after RTW, 0 was set if motivation completely disappeared, and 10 was set if motivation was at its maximum. Each

HCW's current QOL was evaluated using EuroQol-visual analogue scales (EQ-VAS) (Supplementary figure). Statistical differences were determined by Student *t*-test or Mann-Whitney *U* test.  $P < 0.05$  was considered to indicate statistical significance.

**3. Results**

Of the 92 staff members, 83 HCWs consented to participate in this study, from whom data were collected by the questionnaire (Fig. 1). 2 nurses and 4 doctors were moved after the outbreak due to reasons unrelated to COVID-19. One nurse quit work due to anxiety regarding re-infection with COVID-19. The characteristics of these 83 HCWs are

**Table 1**

Clinical characteristics of the HCWs infected with COVID-19 in our hospital.

Age (yrs), median (IQR)	34.0 (25.0–48.0)
Sex, n (%)	
Male	23 (27.7)
Female	60 (72.3)
BMI (kg/m <sup>2</sup> ), median (IQR)	21.0 (19.8–23.4)
Job type, n (%)*, total number (%)†	
Doctor	10 (12.0), 127 (7.9)
Nurse	52 (62.7), 522 (10.0)
Nursing Assistant	7 (8.4), 68 (10.3)
Pharmacist	1 (1.2), 23 (4.3)
Medical Technologist	1 (1.2), 20 (5.0)
Radiological Technologist	2 (2.4), 39 (5.1)
Rehabilitation Technician	5 (6.0), 82 (6.0)
Dental Hygienist	3 (3.6), 5 (60.0)
Childcare Worker	1 (1.2), 16 (6.3)
Hospital Clerk	1 (1.2), 182 (0.5)
Underlying conditions, n (%)	
None	68 (81.9)
Hypertension	5 (6.0)
Diabetes mellitus	3 (3.6)
Asthma	3 (3.6)
Hypothyroidism	1 (1.2)
History of malignant disease	2 (2.4)
Pregnancy	1 (1.2)
Other	3 (3.6)
Smoking history, n (%)	
None	65 (78.3)
Current	9 (10.8)
Past	9 (10.8)

HCWs = health care workers, IQR = interquartile range, BMI = body mass index.

\*Number and proportion of infected HCWs for each job type.

†Total number of people in each job type in our hospital and percentage of infected people among them.

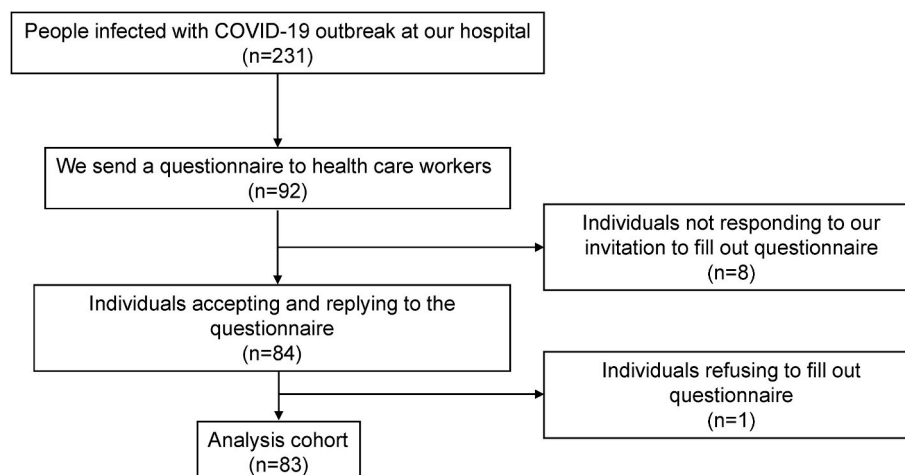


Fig. 1. Flowchart of subject enrollment and data collection.

listed in Table 1. Among them, 23 were males (27.7%) and 60 were females (72.3%). Their median age was 34.0 years old, and most of them were quite healthy, not obese and without a past medical history. More than 70% of the participants were nurses (62.7%) and medical doctors (12.0%). There were no HCWs to receive the COVID-19 vaccination because the vaccines had been not available at that time. Among these HCWs, 46 were hospitalized, 35 were treated at a recovery accommodation facility, and 2 were treated at home. The recovery accommodation facility was for people who were not severely infected with COVID-19. Nurses in the facility checked the physical condition of the infected HCWs. Time to hospitalization or entering the facility from diagnosis, length of hospitalization or stay at the facility and the RTW period are shown in Table 2. Average time to hospitalization or entering the facility from diagnosis was 2.0 days. The median length of hospitalization or stay in the facility and days from infection to RTW were 9.0 days and 14.0 days, respectively. Treatment with favipiravir, remdesivir, dexamethasone or a combination of these were administered to 9 HCWs (10.8%). Six HCWs (7.2%) required supplemental oxygen, but none required mechanical ventilation.

Symptoms at diagnosis and at 1, 3 and 6 months after infection are shown in Fig. 2. The most frequent symptom at the time of infection was cough, followed by fatigue and anosmia, and 60 (72.2%, 16 males/44 females), 32 (38.6%, 10 males/21 females) and 17 (29.5%, 7 males/10 females) HCWs had at least one symptom at 1, 3 and 6 months after infection, respectively. Three HCWs (3.6%) received medication even though 6 months had passed after infection: two were treated for ageusia and anosmia and one for sleep disorder. The most common symptoms at 1 month after infection were anosmia (33.7%) and fatigue (33.7%), followed by cough (21.7%). At 3 months after infection, anosmia (18.1%) was the most frequent symptom, followed by fatigue (9.6%) and headache (9.6%), and at 6 months after infection, the most common symptom was anosmia (7.2%) followed by fatigue (4.8%).

The analysis of QOL and motivation for working after COVID-19 are shown in Fig. 3. The median EQ-VAS score was 75.0, and the median motivation score was 4.0. There were no significant differences between males and females, nurses and other HCWs except nurses, the treatment group (any treatment including administration of medications such as favipiravir, remdesivir, dexamethasone and supplemental oxygen) and the non-treatment group in QOL and motivation for work. We also analyzed the effect of supplemental oxygen on QOL and the motivation, there were no differences between supplemental and non-supplemental oxygen group.

#### 4. Discussion

HCWs face higher risks of COVID-19 compared to the general population [4,9,10]. Indeed, the number of infections is high among nurses who care for patients [8–10]. Consistent with previous reports, the number and percentage of infected nurses were high in this study. COVID-19 has a great impact on the mental health of HCWs (e.g., anxiety regarding infection and a heavy workload due to the increased number of patients) [20–27]. With the spread of COVID-19, HCWs intending to leave their jobs indicated that stress was related to the high

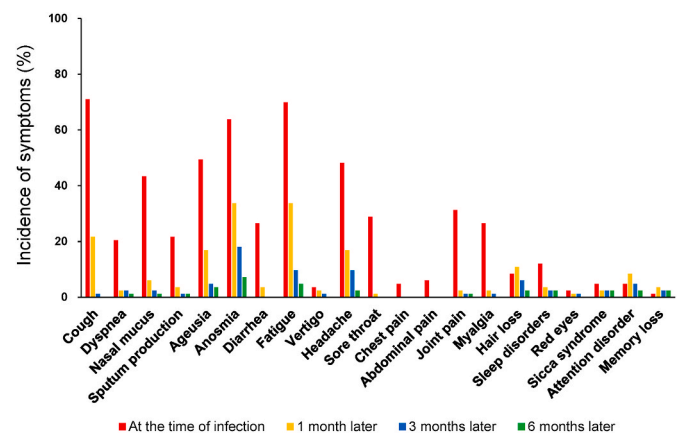


Fig. 2. Incidence of symptoms in health care workers with COVID-19.

turnover of HCWs [22,28–30]. The turnover rate of infected HCWs during the outbreak was expected to be high, but only one HCW in our hospital quit work due to COVID-19. Moreover, the median motivation score was 4.0, which suggested that the motivation to keep working was reduced only mildly so after infection. This result may be due to the high professionalism and responsibility HCWs assumed for their jobs. The relatively short 2-week period of RTW compared to other reports in the early phase of COVID-19 pandemic may support this supposition [31, 32].

The importance of providing mental health support to HCWs during the COVID-19 epidemic has been reported [23,25,33,34]. Mental support for infected HCWs might be even more important due to increased psychological symptoms experienced by infected HCWs compared to non-infected HCWs [9,26]. Our hospital provided mental support by phone for the hospitalized HCWs and those isolated in the care facility. Four doctors working with rehabilitation technicians and clinical psychologist were responsible for mental support. Rehabilitation technicians checked any complaints, anxieties or psychological distress of infected HCWs by phone every day. Their complaints were reported to the doctors, and clinical psychologist provided psychological support by phone. Our hospital also provided a system that infected HCWs were able to see psychiatrist if necessary. This mental support may have helped to reduce the risk of mental health problems. The usefulness of mental support by telephone was also reported [35].

Sufficient and adequate personal protective equipment (PPE), early recognition of infection, and isolation of infected patients reduce the risk of COVID-19 [4,9,10,25]. After the outbreak in our hospital, we repeatedly conducted education on PPE. In addition, HCWs who showed any physical symptoms or who had contact with COVID-19-infected individuals without adequate PPE were examined several times by polymerase chain reaction (PCR) test or COVID-19 antigen testing regardless of their symptoms. Moreover, we paid particular attention to fever of unknown origin and repeated the tests to detect COVID-19 early in all hospitalized patients. Even if the test was negative at the time of admission, we determined whether the patient had asymptomatic COVID-19 based on our criteria. Once a patient was suspected of having COVID-19, the patient was managed in an isolated room and treated by staff using sufficient PPE until no COVID-19 could be proved. Although this system might be excessive, it might also have reduced the fear of infection among HCWs. Some reports showed that the lack of or unfamiliarity with PPE and fear of infection adversely affect the mental health of HCWs [21,22,24,36] and that opportunities for education on PPE reduce physical and mental burden [21]. All of these factors might have had positive effects not only in preventing the spread of infection but also on the mental health of the HCWs, resulting in a shorter RTW period, low turnover rate and mild decrease in the motivation to keep working.

Table 2

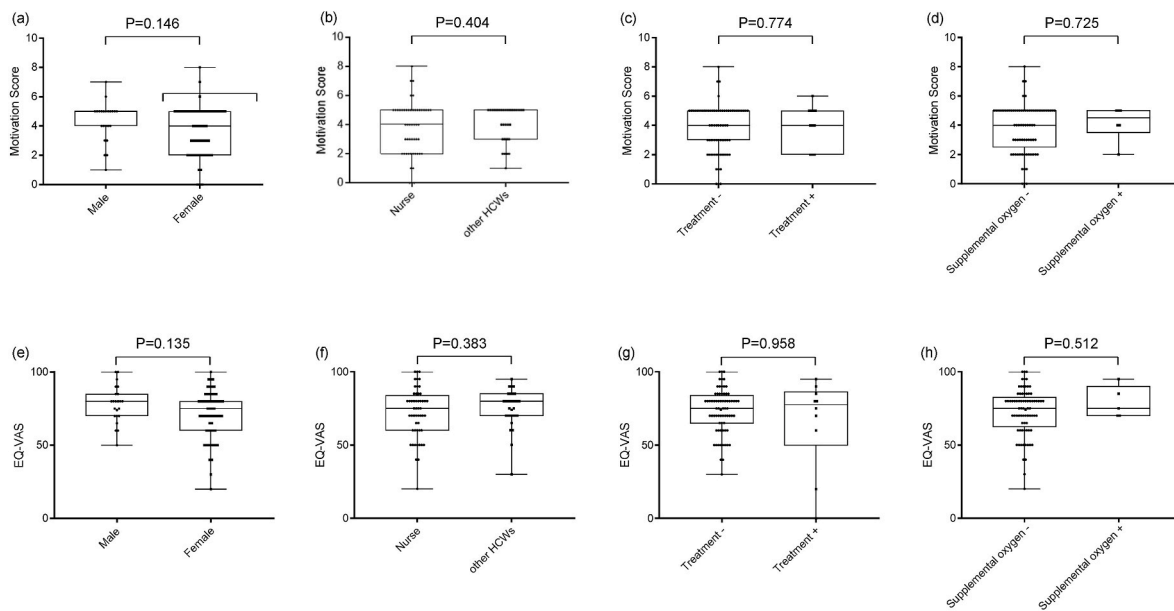
Diagnosis to hospitalization, hospitalization, and return to work times.

Time to hospitalization or entering the facility* from diagnosis (n = 78)	2.0 (1.0–3.0)
Length of hospitalization or stay in the facility (n = 77)	9.0 (8.0–20.0)
Time to return to work (n = 76)	14.0 (12.0–17.0)

Values are number of days (IQR).

IQR = interquartile range.

\* Recovery accommodation facility, which is for COVID-19 infected patients with a non-severe condition.



**Fig. 3.** The scores for motivation and the EuroQol-visual analogue scales (EQ-VAS). Comparison of motivation score between males and females (a), nurses and other HCWs (b), non-treatment and treatment group (c), and non-supplemental oxygen and supplemental oxygen group (d). Comparison of EQ-VAS between males and females (e), nurses and other HCWs (f), non-treatment and treatment group (g), and non-supplemental oxygen and supplemental oxygen group (h). Data shown in the box and whiskers plots are interquartile range (IQR: box), median (thick vertical line in the box) and 1.5 IQR (whiskers).

Decreased income is well known to effect a HCW's mental condition [27,37,38]. In Japan, reduced income of HCWs infected with COVID-19 during work are supplemented by workers' accident compensation insurance, and 80% of the HCW's usual income was paid by insurance. During the outbreak at our hospital, the remaining of 20% of income was paid by our hospital. This monetary support was also considered to be one of the reasons for the low rate of retirement and the mild decrease in the motivation to keep working.

The median EQ-VAS score was 75.0, which was slightly lower than that reported in patients infected with COVID-19 [12,39], and the motivation to keep on working was slightly reduced after infection. Female HCWs and nurses are at higher risk of psychological symptoms such as anxiety and depression than male HCWs and other HCWs [21–23,25,40–42], and COVID-19-infected HCWs are at higher risk of these symptoms than are non-infected HCWs during the COVID-19 pandemic [9,26]. Based on these reports, it was expected that work motivation and current QOL would be lower in female and nurses than male HCWs and other HCWs, respectively. In addition, lower motivation and QOL were expected in the treatment group or supplemental oxygen group because the groups were thought to have more significant symptoms. However, there was no significant difference in work motivation or current QOL in this study. Our mental and financial support may be one of the reasons to reduce mental risks in specific groups.

It is now widely known that various systemic symptoms continue after the acute COVID-19 [13–16]. Many long COVID symptoms were identified in this study. At the time of diagnosis, more than half of the HCWs had symptoms of anosmia and fatigue, and these two symptoms were those most frequently found at 3 and 6 months after infection in this study. Previous reports also reported that the long-lasting symptom was fatigue, which is consistent with the findings of the present study [13–16]. Although research is continuing to determine risk factors for long COVID, such as age, sex, more than five early symptoms and severity of the initial acute COVID-19, no obvious risk factors have been found so far [15]. The prevalence of long COVID in our cohort was relatively low compared to some previous reports [13,15]. The mostly younger population without a medical history and with mild COVID symptoms may explain this result.

This study has some limitations. The sample size was small, and the

questionnaire was answered based on personal memory, which might lead to cognitive bias and undervaluation. Due to simultaneous survey for all infected HCWs, the periods from infection to survey were not consistent. There are few reports on turnover rate and change in motivation due to COVID-19 of HCWs. Therefore, the results of the present study focusing on the mental health of HCWs infected with COVID-19 in a facility undergoing a single outbreak may be valuable for further research on the mental health of HCWs worldwide.

## 5. Conclusion

In conclusion, the turnover rate of HCWs infected with COVID-19 during an outbreak period was low, and the RTW period was relatively short although the motivation to keep on working was slightly decreased. Appropriate mental and financial support for infected HCWs may have reduced the turnover rate and encouraged the HCWs to maintain their motivation.

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No funding was received.

## Authorship

All authors meet the ICMJE authorship criteria. KK, KM, YM, MY, YI and SI designed the study. KK collected and analyzed the data. KK wrote the manuscript and MK edited the manuscript. All authors reviewed and approved the manuscript.

## Declaration of competing interest

The authors declare that they have no conflict of interests.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jiac.2022.10.003>.

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