American Journal of Infection Control 50 (2022) 645–650

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Retrospective evaluation of the symptom-based work restriction strategy of healthcare providers in the first epidemic of COVID-19 at a tertiary care hospital in Tokyo, Japan

Hiroki Shikano MT [a], Yuki Uehara MD, PhD [a,b,c,*], Rino Kuboki MT [a], Erika Tashino MT [a], Fumiko Nakahara MT [a], Yumi Matsumoto MT [a], Satomi Kusakabe MT [a], Chizumi Fukazawa MT [a], Takahiro Matsuo MD [b], Nobuyoshi Mori MD [b], Akiko Ayabe RN [d], Torahiko Jinta MD, PhD [d,e], Fumika Taki MD, PhD [d,f], Fumie Sakamoto BSN, MPH, CIC [g], Osamu Takahashi MD, PhD, MPH [h,i], Tsuguya Fukui MD, PhD, MPH [h,i]

[a] *Department of Clinical Laboratory, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*
[b] *Department of Infectious Diseases, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*
[c] *Department of Microbiology, Juntendo University Faculty of Medicine, Bunkyo-ku, Tokyo, Japan*
[d] *Division of Health Care Administration, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*
[e] *Department of Respiratory Medicine, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*
[f] *Department of Nephrology, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*
[g] *Quality Improvement Center, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*
[h] *Graduate School of Public Health, St. Luke's International University, Chuo-ku, Tokyo, Japan*
[i] *Department of General Internal Medicine, St. Luke's International Hospital, Chuo-ku, Tokyo, Japan*

Key words:
Severe acute respiratory syndrome coronavirus 2
Anti-severe acute respiratory syndrome coronavirus 2 antibody
Adherence to infection control strategy
Allergic rhinitis

A B S T R A C T

Background: Effectiveness of restricting healthcare providers (HCPs) from working based on the coronavirus disease 2019 (COVID-19)-like symptoms should be evaluated.
Methods: A total of 495 HCPs in a tertiary care hospital in Tokyo, Japan, participated in this study between June and July in 2020. Analysis of serum anti-severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibody to identify infected HCPs, questionnaire surveys, and medical record reviews were conducted to evaluate the appropriateness of symptom-based work restriction for 10 days.
Results: Five participants (1.0%) were identified as infected. Forty-six participants (9.3%) experienced work restriction and all 5 infected participants (10.8%) restricted working, even though the real-time reverse transcription-polymerase chain reaction was positive only in 4 participants (80.0%). There were no unexpectedly infected participants among those who did not experience work restriction. However, only 46 of 110 HCPs with COVID-19-like symptoms (41.8%) restricted themselves from working.
Discussion: Symptom-based work restriction strategy successfully prevented infected HCPs to work, but showed low specificity to identify truly infected HCPs, and their low adherence to the strategy was revealed.
Conclusions: HCPs with COVID-19-like symptoms should restrict working as the first step of infection prevention, but the strategy to identify truly infected HCPs is necessary.

* Address correspondence to Yuki Uehara, MD, PhD, Department of Clinical Laboratory, St. Luke's International Hospital, 9-1 Akashi-cho, Chuo-ku, Tokyo 104-8560, Japan
E-mail address: yukiue@luke.ac.jp (Y. Uehara).
Funding/support: This work was supported by a donation for research projects about COVID-19 from an anonymous patient of St. Luke's International Hospital. The authors acknowledge the generous help for our research. The benefactor had no involvement in conducting this study.
Conflicts of Interest: None of the authors have any commercial or financial involvements in connection with this study that represent or appear to represent any conflicts of interest. All authors report no conflict of interest relevant to this article.

https://doi.org/10.1016/j.ajic.2021.11.029

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first reported in Wuhan, China, at the end of 2019 and rapidly became a pandemic in 2020.[1] Healthcare providers (HCPs) are recognized as a high-risk population to contract COVID-19.[2,3] Therefore, prevention of SARS-CoV-2 infection of healthcare providers (HCPs) while working needs considerable effort, and secondary spread of SARS-CoV-2 from HCPs to patients, or among HCPs should be prevented for patients' and occupational safety.

Our hospital is a tertiary care hospital with 520 beds, located in the center of Tokyo, and has been taking care of COVID-19 patients since January 2020. As a result, a total of 73 COVID-19 patients were managed in our hospital from January to May 2020. The first large epidemic of COVID-19 was observed in Japan from March to May 2020, but no obvious transmission of SARS-CoV-2 in our hospital was observed by the end of May 2020. To protect both of the patients and employees in our hospital, HCPs were restricted from working regardless of real-time reverse transcription-polymerase chain reaction (RT-PCR) results when suspicious symptoms of COVID-19 appeared because the sensitivity of nucleic acid amplification test (NAAT) to detect SARS-CoV-2 is not perfect to find infected persons.[4]

The aim of this study was to evaluate the appropriateness of restriction of HCPs from working simply based on the COVID-19-like symptoms in a tertiary care hospital during the first epidemic in Japan.

METHODS

COVID-19-like symptom-based work restriction strategy

When HCPs noticed any of suspicious symptoms of COVID-19, they had to report their symptoms to the Division of Infection Control and the Division of Health Care Administration of the hospital, restrict themselves from working immediately, visit the clinic of the Department of General Internal Medicine in our hospital, and receive RT-PCR tests on the first weekday after appearance of symptoms. The list of suspicious symptoms were as follows: body temperature over 37.0°C, malaise, shivering, headache, conjunctival injection, nasal congestion, nasal discharge, taste disturbance, smell disturbance, sore throat, cough, sputum, shortness of breath, and myalgia. After they received RT-PCR tests, they had to continue restriction from working at least for 10 days from the onset of the symptoms even if RT-PCR results were negative. If symptoms were residual on the 10th day, work restriction was continued and they could return to their work 72 hours after symptoms were resolved.

Study setting and participants

On April 1, 2020, there were 3,316 employees at our hospital, Tokyo, Japan. The study was conducted between 23rd June 2020 and 15th July 2020, and the total of 495 (14.9%) agreed to participate in this study. Written, informed consent was obtained from each participant.

Serological analysis of anti-SARS-CoV-2 antibodies

Serum samples were obtained from all study participants and stored at 4°C. The methods used for analysis of anti-SARS-CoV-2 antibodies were as follows: Test 1, cobas 8,000 <e602> with Elecsys Anti-SARS-CoV-2 (RUO) (Roche Diagnostics Inc., Tokyo, Japan); Test 2, ARCHITECT i2000SR with ARCHITECT SARS-CoV-2 IgG (Abbott Japan LLC, Tokyo, Japan); Test 3, new coronavirus (SARS-CoV-2) antibody test reagent kit (immunoglobulin G [IgG]) (Kurabo Industries Ltd., Osaka, Japan); and Test 4, new coronavirus (SARS-CoV-2) detection antibody kit (Artron) (Artron Laboratories Inc., British Columbia, Canada). Tests 1 and 2 were automatic immunology analysers. Test 1 could detect IgM and IgG without separation, and Test 2 could detect IgG only. Tests 3 and 4 were lateral-flow immunoassay kits to detect IgG independently.

We could obtain sufficient amount of Test 1 reagents, so Test 1 was performed for all 495 samples for screening. If Test 1 showed positive results, other 3 tests were performed for the same samples additionally. Infected participants were defined when Test 1 and at least one other test for IgG were positive.

Questionnaire and medical record review of the study participants

For the study participants, a questionnaire was used to ask their age, sex, profession, department, history of contact with COVID-19 patients in their work regardless of the degree of infection risk, history of close contact with COVID-19 patients in their work (contact within 2 meters of an infected person for a total of 15 minutes or more per day without appropriate PPE, based on the recommendation of the Centers for the Disease Control and Prevention (CDC) about the definition of close contact[5]), overseas travel, visits to high-risk places such as karaoke facilities, sports gyms, and crowded live music venues, presence of symptoms suspicious of COVID-19, history of clinic visits and having SARS-CoV-2 RT-PCR tests, and number of days of work restriction, from January 2020 to May 2020. Whether the participant had a history of seasonal allergic rhinitis was asked specifically because the period overlapped with the high season of cedar pollinosis in Japan.

For those who underwent SARS-CoV-2 RT-PCR tests, the results of SARS-CoV-2 RT-PCR tests, the official reading reports of chest computed tomography (CT) from the Department of Radiology if performed, and duration from onset of symptoms to the RT-PCR tests were extracted by medical record review.

RT-PCR for SARS-CoV-2

Samples for RT-PCR were collected by nasopharyngeal swabbing. RT-PCR for SARS-CoV-2 was performed using LightMix Modular SARS-CoV (COVID-19) E-gene (Roche Diagnostics Inc.) and cobas z 480 (Roche Diagnostics Inc.) for participants who experienced work restriction.

Statistical analysis

The relationships between the antibody test results and the factors obtained by questionnaires and medical record review were evaluated by Fisher's exact test using statistical software JMP 15.1.0 (SAS Institute Inc., Cary, NC, USA). A *P*-value of .05 was used as the cut-off for significance.

Ethical approval

The study protocol was approved by the ethics committee of St. Luke's International University (approval number 20-R046).

RESULTS

Study population

Table 1 shows the age, sex, and professions of the study participants. Compared to the ratio of the professions of all the hospital employees, the proportion of medical technologists, radiology technologists, physical therapists, and clinical engineers was high in the study participants.

Table 1
Basic characteristics and proportion of the study participants in each profession

	Study participants (n = 495)	All employees (n = 3,316)	% of study participants (study participants/all employees)
Age, y (median, minimum to maximum)	33, 20-69	35, 19-82	-
Sex (number of females, %)	370, 74.7	2,470, 74.5	-
Profession (number, %)			
Physician	56, 11.3	653, 19.7	4.8
Nurse and nurse assistant	166, 32.9	1,174, 35.4	14.1
Pharmacist	32, 6.5	63, 1.9	50.8
Medical technologist	74, 15.0	150, 4.5	49.3
Radiology technologist	35, 7.1	74, 2.2	47.3
Physical therapist	21, 4.2	35, 1.1	60.0
Clinical engineer	28, 5.7	36, 1.1	77.8
Administrative staff	73, 14.8	734, 22.1	10.0
Other healthcare staff	10, 2.0	397, 12.0	2.5

Table 2
Detailed positive results of the anti-SARS-CoV-2 antibody assays who were positive for Test1

Participant ID No.	Previous history of RT-PCR test	Test 1 result	Test 1 COI (positive: ≥1.0)	Test 2 result	Test 2 COI (positive: ≥1.4)	Test 3 (IgG)	Test 4 (IgG)	Definition
1	Positive	Positive	30.9	Positive	3.41	Positive	Positive	Infected
2	Positive	Positive	118.5	Positive	7.12	Positive	Positive	Infected
3	Positive	Positive	54.9	Positive	3.15	Positive	Positive	Infected
4	Positive	Positive	123.8	Positive	7.38	Positive	Positive	Infected
5	Negative	Positive	79.8	Positive	5.39	Positive	Positive	Infected
6	Not performed	Positive	1.61	Negative	0.03	Negative	Negative	Uninfected

SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; RT-PCR, real-time reverse transcription-polymerase chain reaction; COI, cut-off index; IgG, immunoglobulin G. Test 1, cobas 8000 <e602> with Elecsys Anti-SARS-CoV-2 (RUO) (Roche Diagnostics Inc., Tokyo, Japan); Test 2, ARCHITECT i2000SR with ARCHITECT SARS-CoV-2 IgG (Abbott Japan LLC, Tokyo, Japan); Test 3, new coronavirus (SARS-CoV-2) antibody test reagent kit (immunoglobulin G [IgG]) (Kurabo Industries Ltd., Osaka, Japan); and Test 4, new coronavirus (SARS-CoV-2) detection antibody kit (Artron) (Artron Laboratories Inc., British Columbia, Canada).

Identification of the infected participants by anti-SARS-CoV-2 antibody tests

Six participants were positive for anti-SARS-CoV-2 antibody in Test 1. The results are shown in detail in Table 2. One participant (No. 793) showed very low titer (cut-off index =1.61) in Test 1, and 3 other IgG tests were negative. Therefore, this participant was defined as uninfected, and other 5 participants with positive results for all 4 antibody tests were confirmed as the infected participants.

The infection rate of the study participants was calculated as 1.0% (5/495), and 4 infected participants (80.0%) were positive for the SARS-CoV-2 RT-PCR test at the time when they restricted themselves from working.

Comparison of the infected and uninfected participants

Table 3 shows a comparison between the infected and uninfected participants. Experience of symptoms, self-report of symptoms, work restriction and anti-SARS-CoV-2 antibody results of the study participants is also shown in Supplementary Figure S1. By profession, 2 physicians, 2 nurses, and 1 administrative staff member were infected with SARS-CoV-2. Two hundred and fifty-seven participants (53.7%) reported contact with COVID-19 patients while working, including one physician and 2 nurses (3 in total, 1.2%) infected with SARS-CoV-2. However, these 3 HCPs denied close contact with COVID-19 patients and failure of appropriate PPE use in their work. Of the 238 participants who did not have any contact with COVID-19 patients, one physician and one administrative staff member (2 in total, 0.8%) were infected with SARS-CoV-2.

All 449 participants who did not experience restriction from working (90.7%) were uninfected. Seventy-seven participants (15.6%) had used sports gyms and/or karaoke facilities in 5 months, but none of them were infected.

Of the 495 participants, 110 participants (22.2%) reported various symptoms suspicious of COVID-19 in 5 months, and all 5 infected participants experienced any symptoms more frequently than uninfected participants (P = .0005).

Of the 110 participants who had symptoms suspicious of COVID-19, only 67 (60.9%) had a history of clinic visits for their symptoms, and 46 participants (41.8%) were restricted from working. Five infected participants visited clinics and were restricted from working appropriately.

Table 4 shows the relationships between the presence of seasonal allergic rhinitis (cedar pollinosis) and symptoms, clinic visits, and work restriction. Two-hundred and thirty-one participants (46.7%) reported history of seasonal allergic rhinitis, and 3 of 5 infected participants (30.0%) had seasonal allergic rhinitis. The participants who answered they had seasonal allergic rhinitis showed a higher frequency of symptoms (27.3% vs 17.9%, P = .013) and clinic visits (19.5% vs 8.3%, P = .020). The frequency of work restriction was also significantly higher in participants with seasonal allergic rhinitis than in those without rhinitis (12.1% vs 6.8%, P = .045), even though the prevalence of infected participants did not show a significant difference in this study.

Detailed comparison of the participants with previous history of SARS-CoV-2 RT-PCR test

Table 5 shows the detailed comparison of the 5 infected and 32 uninfected participants who underwent RT-PCR tests in our hospital and were restricted from working. Male HCPs contracted SARS-CoV-2 more frequently than female HCPs (P = .022). Infected participants experienced myalgia more frequently than uninfected ones (P = .0049). Chest CT was performed in 35 participants, and 9 participants (25.7%) had abnormal findings compatible with COVID-19, such as ground-glass opacities, mixed ground-glass opacities and

Table 3
Comparison of characteristics between the infected and uninfected participants

	Total (n = 495)	Infected (n = 5)	Uninfected (n = 490)	*P*
Profession (n, %)				
Physician	56, 11.3	2, 40.0	54, 11.0	-
Nurse and nurse assistant	166, 33.5	2, 40.0	164, 33.5	-
Pharmacist	32, 6.5	0, 0	32, 6.5	-
Medical technologist	74, 15.0	0, 0	74, 15.1	-
Radiology technologist	35, 7.1	0, 0	35, 7.1	-
Physical therapist	21, 4.3	0, 0	21, 4.3	-
Clinical engineer	28, 5.7	0, 0	28, 5.7	-
Administrative staff	73, 14.7	1, 20.0	72, 14.7	-
Other healthcare staff	10, 2.0	0, 0	10, 2.0	-
Age, y (median, minimum-maximum)	33, 20-69	39, 23-53	33, 20-69	.57
Sex (number of females, %)	370, 74.7	2, 40.0	368, 75.1	.11
RT-PCR, performed (n, %)	37, 7.5	5, 100.0	32, 6.53	<.0001*
RT-PCR, positive (n, %)	4, 0.81	4, 80.0	0, 0	<.0001*
Contact with confirmed COVID-19 patients in their work (n, %)	257, 51.9	3, 60.0	254, 51.8	1.00
Clinic visits for symptoms (n, %)	67, 13.5	5, 100.0	62, 12.7	<.0001*
Restricted from working (n, %)	46, 9.3	5, 100.0	41, 8.4	<.0001*
History of travel overseas in 2020 (n, %)	46, 9.3	1, 20.0	45, 9.18	.39
History of use of karaoke, gym, live music venue (n, %)	77, 15.6	0, 0	77, 15.7	1.00
History of cedar pollinosis (n, %)	231, 46.7	3, 60.0	228, 46.5	.67
Symptom (n, %)				
Any	110, 22.2	5, 100.0	105, 21.4	.0005*
Malaise	25, 5.05	3, 60.0	22, 4.5	.0011*
Shivering	19, 3.8	3, 60.0	16, 3.3	.0005*
Fever	48, 9.7	4, 80.0	44, 9.0	.0004*
Headache	37, 7.5	4, 80.0	33, 6.7	<.0001*
Eye symptoms	6, 1.2	1, 20.0	5, 1.0	.06
Nasal symptoms	36, 7.3	2, 40.0	34, 6.9	.0450*
Taste disturbance	4, 0.8	0, 0	4, 0.8	1.00
Smell disturbance	3, 0.6	1, 20.0	2, 0.4	.0300*
Sore throat	56, 11.3	3, 60.0	53, 10.8	.0120*
Cough	43, 8.7	2, 40.0	41, 8.4	.06*
Myalgia	6, 1.2	3, 60.0	3, 0.61	<.0001*

RT-PCR, real-time reverse transcription-polymerase chain reaction; COVID-19, coronavirus disease 2019.
*Fisher's exact test significant at 0.05 level.

consolidation, vascular enlargement in the lesion and traction bronchiectasis,[6] according to the official reports from the Department of Radiology. All 5 infected participants received chest CT investigation, and the findings suspicious of COVID-19 were found in 4 participants (80.0%), including one RT-PCR-negative/antibody-positive participant. The frequency of positive CT findings was higher than the uninfected participants (16.7%, *P* = .011).

DISCUSSION

Infection prevention in patients with suspected or known COVID-19 in hospitals need combination of multiple practices, such as appropriate hand hygiene, use of PPEs, and isolation of infected, or suspected patients.[5] Especially, infection prevention between patients and HCPs as well as among HCPs is essential for safety of both patients and HCPs, and for maintaining function of healthcare facilities. Therefore, HCPs with COVID-19 should immediately be found and start restriction from working.[7] When this study was conducted in the first epidemic of COVID-19 in Tokyo in 2020, our hospital could manage shortage of PPEs, universal masking of HCPs was started, and conversation without masks among HCPs was strictly prohibited all the time in the hospital. Vaccines against COVID-19 were not available, and turn-around time of RT-PCR was about 2 to 3 days in the first epidemic time. Based on these circumstances, this study could simply reveal the reality and effectiveness of symptom-based work restriction strategy of HCPs.

Table 4
Relationship between the presence of seasonal allergic rhinitis (cedar pollinosis) and symptoms, clinic visits, and work restriction

	Rhinitis + (n = 231)	Rhinitis - (n = 264)	*P*
Antibody, positive (n, %)	3, 1.3	2, 0.76	.67
Symptom, positive (n, %)	63, 27.3	47, 17.8	.013*
Clinic visits for symptoms (n, %)	45, 19.5	22, 8.3	.0003*
Restriction from working (n, %)	28, 12.1	18, 6.8	.045*

*Fisher's exact test significant at 0.05 level.

The anti-SARS-CoV-2 antibody test has been recognized as a tool for epidemiological investigation, rather than for diagnosis of SARS-CoV-2 infection in the clinical setting.[8] We chose Test 1 as the first screening of the antibody because of the sufficient supply of the reagents, but we had already reported that the sensitivity to detect antibody was the highest in Test 1 among the 4 antibody tests used in this study, which provided the appropriateness of the choice retrospectively.[9]

The sensitivity and specificity of a single NAAT of sample from upper respiratory tract to detect SARS-CoV-2 infection has been reported to be 76% and 100%, respectively, so the symptom-based strategy is preferred rather than the test-based strategy to decide the restriction and return to work for HCPs.[4,10] However, it was concerned that symptom-based work restriction strategy was too sensitive and had possibility to cause a shortage of staff, which could also cause insufficient balance of patients and HCPs and increase the risk of occupational infection of SARS-CoV-2 because of inadequate infection prevention measures.[11] Another report also revealed that only 30.3% of essential workers including HCPs who reported belief that they had COVID-19 with experience of compatible symptoms were seropositive on anti-SARS-CoV-2 antibodies.[12]

Chest CT was expected as a diagnostic tool of COVID-19, but the findings of chest CT were nonspecific to diagnose COVID-19 in this study, which was concordant with the recommendations from the

Table 5
Detailed comparison of the antibody-positive and antibody-negative participants who restricted themselves from working

	Total (n = 37)	Infected (n = 5)	Uninfected (n = 32)	*P*
Profession (n, %)				
Physician	6, 16.2	2, 40.0	4, 12.5	-
Nurse and nurse assistant	16, 43.2	2, 40.0	14, 43.8	-
Pharmacist	0	0	0	-
Medical technologist	0	0	0	-
Radiology technologist	1, 2.7	0	1, 3.1	-
Physical therapist	0	0	0	-
Clinical engineer	1, 2.7	0	1, 3.1	-
Administrative staff	11, 29.3	1, 20	10, 31.3	-
Other healthcare staff	2, 5.4	0	2, 6.25	-
Age, y (median, minimum-maximum)	34, 22-54	39, 23-53	33, 22-54	.46
Sex (number of females, %)	31, 83.8	2, 40.0	29, 90.6	.022*
RT-PCR, positive (n, %)	4, 10.8	4, 80.0	0, 0	<.0001*
Contact with confirmed COVID-19 patients in their work (n, %)	17, 45.9	3, 60.0	14, 43.8	.64
Duration of restriction from working (median, minimum-maximum)	7, 2-33	14, 12-33	7, 2-14	.0006*
History of travel overseas in 2020 (n, %)	1, 2.7	1, 20.0	0, 0	.14
History of use of karaoke, gym, live music venue (n, %)	3, 8.1	0, 0	3, 9.4	1
History of cedar pollinosis (n, %)	21, 56.8	3, 60.0	18, 56.3	1
Symptom (n, %)				
Malaise	13, 35.1	3, 60.0	10, 31.3	.32
Shivering	11, 29.7	3, 60.0	8, 25.0	.14
Fever	25, 67.6	4, 80.0	21, 65.6	1
Headache	16, 43.2	4, 80.0	12, 37.5	.14
Eye symptoms	1, 2.7	1, 20	0, 0	.14
Nasal symptoms	10, 27.0	2, 40.0	8, 25.0	.6
Taste disturbance	2, 5.4	0, 0	2, 6.25	1
Smell disturbance	2, 5.4	1, 20	1, 3.13	.26
Sore throat	20, 54.1	3, 60.0	17, 53.1	1
Cough	14, 37.8	2, 40.0	12, 37.5	1
Myalgia	4, 10.8	3, 60.0	1, 3.13	.0049 *
Positive findings on chest CT (n, %)	9 (n = 35), 25.7	4, 80.0	5, 16.7	.011*

RT-PCR, real-time reverse transcription-polymerase chain reaction; COVID-19, coronavirus disease 2019; CT, computed tomography.
*Fisher's exact test significant at 0.05 level.

American College of Radiology stating that CT should not be used to screen for or as a first-line test to diagnose COVID-19.[13]

High sensitivity and safety of symptom-based work restriction strategy to detect infected HCPs, as well as its low specificity, was revealed in this study, but this study also found the low adherence of HCPs to the strategy of self-reporting and restriction from working. HCPs with COVID-19-like symptoms did not always restrict themselves from working nor received RT-PCR tests, and some HCPs who experienced work restriction returned to work within 10 days after the onset of the symptom if RT-PCR was negative. It was reported that 38.3% of Japanese people had cedar pollinosis in 2019.[14] Because of the high prevalence of seasonal allergic rhinitis in Japan and in the study participants, HCPs might diagnose their symptoms as a part of seasonal allergic reaction by themselves. It was fortunate that no unexpectedly infected participants were found among HCPs who did not experienced work restriction, so we had to motivate HCPs to adhere to the strategy and to ensure them to restrict from working immediately as the first step of infection prevention in healthcare facilities.

It is also necessary to identify truly infected HCWs as much as possible. Myalgia seemed to be one of the specific symptoms of COVID-19 in this study, which was compatible with a previous report of symptoms of HCPs with COVID-19.[15] There had been multiple suggestions to distinguish patients with COVID-19 from patients without COVID-19. For example, new loss of taste or smell without nasal discharge or congestion is specific to distinguish COVID-19 from influenza, and symptoms of COVID-19 usually continues longer than those of influenza.[16] In contrast, fever, myalgia, sore throat and gastrointestinal symptoms rarely happen in seasonal allergy.[17] For symptomatic patients, repeated NAATs were useful not only to increase sensitivity of true positives but also to confirm true negatives.[4] In addition to the high-yield symptoms to distinguish COVID-19 from other diseases, repeated NAATs and vaccination history can be used to mitigate the duration of restriction days to avoid shortage of staff.[18]

Asymptomatic cases were estimated as at least one third of COVID-19 cases, and could reach 58% in high-burden outbreak settings.[19,20] These reports suggested the risk of missing infected cases only by symptom-based strategy and the need of combined strategy with NAAT to find asymptomatic cases, especially in circumstances with high incidence of COVID-19 and sufficient capacity of NAAT. In the resource-limited circumstances, syndromic surveillance approaches of HCPs including self-report of the symptoms are still recommended to detect HCPs contracting COVID-19.[21] This study could provide the reality of symptom-based work restriction strategy and help to establish the reasonable and feasible infection prevention and control measures regardless of availability of resources.

There were several limitations in this study. First, this study was conducted in a single center in Tokyo and the number of study participants was small. Second, the study population was biased in terms of the types of professions, and it might not reflect the entire population of all hospital employees. Third, gastrointestinal symptoms were not recognized as COVID-19-like symptoms and not included in the list of symptoms by which HCPs should restrict from working when this study was conducted. Forth, all of HCPs would not report their previous symptoms honestly, which could result in lower percentage of symptomatic HCPs than true percentage in this study.

CONCLUSIONS

In conclusion, work restriction strategy based on COVID-19-like symptoms successfully prevents infected HCPs from working. Additional encouragement is necessary for HCPs with suspicious symptoms to restrict from working, as well as the modification of the strategy to mitigate the duration of restriction based on additional clinical information.

Acknowledgments

None.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.ajic.2021.11.029.

References

1. World Health Organization. Timeline: WHO's COVID-19 response. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline. Accessed September 12, 2021.
2. Nguyen LH, Drew DA, Graham MS, et al. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *The Lancet Public Health*. 2020;5:e475–ee83.
3. Chou R, Dana T, Buckley DI, Selph S, Fu R, Totten AM. Epidemiology of and risk factors for Coronavirus infection in health care workers: a living rapid review. *Ann Intern Med*. 2020;173:120–136.
4. Hanson KE CA, Arias CA, Hayden MK, et al. Infectious Diseases Society of America Guidelines on the Diagnosis of COVID-19: Molecular Diagnostic Testing. *Infectious Dis Soc Am*. 2020. Version 2.0.0. 2020.
5. Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic. 2021. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html. Accessed September 12, 2021.
6. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation between chest CT findings and clinical conditions of coronavirus disease (COVID-19) pneumonia: a multicenter study. *AJR Am J Roentgenol*. 2020;214:1072–1077.
7. Centers for Disease Control and Prevention. COVID-19 Exposure in Healthcare Settings. 2021. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/exposure-in-healthcare.html. Accessed September 12, 2021.
8. Hanson KE CA, Arias CA, Englund JA, et al. Infectious Diseases Society of America Guidelines on the Diagnosis of COVID-19: Serologic Testing. *Infectious Dis Soc Am*. 2020. Version 1.0.0. 2020.
9. Kuboki R, Shikano H, Tashino E, et al. Comparative evaluation of the reagents for anti-SARS-CoV-2-antibody after the first attack by COVID-19 pandemic. *Japanese J Med Technol*. 2021;70:330–335. [Japanese].
10. Centers for Disease Control and Prevention. Return to Work Criteria for Healthcare Personnel with SARS-CoV-2 Infection (Interim Guidance). 2021. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/return-to-work.html. Accessed September 12, 2021.
11. Centers for Disease Control and Prevention. Strategies to Mitigate Healthcare Personnel Staffing Shortages. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/mitigating-staff-shortages.html. Accessed September 12, 2021.
12. Mulchandani R, Taylor-Philips S, Jones HE, et al. Association between self-reported signs and symptoms and SARS-CoV-2 antibody detection in UK key workers. *J Infect*. 2021;82:151–161.
13. American Collage of Radiology. ACR Recommendations for the use of Chest Radiography and Computed Tomography (CT) for Suspected COVID-19 Infection. 2020. Available at: https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Recommendations-for-Chest-Radiography-and-CT-for-Suspected-COVID19-Infection. Accessed November 19, 2021.
14. Matsubara A, Sakashita M, Gotoh M, et al. Epidemiological survey of allergic rhinitis in Japan 2019. *Nippon Jibiinkoka Gakkai Kaiho*. 2020;123:485–490. [Japanese].
15. Kohler PP, Kahlert CR, Sumer J, et al. Prevalence of SARS-CoV-2 antibodies among Swiss hospital workers: results of a prospective cohort study. *Infect Control Hosp Epidemiol*. 2021;42:604–608.
16. Centers for Disease Control and Prevention. Similarities and Differences between Flu and COVID-19. 2021. Available at: https://www.cdc.gov/flu/symptoms/flu-vs-covid19.htm. Accessed September 12, 2021.
17. Mayo Clinic. COVID-19, cold, allergies and the flu: What are the differences? 2021. Available at: https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/covid-19-cold-flu-and-allergies-differences/art-20503981. Accessed September 12, 2021.
18. Centers for Disease Control and Prevention. Updated Healthcare Infection Prevention and Control Recommendations in Response to COVID-19 Vaccination. 2021. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-after-vaccination.html. Accessed September 12, 2021.
19. Oran DP, Topol EJ. The proportion of SARS-CoV-2 infections that are asymptomatic: a systematic review. *Ann Intern Med*. 2021;174:655–662.
20. Sakurai A, Sasaki T, Kato S, et al. Natural history of asymptomatic SARS-CoV-2 infection. *N Engl J Med*. 2020;383:885–886.
21. World Health Organization. Prevention, identification and management of health worker infection in the context of COVID-19 Interim guidance. 2020. Available at: https://apps.who.int/iris/bitstream/handle/10665/336265/WHO-2019-nCoV-HW_infection-2020.1-eng.pdf?sequence=1&isAllowed=y. Accessed November 19, 2021.