

# Evaluation of the Validity of SARS-CoV-2 Infection Control Measures through Antibody Testing for Employees of a University and Hospital

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## Abstract

**Introduction:** Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is spread through person-to-person transmission and has become a global pandemic. At Saitama Medical University Hospital, many medical staff members have been involved in treating patients with COVID-19. The Care Task Force was established in collaboration with physicians, medical staff, and clerical staff in the various hospital departments to strengthen infection control measures based on standard precautions. **Methods:** To determine the outcome of infection control measures, we administered anti-SARS-CoV-2 antibody tests and questionnaires to all 2461 employees including nonhospital workers, as a local standard, between June 29 and July 10, 2020. **Results:** Among the hospital workers, 698 (33.99%) had contact with patients with COVID-19 and 325 healthcare workers worked in specialized wards for the COVID-19, intensive care unit, and high-fever outpatient clinics. Positive for the anti-SARS-CoV-2 antibody were only 4 (0.16%) employees. Among them, the past histories of two employees were unknown, while the other two had a history of COVID-19 before the test and were not involved in the medical care of COVID-19 patients at our hospital. **Conclusion:** It is the first study assessing the seropositive rate in Saitama-prefecture, a bed-town of Tokyo. Compared with the local standard, we found that health care workers are not at risk for viral droplet transmission, especially with SARS-CoV-2 and even with the

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current pandemic, with infection control measures based on standard precautions. Based on our findings and with no clusters formed in our university and hospital, we continued current infection control measures.

## Keywords

COVID-19, Infection Control, Health Care Workers, Standard Precautions

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## 1. Introduction

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in December 2019 and has since become a global pandemic [1]. COVID-19 spreads through person-to-person transmission, primarily through respiratory droplets produced during talking, coughing, or sneezing, and approximately half of transmissions may occur via asymptomatic carriers [2] [3]. Therefore, as the primary sector in contact with COVID-19 patients, all healthcare workers (HCWs) should adhere to standard precautions, including simple ventilation, universal masking of all patients and hospital staff, and sufficient physical distances to control hospital COVID-19 infections.

Saitama Medical University Hospital, located in western Saitama Prefecture, has been providing medical care to patients with COVID-19 since March 2020, before the declaration of the first state of emergency in Japan. The COVID-19 Care Task Force was established in response to the initial COVID-19 outbreak in Japan, on March 10, 2020, and in collaboration with physicians, medical staff, and clerical staff in various hospital departments. The Care Task Force aimed to raise awareness regarding universal masking; social distancing throughout university facilities, including hospital areas; monitoring febrile patients at hospital entrances; and early isolation. The Care Task Force, which is led by infectious disease specialists, received medical treatment requests from febrile patients and immediately provided consistent COVID-19 treatment in the infectious disease ward and dedicated outpatient booths. Symptomatic patients or patients with a history of contact with COVID-19 underwent in-hospital reverse transcriptase-polymerase chain reaction (RT-PCR) tests using nasopharyngeal swab specimens. Moreover, the Care Task Force members underwent RT-PCR screening tests.

This study aimed to determine the outcomes of infection control measures based on standard precautions against viral pathogens in the early stage of the pandemic, when the virological characteristics of SARS-CoV-2 were still unclear. All employees, including nonhealthcare workers, underwent assessments of the prevalence of specific IgM and IgG antibodies that target the nucleocapsid protein (N) of SARS-CoV-2. Testing was done using commercially available automated high-throughput immunoassays and questionnaires were administered.

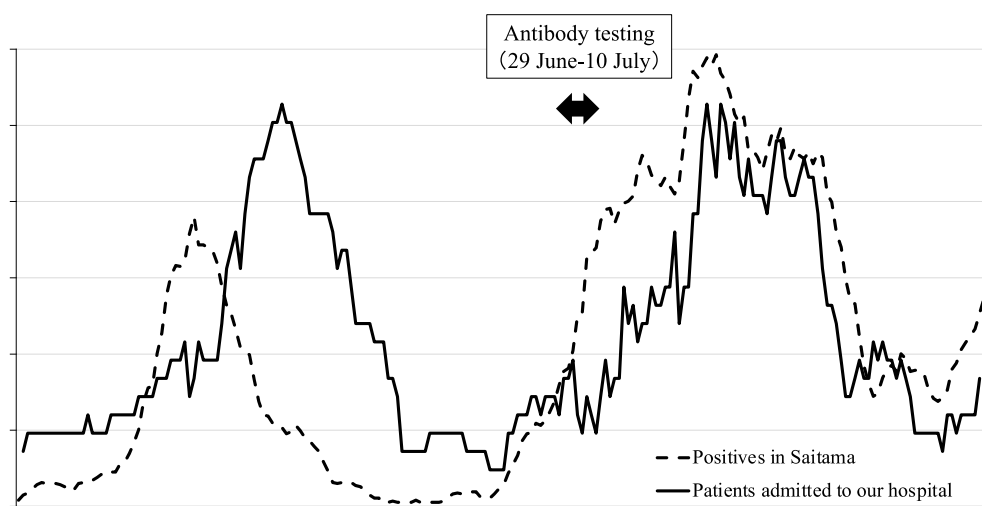
## 2. Methods

Between June 29 and July 10, 2020, all university staff, including physicians, nurses, radiologists, pharmacists, clinical laboratory technicians, and clerical staff were invited to voluntarily participate in testing for IgG antibodies against the N protein of SARS-CoV-2, which indicated exposure (**Figure 1**). All employees were aged  $\geq 18$  years. Though we excluded staff who declined consent, there were no specific inclusion or exclusion criteria. Antibody quantification was performed using a residual serum specimen collected during a periodic health checkup. Anti-SARS-CoV-2 antibody testing was done using Roche's Elecsys® Anti-SARS-CoV-2 and the electrochemiluminescence method (ECLIA) for IgM and IgG for N protein (Roche Diagnostic Scandinavia AB, Solna, Sweden) on a Cobas 8000 e801 (Roche Diagnostics, Mannheim, Germany), following the manufacturer's instructions. The results were reported as signal sample/cutoff (cutoff index [COI]) values and qualitative results indicating nonreactive (COI < 1.0; negative) or reactive (COI  $\geq 1.0$ ; positive). Additionally, the participants were asked to fill out a questionnaire that assessed type of work, work area, contact history with patients with COVID-19, and history of symptoms associated with COVID-19 from January 2020 to June 2020. This study was approved by the ethics committee of Saitama Medical University (Approval No. 944).

Serum samples were collected from 2461 employees for antibody testing. We counted the number of respondents to each questionnaire item and the number of respondents who were anti-SARS-CoV-2 antibody positive and compared the results with those of the questionnaire items.

## 3. Results

**Table 1** shows the background characteristics of the employees. The numbers of hospital and nonhospital staff who completed the questionnaire were 2054 and



**Figure 1.** Time of antibody test implementation, number of new patient outbreaks in Saitama Prefecture, and number of patients admitted to our hospital.

330, respectively, while 77 staff members did not respond. Among the hospital workers, 449 (18.24%), 834 (33.89%), 395 (16.05%), and 200 (8.13%) were doctors, nurses, other medical staff, and clerical staff, respectively. Furthermore, 698 (33.99%) HCWs had contact with patients with COVID-19 while 325 HCWs belonged to specialized wards for COVID-19, intensive care unit, or febrile out-patient clinics as members of the COVID-19 Care Task Force.

**Table 2** shows an overview of the anti-SARS-CoV-2 antibody-positive employees. Four (0.16 %) employees tested positive for anti-SARS-CoV-2 antibodies.

**Table 1.** Background characteristics of the employees.

		Number	Ratio (%)
<b>Type of work (n = 2461)</b>			
Hospital workers		2054	83.46
	Doctor	449	18.24
	Nurse	834	33.89
	Other medical staff	395	16.05
	Clerical staff	200	8.13
	Others	173	7.03
	N.A.	3	0.12
Nonhospital workers		330	13.40
	Clerks, teaching staff and basic scientists		
N.A. <sup>a</sup>		77	3.13
<b>Contact history with COVID-19 among the hospital workers (n = 2054)</b>			
Yes		698	33.99
No		1344	65.43
N.A. <sup>a</sup>		12	0.58

a. N.A.; not available; Two of antibody positive employees did not respond to the questionnaire.

**Table 2.** Overview of employees positive for anti-SARS-CoV-2 antibody.

Age	History of COVID-19 pneumonia	Antibody titer (U/mL)	Occupation	Medical services for patients with fever or COVID-19	History of contact with COVID-19 outside the hospital
50s	Yes	34.1	Administrative staff	No	Yes
40s	Yes	72.0	Nurse	No	Yes
N.A. <sup>a</sup>	N.A. <sup>a</sup>	109.5	N.A. <sup>a</sup>	N.A. <sup>a</sup>	N.A. <sup>a</sup>
N.A. <sup>a</sup>	N.A. <sup>a</sup>	127.0	N.A. <sup>a</sup>	N.A. <sup>a</sup>	N.A. <sup>a</sup>

a. N.A.; not available; Two of antibody positive employees did not respond to the questionnaire.

Among them, two (one nurse and one nonhospital worker) had a history of hospitalization for COVID-19 before the antibody test, while the past histories for the other two employees were unknown, as they had not completed the questionnaire. The two antibody-positive employees had an established history of out-of-hospital contact with individuals with COVID-19 at the time of COVID-19 onset. The antibody-positive nurse was not involved in the medical care of and did not have direct contact with COVID-19 patients or those with fever. Thus, at least these two seemed to be a local background. No evidence of high-risk SARS-CoV-2 transmission during worktime was noted at our hospital.

#### 4. Discussion

It is the first study assessing the seropositive rate in Saitama-prefecture, a bed-town of Tokyo. In this study we assessed the risk of SARS-CoV-2 infection among hospital workers compared with nonhospital workers. It is particularly important to study the antibody positivity of the hospital workers compared with nonhospital ones at the same time in the same area as a fair control. To do so, we can show the medical workers are not high risk at our hospital compared with the local control. Our findings suggest that infection control based on standard precautions practiced in our university and hospital with periodic health checkups effectively controlled COVID-19 infections among the employees. However, since both antibody-positive cases were due to out-of-hospital contacts, infection and the spread of pathogens should be prevented not only in the hospital care of patients, but also in the daily life of the staff, especially during the pandemic. Several large-scale antibody tests conducted in Japan in early June 2020 revealed an estimated antibody positive rate of 0.03% - 0.17% [4], which is consistent with our findings. Additionally, from July to August 2020, medical staff at the Juntendo University Hospital in Japan were tested for antibodies against SARS-CoV-2. The antibody positivity rate was 0.34%, which was consistent with findings among Tokyo citizens, as reported by the Japanese government [5]. Most of these studies were conducted in big cities, like Tokyo and Osaka, that were different from ours. In other countries, HCWs do not necessarily have high antibody-positive rates [6] [7] [8] [9]. University and hospital staff are considered to be at high risk of infection because the “three Cs (closed spaces, crowds, and close contact)” can easily be formed through contact with many people and meetings in the workplace. These results suggest that adherence to standard precautions, including simple ventilation, universal masking, and sufficient physical distancing, is effective in hospital settings.

This study has several limitations. First, this was a single-center study. There is a need for large-scale, multi-center studies to elucidate the adequacy of infection control measures. Second, antibody tests can yield false-negative results. Early cases of SARS-CoV-2 infections may have been missed due to the low antibody positivity rate within 7 days of infection [10]. Third, the background characteristics of the staff might not be accurate because we relied on self-reported

questionnaires. Finally, we lacked information on employees who did not fill out the questionnaire. For example, in this study, two antibody-positive cases did not fill out the questionnaire so that we could not assess their transmission route.

## 5. Conclusion

The described infection control strategies were continued based on our findings and no clusters of SARS-CoV-2 infections have occurred among employees in our university and hospital. Our findings demonstrate that with infection control measures based on standard precautions, HCWs are not at risk of viral transmission, especially with SARS-CoV-2 and even in the current pandemic.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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