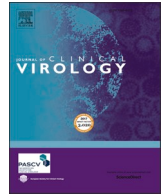




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Short communication

## Universal Polymerase Chain Reaction Screening for Severe Acute Respiratory Syndrome Coronavirus 2 in Asymptomatic Patients Before Hospital Admission in Tokyo, Japan

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### ABSTRACT

**Objectives:** Universal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; i.e., the causative agent of coronavirus disease 2019 [COVID-19]) polymerase chain reaction (PCR) screening before admission has been adopted by several hospitals to prevent nosocomial SARS-CoV-2 transmission from asymptomatic and pre-symptomatic patients. However, screening usefulness remains unclear because it depends on the regional COVID-19 prevalence, and only a few large-scale studies have been reported. Here we describe the universal PCR screening performed in our hospital before admission of more than 12,000 patients and their attendants to evaluate the usefulness of the screening.

**Methods:** We retrospectively described the universal PCR screening results for asymptomatic patients and their attendants before planned admissions at a hospital in Tokyo, Japan, from August 3, 2020, through March 31, 2021. Nasopharyngeal swab samples were collected at an in-hospital PCR center.

**Results:** In total, 12,133 persons (11,859 asymptomatic patients and 274 attendants) underwent PCR screening; nine (0.07%) tested positive for SARS-CoV-2 RNA.

**Conclusions:** Universal PCR screening may be useful for the advanced detection of SARS-CoV-2 infected patients with or without symptoms, which can be a potential source of nosocomial SARS-CoV-2 transmission.

### 1. Introduction

Coronavirus disease 2019 (COVID-19) became a global pandemic in the spring of 2020 and is still a major threat to public health. Consequently, several practices to prevent nosocomial COVID-19 outbreaks have been implemented. Universal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) polymerase chain reaction (PCR) screening before admission has been adopted in several hospitals to prevent nosocomial SARS-CoV-2 transmission from asymptomatic and pre-symptomatic patients. However, the usefulness of this type of screening remains unclear as it depends on the regional COVID-19 prevalence, and, to date, only a few large-scale studies have been conducted [1–3]. Here, we report the universal COVID-19 PCR screening

results for over 12,000 asymptomatic patients and their attendants before admission to a hospital in Tokyo, Japan, to evaluate the universal screening benefits.

### 2. Methods

This study retrospectively described the universal PCR screening results at Keio University Hospital, a tertiary care center with 960 beds in the center of metropolitan Tokyo. From August 3, 2020, through March 31, 2021, universal PCR screening was performed for all asymptomatic patients and their attendants before planned admissions or respiratory function tests at the in-hospital PCR center. Individuals who came to the hospital for a health check-up until August 21, 2020

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**Table 1**

The number of COVID-19 PCR tests and positive results of our in-hospital PCR center and the Tokyo metropolitan area from August 2020 through March 2021.

	Our in-hospital PCR center			The Tokyo metropolitan area <sup>a</sup>		
	No. of PCR tests	No. of positive results	Positivity rate (%)	No. of PCR tests	No. of positive results	Positivity rate (%)
August	1732	2	0.12	129,378	7361	5.7
September	1379	0	0	126,409	4918	3.9
October	1575	0	0	142,024	5350	3.8
November	1494	1	0.07	159,670	9861	6.2
December	1428	0	0	237,034	19,369	8.2
January	1523	2	0.13	315,877	40,367	12.8
February	1442	1	0.07	221,522	10,997	5.0
March	1560	3	0.19	226,228	9310	4.1
Total	12,133	9	0.07	1,557,142	107,533	6.9

<sup>a</sup> Number based on officially released data from Tokyo Metropolitan Government [4]; PCR: polymerase chain reaction; COVID-19: Coronavirus disease 2019.**Table 2**

Characteristics of the positive patients and attendants.

No.	Age	Sex	Department	Ct value <sup>a</sup>		Notes
				N1	N2	
1	71	M	Medical check-up	24.1	24.5	Tested positive for COVID-19 14 days before the universal screening test.
2	35	F	Obstetrics	37.3	–	Had a fever 15 days before the universal screening test.
3	34	F	Pediatrics (Attendant)	35.0	33.4	Had olfactory impairment 16 days before the universal screening test.
4	78	F	Surgery	32.9	36.9	
5	22	M	Oral surgery	32.6	35.7	
6	76	M	Cardiac surgery	35.5	–	
7	80	F	Thoracic surgery	39.7	–	
8	55	M	Orthopedic surgery	30.6	30.9	
9	57	M	Cardiology	17.5	18.3	Had fever and cough for 3 days before the universal screening test; revealed in a post-exam interview.

<sup>a</sup> Cycle threshold value; COVID-19: coronavirus disease 2019.

were also included in the universal screening. Almost all attendants were parents of pediatric patients who were staying in the hospital rooms with their children. Nasopharyngeal swab samples were collected at the in-hospital PCR center and transported in UTM (Copan, Italy). Real-time reverse transcription PCR for SARS-CoV-2 detection was performed using the BD MAX System and BD MAX SARS-CoV-2 reagents (Becton Dickinson, Franklin Lakes, NJ, USA) according to the manufacturer's instructions. Positivity was defined as elevated amplification curves of either N1 or N2 primer-probe sets before 45 cycles. If the amplification curves did not show clear sigmoid curves, there was no amplification over 35 cycles, or there was a single positive case of N1 or N2 primers, then verification was performed using other commercially available SARS-CoV-2 PCR reagents, the 2019-nCoV detection kit (Shimadzu, Kyoto, Japan), or Xpert Xpress SARS-CoV-2 reagents (Cepheid, Sunnyvale, CA, USA). Data from patients aged 15 years or younger were excluded from all universal PCR screening results. The number of tests performed was counted, and the medical chart information of test-positive patients, including the cycle threshold (Ct) values, was collected.

### 3. Results

In total, 12,133 persons (11,859 asymptomatic patients and 274 attendants) underwent PCR screening within the study period. Nine (0.07%) tested positive for SARS-CoV-2 RNA (Table 1). Their characteristics are presented in Table 2.

One patient had been diagnosed with COVID-19 14 days before the universal screening test, and two patients had COVID-19-like symptoms more than 14 days before the test. One patient developed fever and cough in a post-test medical interview. The remaining five patients were followed up for one month after the positive PCR results and did not develop symptoms. A relatively low Ct value was observed in symptomatic patients.

### 4. Discussion

In this study, 0.07% of the asymptomatic patients and attendants tested positive for SARS-CoV-2 RNA by PCR before the scheduled admission. Regarding universal SARS-CoV-2 PCR screening before admission, Krüger et al. [1] reported that 27 of 6940 patients (0.4%) were positive at a tertiary care hospital in Germany, and Scheier et al. [2] demonstrated similar results at four hospitals in Zurich (8 of 2278 positive patients, 0.4%). These studies were conducted in areas where the COVID-19 prevalence was higher than in Tokyo. Conversely, in a study conducted in Tokyo from May 2020 to August 2020, the incidence rate was lower than in our study, and 2 out of 6224 patients (0.03%) tested positive [3].

The positivity rate in our study patients before scheduled admission may be lower than the general population because the patients were instructed to follow the infection prevention behavior guidelines of our hospital. However, when the positivity rate per month in the Tokyo metropolitan area was more than 4–5%, we could detect several COVID-19 patients through the universal PCR screening (Table 1).

The primary goal of universal screening is to detect asymptomatic and pre-symptomatic positive cases. Although the asymptomatic transmission rate is 3–25 times lower than symptomatic transmission, approximately 49% of initially asymptomatic people will develop symptoms [5]. A pre-test interview alone is insufficient to screen for symptomatic patients, let alone asymptomatic patients. Thus, adopting universal screening is important.

The importance of universal PCR screening differs according to the prevalence of infection, available human and material resources, and the economic status of the country. In developing countries where the resources are limited and the economic status is low, it would be difficult to perform universal screening and the priority is low comparing to diagnostic testing. However, in resource-rich countries such as Japan, PCR systems are automated and sufficient reagents are available for universal PCR testing. Moreover, the cost of the test is covered by the insurance system. Therefore, we could afford to perform universal screening and it could be an effective measure for COVID-19 infection control. Our study describes the outcomes of universal PCR screening in a resource-rich area with a low COVID-19 prevalence, and provides evidence that could be used to determine criteria for universal PCR screening.

## 5. Conclusion

Universal PCR screening may be useful for the early detection of SARS-CoV-2 infected patients with or without symptoms, who may be a source of nosocomial SARS-CoV-2 transmission.

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## Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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This research plan was reviewed and approved by the Keio University School of Medicine Ethics Committee (20200063). Individual informed consent was waived according to the national guidelines for retrospective studies.

Sho Uchida designed the study, analyzed the data, and drafted the manuscript. Yoshifumi Uwamino, Shunsuke Uno, and Naoki Hasegawa designed the study and edited the manuscript. Mika Nagata and Wataru Aoki performed the PCR assays. Mitsuru Murata and Yuko Kitagawa conceptualized the study and revised the article for intellectual content. All authors contributed to writing the final manuscript.

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