

Research article

Usefulness of universal SARS-CoV-2 PCR testing for inpatients and their caregivers during the omicron era

Jiwon Jung^{a,b,1}, Hyejin Yang^{b,1}, Soyeon Park^b, Hyun-Jung Lim^b, Sun-Kyung Kim^b, Young-Ju Lim^b, Eun Ok Kim^b, Sung-Han Kim^{a,b,*}^a Department of Infectious Diseases, Asan Medical Center, University of Ulsan College of Medicine, Seoul, South Korea^b Office for Infection Control, Asan Medical Center, Seoul, South Korea

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ABSTRACT

Background: Since January 2022, the Omicron variant has become the dominant strain in South Korea, and COVID-19 cases among hospitalized patients and their guardians or caregivers have increased. We evaluated the usefulness of universal periodic screening for SARS-CoV-2 in patients and resident caregivers in a South Korean tertiary care hospital.

Methods: We evaluated the reason for testing in COVID-19 confirmed patients and resident caregivers during their hospitalization from March 3 to 31, 2022. The rate of positive PCR universal testing in hospital (or residency) (HD) on days 3 and 7 in asymptomatic patients and caregivers were evaluated. The test for SARS-CoV-2 was done by RT-PCR.

Results: During the study period, 677 patients were diagnosed with COVID-19. The reasons for testing were the symptoms (226 (33%)), pre-admission test (183 (27%)), exposure to COVID-19 (124 (18%)), universal testing on HD 3 (94 (14%)), and that on HD 7 (34 (5%)). Caregivers (n = 340) were tested during their residency due to exposure to COVID-19 cases, 103 (30%); universal testing on HD 3, 90 (26%); symptom development, 46 (14%); pre-stay, 39 (11%); and universal testing on HD 7, 29 (9%). The positive test rates of inpatients and caregivers on HD 3 and HD 7 were as follows: 1.4% (93/6553) and 2.1% (55/2646) in inpatients, and 1.3% (79/5989) and 1.7% (35/2106) in caregivers, respectively.

Conclusions: Universal testing, regardless of symptom or epidemiologic link, is useful for detecting pre-symptomatic and asymptomatic COVID-19 cases among hospitalized patients and caregivers and preventing a nosocomial outbreak during the Omicron era.

1. Introduction

There is limited data regarding the usefulness of universal screening for asymptomatic hospitalized patients and resident hospital caregivers, depending on the community prevalence of COVID-19. We previously reported the cases of subsequent positive PCR testing during hospitalization after an initial negative pre-admission test during low prevalence in the community (the year 2020) [1]. The Infectious Disease Society of America (IDSA) suggests SARS-CoV-2 RNA testing in asymptomatic individuals with no known contact with COVID-19 hospitalized in areas with a high COVID-19 prevalence in the community with very low certainty of evidence [2]. In addition, we previously found that patients and

their resident caregivers contracted COVID-19 during their stay and could be responsible for transmission [3].

During the Omicron-dominant period, there were surges of COVID-19 cases both in the community and the hospital. Therefore, we evaluated the positive rates of universal screening for SARS-CoV-2 in asymptomatic inpatients and resident caregivers in a South Korean tertiary-care hospital in March 2022 during the huge Omicron community outbreaks.

2. Methods

This study was performed in Asan Medical Center, a 2,700-bed tertiary care hospital in Seoul, South Korea. In all COVID-19 cases among hospitalized patients, their caregivers were reported to the hospital

* Corresponding author.

E-mail address: kimsunghanmd@hotmail.com (S.-H. Kim).¹ These authors equally contributed to the work.

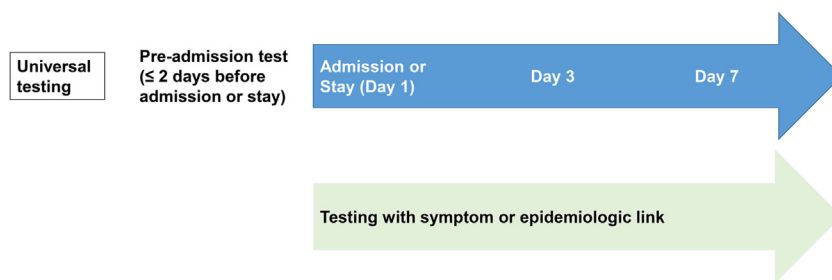


Figure 1. Testing strategy for patients and caregivers.

infection control office. We identified the reason for SARS-CoV-2 testing, presence of symptoms, symptoms onset date, and epidemiologic association. We evaluated the reason for testing in COVID-19 confirmed patients and resident caregivers during their hospitalization from March 3 to 31, 2022. In addition, we evaluated positive PCR rates of universal testing on hospital (or residency) (HD) days 3 and 7 in asymptomatic patients and caregivers. Resident caregivers were defined as hospital visitors staying overnight to provide care and emotional support.

During the study period, patients and resident caregivers were tested for SARS-CoV-2 using real-time PCR at pre-admission (≤ 2 days before admission or stay [hospital day -2 to hospital day 0]), and days 3 and 7. In addition, they underwent SARS-CoV-2 testing if they showed any symptoms or signs of COVID-19 (Figure 1). Real-time RT-PCR testing (cobas SARS-CoV-2 & Influenza A/B test [Roche Molecular Systems, Inc., Branchburg, NJ] or Allplex SARS-CoV-2 Assay [Seegene, Seoul, Korea]) for SARS-CoV-2 was done in individuals with symptoms, epidemiologic link, or those older than 60 years. According to the national insurance policy for PCR test, the universal screening pooled 5 specimens from individuals younger than 60 years with Allplex SARS-CoV-2 Assay (Seegene, Seoul, Korea). All PCR tests were performed from nasopharyngeal swab specimen.

During the omicron outbreak, patients who were admitted in the wards and later diagnosed as having COVID-19 were isolated at the single patient rooms in the same ward. The same healthcare workers with appropriate personal protective equipment provided medical care for these COVID-19 patients. Resident caregivers for these COVID-19 patients were not allowed due to the concern of transmission.

As appropriate, categorical variables were analyzed using the chi-squared test or Fisher's exact test. All tests of significance were two-tailed, with P values < 0.05 being considered significant. Data were analyzed using SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA).

The institutional review board of Asan Medical Center evaluated and approved the medical, scientific, and ethical aspects of the study protocol concerning cohort 1 (2021-0024) and waived the need for informed consent.

3. Results

On 2 March 2022, the proportion of the Omicron variant was more than 99%. From the fourth week of March, subvariant BA.2 became

dominant (56.3% in 3rd week, and 67.7% in 4th week) [4], and the weekly numbers of new cases per 100,000 population in Seoul and nationwide were from 3364 to 5751, and from 2831 to 5457, respectively. During the study period, 20,469 patients performed testing during their hospitalization (Figure 2). Of these, 8495 performed testing due to universal screening, and 11,974 performed due to symptom or epidemiologic link. The positive rate of universal screening was 1.5% (128/8,495), and that of symptom or epidemiologic link was 2.9% (350/11,974). In addition, 1945 patients performed pre-admission test at our hospital, and 183 (9.4%) showed positive results. During the study period, 13,162 caregivers performed testing during their stay. Of these, 10,698 performed testing due to universal screening, and 2464 performed due to symptom or epidemiologic link. The positive rate of universal screening was 1.1% (119/10,698), and that of symptom or epidemiologic link was 6.0% (149/2464). In addition, 1243 caregivers performed pre-stay test at our hospital, of which 39 (3.1%) showed positive results.

A total of 677 patients (58% were men and the median age of 65 [interquartile range, 50–72]) and 340 caregivers (25% were men and the median age of 61 [interquartile range, 47–66]) with COVID-19 were diagnosed. The reasons for SARS-CoV-2 testing in patients, in the most common order, were as follows: symptom development (226 [33%]), pre-admission test (183 [27%]), exposure to COVID-19 cases (124 [18%]), universal testing on HD 3 (94 [14%]), and universal testing on HD 7 (34 [5%]) (Table 1). Of the 340 caregivers diagnosed with COVID-19, 103 (30%) were tested because of exposure to COVID-19 cases, 90 (26%) due to universal testing on HD 3, 46 (14%) due to symptom development, 39 (11%) due to pre-stay and 29 (9%) due to universal testing on HD 7.

The positive rates of inpatients and caregivers on HD 3 and HD 7 were follows: 1.4% (93/6553) and 2.1% (55/2646) in inpatients ($P = 0.02$), and 1.3% (79/5989) and 1.7% (35/2106) in caregivers ($P = 0.25$), respectively.

4. Discussion

This study found that 19% and 35% of positive COVID-19 cases in hospitalized patients and resident caregivers were detected by universal screening during the high prevalence time in the community. In addition,

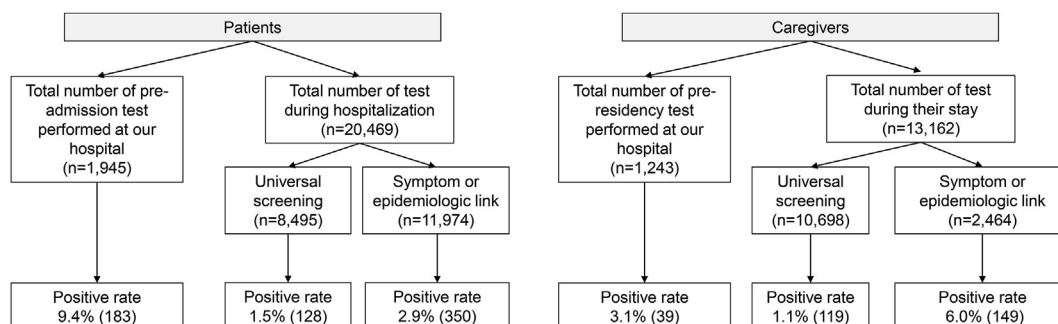


Figure 2. The number of test performed for patients and caregivers, and positive rate according to the reason for testing.

Table 1. The reason for testing in COVID-19 cases among patients and caregivers.

	Patients (n = 677)	Caregivers (n = 340)	P value
Pre-admission or stay	183 (27)	39 (11)	<0.001
During hospitalization or stay			
Symptom development	226 (33)	46 (14)	<0.001
Exposure to COVID-19 case	124 (18)	103 (30)	<0.001
Universal screening	128 (19)	119 (35)	<0.001
Hospital day 3	94 (14)	90 (26)	<0.001
Hospital day 7	34 (5)	29 (9)	0.03
For other reasons ^a	16 (2)	33 (10)	<0.001

Data are presented as numbers of patients (%) unless otherwise specified.

^a Testing before transfer to the other hospital or unknown reasons.

caregivers were less commonly detected by symptom development than inpatients, possibly reflecting that symptom screening for caregivers in real-world settings is difficult.

Pre-symptomatic infections are more infectious than symptomatic cases [5, 6]. Therefore, universal pre-symptomatic screening of hospitalized individuals may effectively prevent nosocomial COVID-19 transmission. However, there are limited data to confirm this, and the cost-effectiveness of universal testing is largely unknown. Nevertheless, we found that about one-fifth of inpatients and 35% of caregivers tested COVID-19 -positive on universal screening. Therefore, regardless of symptom or epidemiologic link, universal screening may prevent nosocomial transmission due to early identification and isolation, especially in a high-prevalence period.

Considering the median incubation period of the Omicron variant (median 3–4 days) [7, 8] and possible exposure in the community before admission, testing on HD 3 is appropriate timing for universal screening for individuals whose test results were negative before admission or residency. In this study, the positive rate on HD 3 was lower than those on HD 7 in patients. The reason for this finding is unclear, but cases of long incubation period and nosocomial transmission may be associated. Further studies are needed to evaluate the optimal timing and frequency of universal screening during hospitalization.

In this study, caregivers with COVID-19 were less commonly detected by testing due to symptoms than inpatients. In Korea, most inpatients have their caregivers (their family or professional caregivers) who stay overnight to provide care and emotional support; about 70% of inpatients had their caregivers during the study period. Caregivers may not voluntarily report symptoms, and it may be labor-intensive for healthcare workers to screen symptoms for all caregivers. Therefore, universal screening may be useful in detecting COVID-19 cases. However, healthcare workers might screen symptoms less carefully for caregivers because of the universal screening strategy.

Our study has several limitations. First, this study was a single-center study and the study period was relatively short. In March 2022, the number of cases peaked in South Korea. Therefore, a further study performed in another setting during a lower prevalence period is needed. Second, we did not determine the cost-effectiveness of universal testing. Third, as our hospital have implemented universal SARS-CoV-2 testing (preadmission test and during hospital day) since 2020 December (during the period of low prevalence), we could not compare the control period without universal repeat testing. So, it is difficult to evaluate the usefulness of universal SARS-CoV-2 testing due to the lack of control group or period without repeated testing. Finally, we screened for SARS-

CoV-2 using PCR testing but did not determine the usefulness of a rapid antigen test for universal screening.

In conclusion, universal screening might be useful for detecting pre-symptomatic and asymptomatic COVID-19 cases among hospitalized patients and caregivers during the Omicron era.

Declarations

Author contribution statement

Jiwon Jung and Sung-Han Kim: Conceived and designed the study; Analyzed and interpreted the data; Wrote the paper.

Hyejin Yang, So Yeon Park, Hyun-Jung Lim, Sun-Kyun Kim, Young-Ju Lim and Eun Ok Kim; Analyzed and interpreted the data.

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Data availability statement

The data that has been used is confidential.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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None of the authors have any potential conflicts of interest.

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