

## Preplanned Studies

## The Infection of Healthcare Workers and the Reinfection of Patients by Omicron Variant — Jiangsu Province, China, December 2022 to January 2023

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### Summary

#### What is already known about this topic?

Healthcare workers (HCWs) and previously infected patients (PIPs) may experience a wave of epidemic following the modification of the country's coronavirus disease (COVID)-zero policy in China.

#### What is added by this report?

As of early January 2023, the initial wave of the COVID-19 pandemic among HCWs had effectively subsided, with no statistically significant differences observed in infection rates compared to those of their co-occupants. The proportion of reinfections among PIPs was relatively low, particularly in those with recent infections.

#### What are the implications for public health practice?

Medical and health services have resumed normal operations. For patients who have recently experienced severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections, appropriate relaxation of policies may be considered.

The coronavirus disease 2019 (COVID-19) emerged in December 2019 and rapidly spread across the globe (1–2). As of November 14, 2021, approximately 3.8 billion people had been infected or re-infected, accounting for 43.9% of the global population, with a peak in April 2021 (3). The proportion of infected individuals varied by region: 73.6% in Eastern Europe, 59.5% in Central Europe, 21.4% in Western Europe, 30.9% in North America, and 25.1% in Southern Latin America (3). In addition, healthcare workers (HCWs) have been identified as particularly vulnerable with a higher risk of infection compared to the general population (4). An Italian study also reported that HCWs were more than twice as likely to be re-infected compared to non-HCWs (5). These disparities between countries highlight the influence of

COVID-19 treatment, host immunity characteristics, and national and local policies on transmission patterns (6).

In the early stages of the pandemic, the Chinese government implemented strict measures to combat the virus, successfully controlling the domestic outbreak. However, with the emergence of the Omicron variant, the virus has undergone significant changes, resulting in a reduced virulence while maintaining high infectivity (7). In response, the Chinese government refined its preventive strategies. On December 7, 2022, China introduced “Ten New Measures”, including discontinuing region-wide mass testing and permitting home isolation or quarantine.

As the Omicron variants continue to spread in China, this study aimed to investigate the infection statuses of HCWs in a general hospital in Jiangsu Province, reinfections of previously infected persons (PIPs), as well as the impact of vaccination on infection rates. These findings could provide a theoretical basis for developing health policy. Both HCWs and PIPs represent unique population groups: the infection status of HCWs directly affects the quality of medical services, particularly during the COVID-19 pandemic (8), while assessing the prevalence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) reinfection is vital for understanding its burden and impact on the general population, informing appropriate mitigation policies (9). Therefore, conducting research on these two distinct populations bears significant practical implications.

The participants in this study comprised current HCWs in the Affiliated Taizhou People's Hospital of Nanjing Medical University and PIPs who were admitted due to COVID-19 between January 1, 2020, and December 7, 2022. The diagnosis and classification of COVID-19 rely on the updated definition provided by the World Health Organization (WHO) in their Public Health Surveillance guidelines,

as of July 22, 2022. PIPs in this investigation were individuals who had a previous positive SARS-CoV-2 RT-PCR test following clinical recovery from a COVID-19 episode and at least one negative RT-PCR result after their initial infection.

This study was conducted from January 6 to 11, 2023, utilizing electronic questionnaires to gather demographic and epidemiological data. The office of the dean at our hospital notified the department directors to organize and complete the questionnaires for HCWs. Testing and vaccination dates were obtained from the clinical laboratory information system and the public health department records within our hospital, respectively, to ensure data accuracy. For PIPs, their demographic characteristics, clinical information during hospitalization, and contact information were obtained from the information office based on case diagnoses. A total of 732 PIPs were identified, with 53 patients being excluded due to missing contact information. Following this, our team conducted telephone interviews and completed the questionnaire for the remaining PIPs.

All data were analyzed using SPSS (version 26.0, IBM Corporation, Armonk, NY, USA) and Excel (version 2010, Microsoft Corporation, Redmond, WA, USA). Qualitative data were reported as frequency (percentage) and compared using the chi-square test. Quantitative data were presented as mean±standard deviation when normality assumptions were met, and as median (interquartile range) when normality assumptions were not met.

A total of 2,347 electronic questionnaires were

successfully retrieved from HCWs and included in the analysis (Table 1). Of the 2,347 HCWs surveyed, 1,975 were found to be infected, with an infection rate of 84.1%. The infection curve indicated that the first wave of the epidemic within the hospital had primarily concluded, reaching a peak in daily new cases from December 21 to 23, 2022 (Figure 1). Among the 1,975 infected HCWs, 20 (1.0%) required hospitalization, with one (0.1%) being admitted to the intensive care unit (ICU). Furthermore, 794 individuals who experienced severe symptoms during their infection underwent a hospital-organized physical examination post-recovery. Out of these individuals, 185 (23.3%) were diagnosed with pneumonia, and 5 (0.6%) had myocarditis.

In addition, there were 7,068 co-occupants of the

TABLE 1. Demographic characteristics of the subjects.

Characteristics	HCWs (n=2,347)	PIPs (n=382)
Sex (%)		
Male	548 (23.3)	220 (57.6)
Female	1,799 (76.7)	162 (42.4)
Age (years)	33 (29–42)	50 (35–58)
Times of vaccination (%)		
0	16 (0.7)	21 (5.5)
1	17 (0.7)	23 (6.0)
2	113 (4.8)	66 (17.3)
3	1,225 (52.2)	270 (70.7)
4	976 (41.6)	2 (0.5)

Abbreviation: HCWs=healthcare workers; PIPs=previously infected persons.

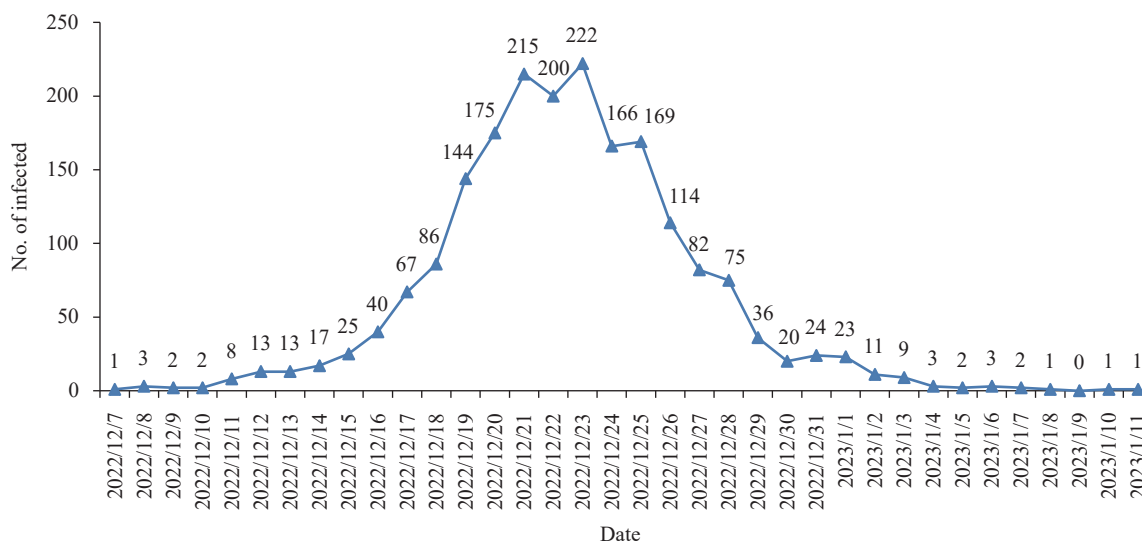


FIGURE 1. The number of healthcare workers infected with the coronavirus disease 2019 in our hospital over time.

HCWs, among whom 5,995 were infected, resulting in an infection rate of 84.8%. The infection rate did not significantly differ from that of HCWs in the same hospital ( $P>0.05$ , Figure 2). Furthermore, the secondary attack rate in families was 82.1%. Among the 1,975 medically infected individuals in our hospital, 1,018 (51.5%) were infected before the first infection of their co-resident, 188 (9.5%) were infected after their co-resident's first infection, 620 (31.4%) were infected on the same day as their co-resident's first infection, and 149 (7.5%) lived alone.

Moreover, we also explored the effect of vaccination on the rate of infection among HCWs, with a focus on the association between the number of vaccine doses, timing of the last dose, and the infection rate. It was found that receiving the fourth dose of the CanSinoBIO (viral vector) vaccine and a shorter time interval since the last dose were both significantly associated with a reduced infection rate (Table 2). Furthermore, during the initial wave of the COVID-19 pandemic, an investigation was conducted on the symptoms of 1,266 infected HCWs at our hospital. The findings indicate that the CanSinoBIO vaccine may mitigate the severity of COVID-19 symptoms, particularly fever and alterations in olfactory and gustatory function.

In order to assess hospitalized PIPs within our

institution, we organized staff to conduct this survey, and the data of 382 patients were successfully collected and analyzed (Table 1). According to the WHO grading standards, only one patient was categorized as severe (grade 6), 31 as mild cases (grade 4), and the remaining 350 as mild cases (grade 3 or below). Of the 382 patients, 21 were initially infected with SARS-CoV-2 more than a year ago. After China's adjustment to the zero-COVID policy, nine were reinfected, yielding a secondary infection proportion of 42.9%. A total of 114 patients were infected between three months and one year ago, and 12 were reinfected, resulting in an infection proportion of 10.5%. About 247 patients were infected within the past three months, and none exhibited COVID-19 symptoms or tested positive for SARS-CoV-2 using the RT-PCR method. There was a significant difference observed between any two groups ( $P<0.05$ ; Figure 3). All the reinfected patients had symptoms of grade 2 or less, of whom 5 were asymptomatic.

## DISCUSSION

The findings in this study suggest that the first wave of the COVID-19 epidemic among HCWs has largely subsided, marked by a relatively high infection rate. Currently, medical and health services have fully

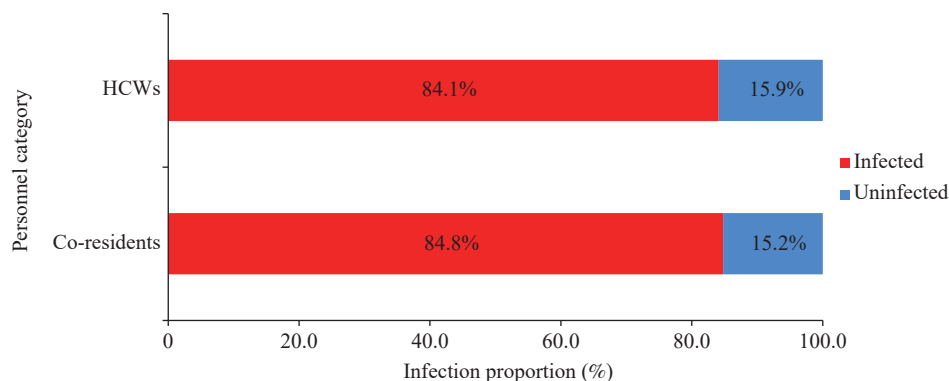


FIGURE 2. Comparison of infections between healthcare workers and co-residents.

TABLE 2. Association between vaccination and infection rates among healthcare workers [ $n$  (%)].

Vaccination		Uninfected ( $n=372$ )	Infected ( $n=1,975$ )	$\chi^2/z$	$P$
Number of vaccinations	$\leq 3$	183 (13.3)	1,188 (86.7)	15.48	<0.001
	4	189 (19.4)	787 (80.6)		
Last inoculation time	<1 month	183 (19.0)	780 (81.0)	14.92	<0.001
	1 month to 1 year	35 (11.4)	271 (88.6)		
	>1 year	138 (13.8)	863 (86.2)		
	Missing	16 (20.8)	61 (79.2)		

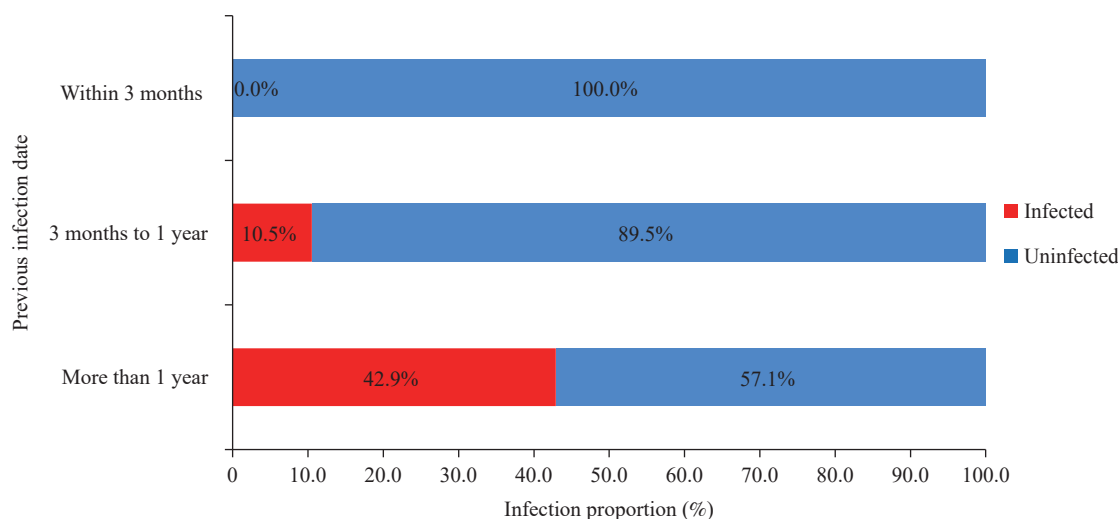


FIGURE 3. Comparison of the infections of previously infected patients.

returned to normal compared to the pre-adjustment period of the zero-COVID policy. It is strongly recommended that those who have not received the fourth vaccine dose do so as soon as possible in order to decrease infection rates. The fourth dose administered to HCWs in our hospital utilizes an adenovirus vector (CanSinoBIO), which induces robust antigen-specific humoral and cellular immune responses.

Nevertheless, during this epidemic wave, HCWs experienced an excessively high rate of SARS-CoV-2 infections in a single day, adversely impacting medical and health services. Efforts should be made to prevent such occurrences during future waves. Additionally, ensuring the timely availability of appropriate medications, such as antipyretic drugs and analgesics, is crucial in order to alleviate concerns and prevent panic before the next outbreak.

Our research indicates that the proportion of reinfection of SARS-CoV-2 is relatively low among PIPs, particularly for those with short-term recovery. This finding is consistent with previous studies (10). Nonetheless, the likelihood of reinfection may increase over time due to an insufficient immune response following the primary infection, which fails to provide adequate protection against subsequent infections. Furthermore, no severe cases were observed during reinfections, which could be attributed to the reduced virulence of the Omicron variant and the presence of antibodies in recovered patients. Consequently, policymakers should consider implementing less restrictive measures for individuals who have previously been infected with SARS-CoV-2, especially for those who have recovered recently.

This study examined the infection status of HCWs and the reinfection status of PIPs. Nonetheless, several limitations of this research must be acknowledged. Firstly, the study's retrospective design may have introduced a degree of recall bias, potentially compromising the accuracy of the collected data. Secondly, by drawing participants (both HCWs and PIPs) exclusively from a single hospital, the generalizability of these findings may be limited, though this does not impact the validity of the conclusions.

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