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Brief Communication

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Vaccination Rates of Hospitalized Patients at High Risk of Severe COVID-19: A Single-Center Cross-Sectional Study

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ABSTRACT

We investigated coronavirus disease 2019 (COVID-19) vaccination rate in patients admitted to chronic pulmonary disease, cardiovascular disease, chronic kidney disease, and cancer wards in the third week of April 2022 to determine the immunity level of these vulnerable groups. Compared to the general population, our study subjects had lower vaccination rates, except for higher percentages of boosted individuals in patients with chronic pulmonary disease and cardiovascular disease. This tendency was most pronounced in cancer patients, less than half of whom were boosted. Patients with cancer should be encouraged to complete their COVID-19 vaccination.

Keywords: COVID-19; Vaccination; Immunity; Chronic disease

Throughout the coronavirus disease 2019 (COVID-19) pandemic, various preventive measures have been implemented to protect those at high risk of developing severe COVID-19, especially those admitted to hospitals or long-term care facilities. This changed after two years of social distancing. By mid-April 2022, virtually all restrictions were lifted in the context of adequate population immunity, achieved by a high vaccination rate and recent the gigantic wave of the Omicron (B.1.1.529) variant of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). However, even though the Omicron wave is receding, the case incidence in the community is still high enough to spill into hospitals to affect the vulnerable, often severely. While the return to pre-pandemic lives may be irresistible, damage should be minimized during the transition. Additionally, the waves of COVID-19 are expected to come repeatedly in the future.

In this regard, understanding the level of immunity in individuals at a high risk of severe COVID-19 is essential. However, little is known about the vaccination rates in Korean individuals with chronic medical conditions, which are important risk factors for severe COVID-19 [1]. Therefore, we aimed to investigate the vaccination rates of patients with comorbidities who require repetitive hospitalization and compared them with those of the general population of a similar age.

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Ethics statement
This study was approved by the institutional review board at the Korea University Guro Hospital (IRB No 2022GR0206), and informed consent was waived.

Conflict of Interest
HJC and JYS are editorial board of Infect Chemother; however, they did not involve in the peer reviewer selection, evaluation, and decision process of this article. Otherwise, no potential conflicts of interest relevant to this article was reported.

Author Contributions
Conceptualization: HJC; Methodology: EN, JYN, JYS; Data curation: EN; Software: EN; Investigation: EN, HH, SH, JGY, JYN, JYS, WJK, HJC; Validation: EN; Writing - original draft: EN; Writing - review & editing: EN, HH, SH, JGY, JYN, JYS, WJK, HJC

We retrospectively reviewed the electronic medical records of consecutive patients admitted to the pulmonology, cardiology, nephrology, and hematology-oncology units, and whose department coincides with the main patient group in the corresponding unit of Korea University Guro Hospital from April 18, 2022 to April 24, 2022. Patients under 18 years of age, admitted to one-day wards for simple procedures, or short chemotherapy sessions, and those admitted to intensive care units were excluded. Demographic variables, comorbidities, dates of COVID-19 vaccination, name of the vaccine (s) received, and history of COVID-19 were collected. The vaccination status was verified based on the National Immunization Registry and medical records. JNJ-78436735 (Janssen, Titusville, NJ, USA) as a first dose was considered equivalent to two doses of other COVID-19 vaccines. Information on vaccination rate and cumulative COVID-19 incidence in the general population was obtained from the official daily report of the Ministry of Health and Welfare of Korea and compared to that of our study population [2]. Differences in vaccination rates between study subjects and the general population and differences in the proportion of patients with a history of COVID-19 between the age and comorbidity groups were examined by the Chi-squared test.

Out of 363 patients included, 308 (84.8%), 299 (82.8%), and 239 (65.8%) of the study population have received one, two, and three doses of the COVID-19 vaccine, respectively. The corresponding national statistics up to April 24, 2022, were 97.2%, 96.4%, and 74.1%. Of the 239 patients who were boosted (*i.e.*, receipt of three doses), 24.3% received their third dose in November 2021, 49.4% in December 2021, 16.7% in January 2022, 6.7% in February 2022, 2.9% in March 2022, and 0.0% in April 2022.

While our study subjects were older than the general population, their vaccination rates were lower. This is more clearly shown in **Table 1**. The vaccination rate in each age group was lower in our patients than that in the general population. After the classification of the study population according to comorbidities, patients with cancer (including solid and hematologic malignancies) had the lowest proportion of fully vaccinated and boosted individuals, far below the national statistics (P <0.001, **Fig. 1**). Percentage of patients with chronic kidney disease who were partially or fully vaccinated was significantly lower than that of the general population. In contrast, the proportion of those who were boosted was higher in patients with chronic pulmonary and cardiovascular diseases than in the general population, although statistically insignificant.

One hundred and four patients (28.7%) had a history of COVID-19. The cumulative COVID-19 incidence in Korea was 32.6% on April 24, 2022. There was no significant difference in the proportion of patients with a history of COVID-19 between the age and comorbidity groups (P = 0.395 and P = 0.287, respectively).

Table 1. COVID-19 vaccination rates (%) in each age group of the general population and study population

Age group (years)	1st dose		2nd dose		3rd dose	
	General population	Study population	General population	Study population	General population	Study population
>80	91.2	78.1	90.3	75.0	84.3	65.6
70 - 79	96.6	90.1	96.1	88.1	91.7	79.2
60 - 69	98.0	82.4	97.5	81.4	89.8	63.7
50 - 59	98.4	87.7	97.9	87.7	81.6	61.5
40 - 49	96.2	84.2	95.4	78.9	67.1	36.8
30 - 39	97.0	90.0	95.5	80.0	58.0	50.0

COVID-19, coronavirus disease 2019.

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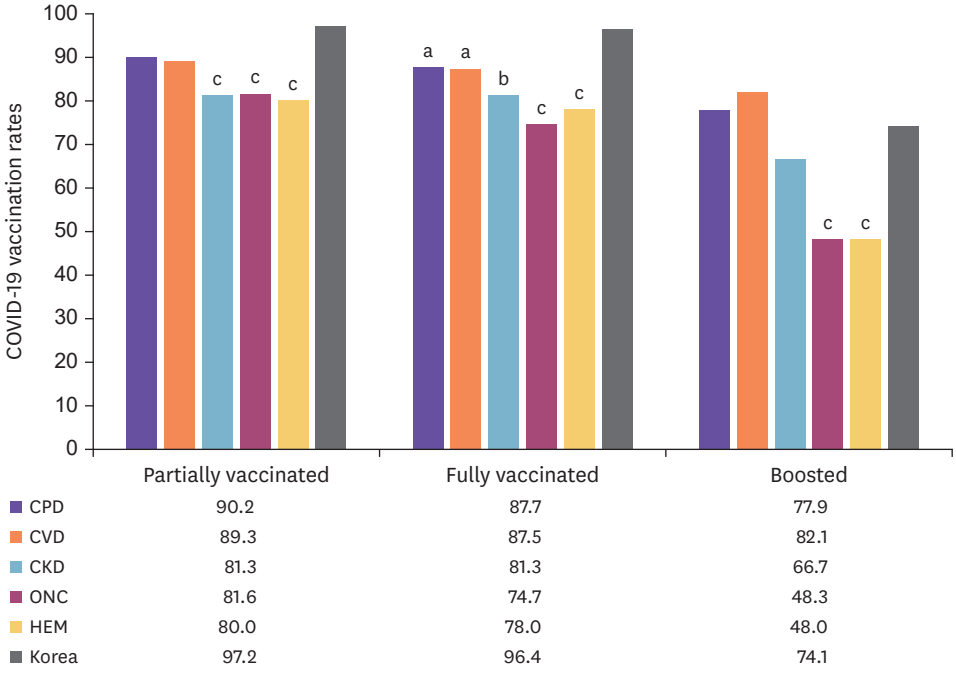

Figure 1. COVID-19 vaccination rates of patients with various medical conditions.
[a]0.01≤ *P*<0.05, [b]0.001≤ *P* <0.01, [c]*P* <0.001.
COVID-19, coronavirus disease 2019; CPD, chronic pulmonary disease; CVD, cardiovascular disease; CKD, chronic kidney disease; ONC, solid tumor; HEM, hematologic malignancy.

This study showed that patients with cancer had a significantly lower vaccination rate, and less than half were fully vaccinated. The proportion of individuals with a history of COVID-19 was similar to that of the general population.

Several surveys have revealed that patients with cancer have low acceptance of COVID-19 vaccination due to their fear of adverse events, especially during active cancer treatment; vaccine incompatibility with their diseases or treatments; mistrust of vaccine efficacy; and lack of information [3-5]. However, health authorities and academic societies worldwide recommend that these people be vaccinated [6]. The low percentage of fully vaccinated individuals in this population is concerning, as the currently prevalent Omicron variant is effectively prevented only after the third dose [7]. It is well known that neutralizing antibody levels correlate with protection against symptomatic COVID-19 [8, 9]. While patients with cancer are reported to develop lower levels of humoral immunity than people without cancer after vaccination[10, 11], a third dose was found to improve antibody levels significantly [12-14].

With these findings in mind, public health authorities and healthcare providers should encourage patients with cancer to receive at least a third dose and, if possible, a fourth and subsequent booster doses. We suggest that COVID-19 vaccination not be restricted to designated immunization centers to promote vaccination. Instead, hospitals that treat patients with cancer should vaccinate their patients more actively. This would allow for ease in the vaccination of patients, who often have difficulty visiting vaccination centers because of their treatment schedules or poor conditions. According to one study, 91.2% of patients with cancer were willing to be vaccinated against COVID-19 if recommended by their physician [3]. This study suggests that doctors' efforts can significantly improve vaccination rates. Therefore, it would be efficient to check inpatients' immunization records and encourage vaccination at

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the time of recovery or discharge in cases of incomplete immunization to increase the third and fourth vaccination rates and reduce nosocomial outbreaks.

This study has limitations. Our study results may not be generalizable to a broader population since this study was performed within a short time interval in a single institution. However, a quick cross-sectional investigation is necessary for the timely establishment of appropriate infection prevention measures in response to the current easing of social distancing. Additionally, our study results are in accordance with previous studies, which described similar or higher acceptance of vaccination by people with chronic conditions other than cancer compared to people without such conditions [15-17].

In conclusion, less than half of the patients with cancer were fully vaccinated against COVID-19, and their vaccination rate was lower than that of the general population and patients with other medical conditions. This suggests that strategies are needed to raise the vaccination rate of patients with malignancy to protect them from COVID-19 in Korea.

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