consideration during pandemic periods, particularly if an influenza vaccine is not available, if there is a poor vaccine match to the predominant circulating strain, or if HCP chose to waive vaccination for various reasons (as discussed by Sharpe et al[1]). Oseltamivir prophylaxis is well tolerated with minimal side effects according to surveys among household contacts of individuals diagnosed with influenza[6] and among nursing home residents.[7] These studies report rates of nausea of 5.5% and 0.5% and discontinuation rates of 1.0% and 2.8% among household contacts and nursing home residents, respectively. Additional studies also report a very low incidence of side effects, even among individuals receiving high doses of the medication.[8] However, in our survey of healthy HCP, the use of oseltamivir prophylaxis was associated with substantially higher rates of nausea and other adverse medication effects. Another factor driving noncompliance may have been that HCP receiving pre-emptive prophylaxis did not perceive ongoing risk of contracting clinical illness. Thus, their focus on symptoms attributed to the antiviral medication outweighed concern about developing influenza when making decisions about whether to continue therapy and potential downsides of this approach to prevention. This finding may suggest that direct counseling about the ongoing risk of developing influenza after exposure should be emphasized because HCP may have misperceptions about the incubation period of influenza and the rationale for a more extended prophylaxis period to prevent clinical infection.

In summary, oseltamivir prophylaxis is a consideration in HCP populations at high risk of developing clinical disease, including in providers who decline vaccination for various reasons and in years with high rates of vaccination failure or delayed or limited vaccine availability. However, HCP may experience higher rates of adverse side effects when receiving oseltamivir than other populations. Thus, when considering institutional responses to influenza pandemics and implementation of oseltamivir for pre-emptive and postexposure prophylaxis, tolerability of oseltamivir is an important variable that may affect the utility and uptake of this intervention.

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Possibility of nosocomial person-to-person transmission of hemorrhagic fever with renal syndrome

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To the Editor—Hantaviruses belong to the family *Bunyaviridae* and mainly infect small mammals. In humans, however, they cause febrile disease, usually named hemorrhagic fever with renal syndrome (HFRS) in Asia and Europe and hantavirus cardiopulmonary syndrome (HCPS) or hantavirus pulmonary syndrome (HPS) in the Americas.[1,2]

Hantavirus transmission from rodents to humans usually occurs via inhalation of aerosolized rodent urine, saliva, and feces, but rarely by rodent bites,[1] and person-to-person transmission has never been conclusively demonstrated. Among the genus *Hantavirus*, person-to-person transmission of Andes virus was documented in a physician who acquired the infection after exposure to patients infected with the Andes.[3–5] However, 2 other studies have reported no evidence of person-to-person transmission of Andes virus.[6,7] Furthermore, there is currently no evidence of person-to-person transmission of HFRS caused by Hantaan virus. Recently, a self-limited febrile illness was noted in several healthcare workers (HCWs) who had cared for a patient with HFRS in our hospital, raising concerns about the possibility of person-to-person transmission of Hantaan virus. In this study, we evaluated whether transmission of Hantaan virus had occurred among HCWs exposed to the patient with HFRS. This study was approved

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Table 1. Clinical, Laboratory and Serological Findings for 6 Healthcare Workers Who Had Hantaan Virus Symptoms

	HCW 1	HCW 2	HCW 3	HCW 4	HCW 5	HCW 6
Profession	Doctor	Doctor	Nurse (GW)	Nurse (ICU)	Nurse (ICU)	Nurse (ICU)
Exposure event	Outpatient clinic	CPR	CPR	Endotracheal suction, CPR	Endotracheal suction	Endotracheal suction
Symptoms						
Fever	No	No	No	Yes	No	Yes
Myalgia	Yes	Yes	Yes	Yes	No	Yes
Headache	No	No	No	No	Yes	No
Laboratory data						
WBC (/mm^3)	8,240	10,710	9,790	5,610	ND	8,630
Platelet (×10^3/mm^3)	317	225	233	213	ND	294
PPE use						
Mask	Yes	No	No	Yes	Yes	Yes
Glove	No	No	No	Yes	Yes	Yes
Facial shield or goggle	No	No	No	No	No	No
IFA (IgG) titer						
Acute	<1:32	1:256	1:32	<1:32	<1:32	<1:32
Convalescence	<1:32	<1:32	<1:32	<1:32	ND	<1:32

Note. HCW, healthcare worker; GW, general word; ICU, intensive care unit; CPR, cardiopulmonary resuscitation; PPE, personal protective equipment; WBC, white blood cell; ND, not determined; IFA, immunofluorescence assay.

by the Institutional Review Board of Kangbuk Samsung Hospital (IRB no. KBSMC2019-07-041).

We collected sera from the index patient and paired sera from most of the exposed HCWs between November 2019 and December 2019. HFRS confirmed an immunofluorescence assays (IFA) for IgG against Hantaan virus. IFA testing were performed as described in a previous study.[8] Blood samples were sent to the Korea Centers for Disease Control and Prevention for confirmation of HFRS infection.

The index patient was a 55-year-old man who lived in Seoul. He was admitted with high fever (39.7°C) on November 13, 2017. He denied any travel history or insect bite. Laboratory testing on admission revealed thrombocytopenia (platelet count, 117,000/m^3) and white blood-cell count of 4,680/mm^3. On November 16, cardiac arrest occurred after progressive tachypnea and anuria. He was transferred to the intensive care unit after cardiopulmonary resuscitation, and mechanical ventilation and renal replacement therapy was started. Despite these efforts, the patient died on November 19. On November 17, the test for Hantaan virus antibody was positive. The final diagnosis of HFRS was available on December 11, with an anti-Hantaan virus IgG of 1:2048.

In total, 6 HCWs had 1 or more symptoms corresponding to febrile illness. The characteristics of the 6 HCWs are described in Table 1. HCW 2 was a doctor who treated the index patient on a general ward. He had first had contact with the patient on November 15, and he participated in cardiopulmonary resuscitation on November 16. He complained of cough, sputum, and myalgia 3 weeks after exposure (December 7). HCW 3 was a nurse on the general ward. She participated in cardiopulmonary resuscitation on November 16 and complained of myalgia at 23 days after contact. HCW 2 showed increased anti-Hantaan virus IgG titers of 1:256 and <1:32 in sera collected at 28 days and 57 days after contact, respectively. HCW 3 exhibited increased IgG titer of 1:32 and <1:32 in sera collected at 30 days and 57 days, respectively. Upon questioning, it was apparent that HCW 2 and HCW 3 did not wear any personal protective equipment (PPE) during contact with the index case. The other HCWs showed normal IgG titers.

In the present study, there was no confirmed HFRS infection among HCWs who had contact with the index patient. However, these HCWs complained of febrile illness. In fact, 2 HCWs showed elevated IgG titer against Hantaan virus. Previous studies have mentioned possible Hantavirus transmission from an index patient to HCWs.[3,5] However, studies on nosocomial transmission of hantaviruses have mainly focused on Andes virus. To date, person-to-person transmission of Hantaan virus has never been proven; therefore, there is no recommendation to isolate HFRS patients in the Korea Centers for Disease Control and Prevention. However, respiratory secretions and/or saliva may be the main route of infection in Hantaan virus, as seen in nosocomial transmission of Andes virus. Furthermore, in Andes virus nosocomial transmission, success of transmission may depend on the extent of PPE used because most HCWs had contact with the patient during the renal phase, which is considered to be the least infectious phase.[3,5] Unfortunately, the infectivity of respiratory secretions from patients with HFRS has not been studied directly. Although we found no evidence of Hantaan virus nosocomial transmission, the possibility of nosocomial transmission of HFRS cannot be completely excluded. Until additional supporting evidence is provided by studies on the transmission of HFRS, PPE should be considered.

Our study has several limitations. First, no RT-PCR data were available for the index patient therefore, Hantaan viral replication status could not be determined. Second, we did not include exposed HCWs who did not display symptoms. Third, the possibility of previous Hantaan virus infection

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should be considered as a potential cause of the elevated IgG titers against Hantaan virus observed in two HCWs. Finally, recall bias among the exposed workers is possible in this study.

In conclusion, we found no evidence of Hantaan virus person-to-person transmission in HCWs exposed to the index case. However, the possibility of such transmission in the future cannot be excluded. We recommend that all HCWs who care for patients with HFRS use PPE. These measures should include routine use of gloves, gowns, and goggles or facial shields to prevent direct patient contact and exposure of mucous membranes to potentially infectious droplets.

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