

# 일개 대학 국제 기숙사에서 발생한 대유행 인플루엔자(H1N1 2009) 유행의 효과적인 조절

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## Effective Containment of Pandemic Influenza (H1N1 2009) Virus Outbreak in an International Residence Hall of a University by Recommended Infection Control Guidance

People living in communal settings, such as in residence halls, are vulnerable to infectious outbreaks and once it occurs, it can be difficult to prevent its spread. An outbreak of pandemic influenza (H1N1 2009) virus was confirmed in September 2009 in an international residence hall of a university in Seoul, Republic of Korea. Herein, we report an outbreak of the pandemic influenza in a university residence hall that was successfully contained by applying the recommended infection control guidance: active surveillance system, isolation of the patients, contact precaution, and education.

**Key Words:** Influenza A virus, H1N1 subtype, Outbreaks, Infection control

The pandemic influenza (H1N1 2009) has spread globally since April 2009 (1). Influenza activity in the Republic of Korea (ROK) had increased from 3,113 laboratory confirmed cases on week 35 to 15,160 cases on week 39 (2). School-aged children and young adults were more vulnerable to influenza than the other population groups during the pandemic, and outbreaks have been predominantly reported in schools (3-5). To help decrease the spread of influenza among students who can cause a community-wide transmission, the Korea Centers for Disease Control and Prevention (KCDC) has provided a guidance to the institutions of higher education on the necessary measures that were to be taken in case of an influenza outbreak (6). However, there have been no reports on the effectiveness of the aforementioned guidance that was applied in the control of an outbreak of the 2009 H1N1 virus in institutions of higher education.

An influenza outbreak occurred in a university located in the northeastern part of Seoul, ROK. This university has an international residence hall that is four stories high and can accommodate up to 326 students. A total of 300 students

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were residing in the residence hall at the time of the outbreak. Each room was shared by three students from various countries. There was a shared bathroom on each floor but some of the rooms were equipped with a private bathroom.

Initially, the outbreak seems to have occurred among those who participated in the annual university festival celebrated by over 5,000 students each year: in 2009, it took place on September 11 and 12. After the festival, the outbreak is then thought to have spread throughout the university, where 135 laboratory confirmed cases of the 2009 H1N1 virus infection have been detected from September 11 to 26. Before the festival, only 5 sporadic laboratory confirmed cases have been reported and none of the cases occurred among those residing in the residence hall.

A confirmed case was defined as a symptomatic case that was positive for real-time reverse transcription polymerase chain reaction (real-time RT-PCR) against the 2009 H1N1 virus; the presenting symptoms included new-onset fever (body temperature  $\geq 37.8^{\circ}\text{C}$ ), respiratory symptoms or any other constitutional symptoms. A suspected case was defined as a symptomatic case that was negative for real-time RT-PCR against the H1N1 2009 virus.

Viral RNA was extracted by using *ExiPrep*<sup>TM</sup> Viral DNA/RNA Extraction kit (Bioneer, Seoul, Korea). Real-time RT-PCR was performed using *AccuePower*<sup>®</sup> new influenza A (H1N1) Real-time RT-PCR kit (Bioneer, Seoul, Korea) which included random primers. Thermocycling conditions for PCR consisted of 40 cycles of 45°C for 15 min, 95°C for 5 min, 95°C for 5 sec, and 55°C for 5 sec by using *Exicycler*<sup>TM</sup> 96 Real-time Quantitative Thermal Block (Bioneer, Seoul, Korea). The results were notified within 24 hours to the symptomatic students, which was made possible by the collaboration and coordination of the tertiary care center in the vicinity of the university.

To give an opportunity to experience something new and exhilarating, and also to make them feel a sense of belonging, the residents of the international residence hall were invited to the annual university festival that took place on September 11

and 12, and every resident participated. However, two residents fell sick on September 14 and two more residents presented with respiratory symptoms the following day. Three of the residents were diagnosed with influenza, confirmed by real-time RT-PCR, and the other resident was suspected to have influenza by showing a positive reaction on the influenza rapid antigen test (Standard Diagnostics, Inc., Suwon, Korea). None of the four residents were roommates with each other; each resident resided in different rooms located on different floors. To prevent the spread of influenza, the four residents were isolated in private rooms equipped with a bathroom and treated with oseltamivir (75 mg twice a day for 5 days). However, oseltamivir was not given to their close contacts, including their roommates.

Since the detection of the four confirmed cases strongly suggested the initiation of the pandemic influenza (H1N1 2009) outbreak among the residents in a university residence hall, the following guidance was applied to prevent a secondary transmission: active surveillance system, isolation of the patients, contact precaution, and education. No one was given antiviral prophylaxis during the outbreak.

Because the foreign students residing in the residence hall did

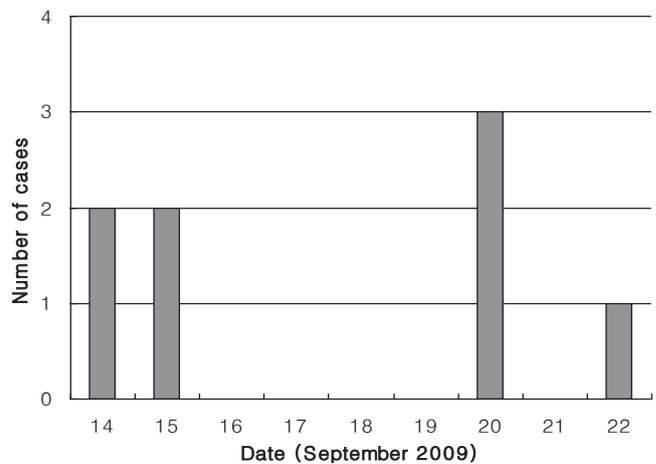
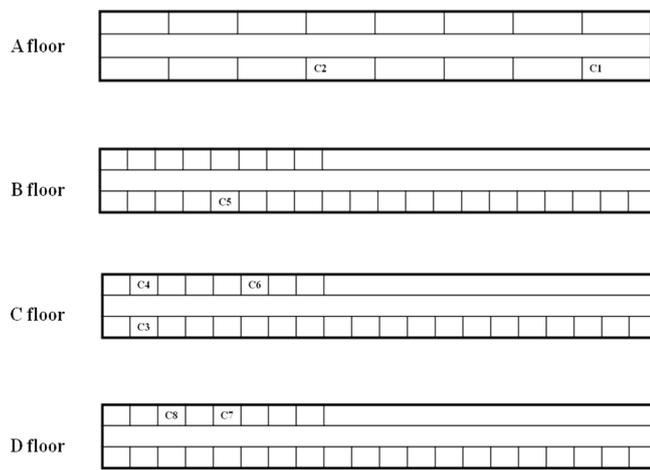


Figure 1. Epidemic curve of the outbreak: timelines of 8 cases from the pandemic influenza (H1N1 2009) outbreak in a university residence hall for foreign students.

Table. Demographic and Clinical Characteristics of 8 Cases that were Infected with the Pandemic Influenza (H1N1 2009) Outbreak in a Residence Hall

Case Series	Sex	Age	Nationality	Onset of Illness	Date of diagnosis	Adission (days)	Related symptoms
C1	M	32	Pakistan	2009.09.14	2009.09.15	No	Fever, myalgia, sore throat, cough
C2	M	19	Morocco	2009.09.14	2009.09.15	Yes (2)	Fever, headache, vomiting
C3	M	20	United States	2009.09.15	2009.09.15	Yes (2)	Fever, headache, sore throat, cough
C4	M	23	United States	2009.09.15	2009.09.15	Yes (2)	Fever, sore throat, cough
C5	F	23	Morocco	2009.09.20	2009.09.20	No	Fever, headache, sore throat, fatigue, cough
C6	M	21	United States	2009.09.20	2009.09.21	No	Fever, myalgia, headache, sore throat, fatigue, cough, diarrhea
C7	M	24	Singapore	2009.09.20	2009.09.22	No	Fever, rhinorrhea, cough
C8	M	24	Singapore	2009.09.22	2009.09.22	No	Sore throat, cough



**Figure 2.** Room locations of the 8 cases of infection with the pandemic influenza (H1N1 2009) in a residence hall of a university (Cases from C1 to C8 were indicated).

not have any other places to go to in order to prevent the spread of the infection, the residents with influenza were placed in private rooms whenever possible or in shared rooms for cohort of patients when no more empty private rooms were available. The residents with influenza were placed under strict contact precautions, including the use of fresh plastic aprons and gloves, and even after the symptoms have subsided, they were isolated for a total of 7 days. One of the residence hall staff members was assigned to be in charge of carrying the meals to the isolated rooms and also to take care of the sick residents who, in turn, were asked to wear surgical masks every time they came in contact with this person in charge. The sick residents were discouraged to participate in any kind of campus events or attend the classes. To detect and monitor new patients with influenza infection, we daily checked body temperatures and respiratory symptoms of all residents throughout the outbreak. The suspected symptomatic residents were made to visit the hospital on the very day, examined by the doctor, and treated with antiviral agents if the test results were positive. Until the test results were confirmed, the suspected symptomatic residents were asked to wear surgical masks. We educated the residence hall staff members and the residents through a special lecture and posted bulletins about the importance of following the basic precautions against the influenza: wash hands frequently with soap and water, and cover the nose and mouth with a tissue when coughing or sneezing.

Four additional cases were detected on September 20 and 22, with all the cases occurring among those residing in different rooms and on different floors; none of them had any contact history with a febrile patient. Since the four initially diagnosed cases were isolated, have been taking antiviral agents, and

have been febrile for about 3.3 days, the possibility of these residents being the cause of secondary transmission to the four additional cases seems to be low. It could rather be attributed to the university-wide influenza outbreak that was ongoing at that time. In addition, no case occurred among the residence hall staff members.

As a result of this effective infection control, no subsequent cases have been found among the residents after September 22 until October 26, when the active surveillance system was terminated.

We found 7 confirmed and one suspected cases of the 2009 H1N1 virus infection out of 300 students during the surveillance period, from September 15 to October 26. The mean age of the cases was  $23 \pm 4.0$  years (range 19–32).

The reported symptoms were fever (87.5%), cough (87.5%), sore throat (75.0%), headache (50.0%), fatigue (25.0%), and myalgia (50.0%). No complication or death was reported.

This is an identified outbreak in an international residence hall of a university in the ROK. Although other sources must have played a role, there is a great chance that the festival itself could have been the seeding event leading to community transmission. To prevent this mode of transmission, many guidelines recommend the suspension and modification of public events on campus (7).

The influenza outbreak in this article was successfully controlled with only contact and/or droplet precautions without airborne precaution. The main route for influenza transmission is via large droplets. Transmission of influenza through the air over longer distances is thought not to occur (8, 9). Although the post-exposure antiviral prophylaxis was not given to any close contacts, no case occurred among the roommates. With the increasing resistance of influenza virus to oseltamivir, antiviral prophylaxis was carefully considered (10). In settings like residence halls, in which the influenza patients cannot always be isolated in private rooms due to limited resources, employing cohort as an isolation method seems to be a feasible, effective, and useful alternative, as shown in this article.

In this study, patients were isolated for 7 days after the symptom onset according to the KCDC guidance, seemingly excessive compare to the recent update CDC guidance, which recommends patients to be isolated until at least 24 hours after they are free of fever without antipyretics (7). However, we considered that this isolation duration could be effective in controlling outbreaks for those living in communal settings such as residence halls. Because the residence hall staff member that was in charge of taking care of the sick residents was understandably nervous about the transmission, we applied strict contact precautions including the

use of fresh plastic aprons and gloves. However, this intervention does not meet the KCDC guidance and might have been an excessive control measure.

In this article, we described an example of an pandemic influenza (H1N1 2009) virus outbreak in a university residence hall that was successfully contained through effective control measures consisting of isolation or cohort of cases, surveillance system for detecting new patients, education of personal hygiene for students, and management for patients.

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