

Brief Report

An Outbreak of Novel Influenza A (H1N1) in the English Language Institute

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Objectives: This report describes the results of an investigation on an outbreak of novel influenza A (H1N1) in an English language Institute in Seoul, Korea in May 2009.

Methods: In this outbreak, novel influenza A (H1N1) was confirmed in 22 of 91 trainees, trainers and staff members. The trainees and 2 staff members were isolated in an assigned facility and the rest were isolated in their homes after we discovered the first patient with novel influenza A (H1N1). After the isolation, the people in the assigned facility were educated to use N95 respirators and they received oseltamivir for prophylaxis.

Results: The initial findings in this study suggest that the symptoms were mild and similar to those of seasonal influenza. The classmates and roommates of the infected patients were more likely to get infected with novel influenza A (H1N1) than the trainees who were not classmates or roommates of the patients (OR: 3.19, 95% CI=0.91-11.11 for classmates and OR: 40.0, 95% CI=7.4-215.7 for roommates).

Conclusions: The public health response seems successful in terms of preventing the spread of this virus into the local community.

Key words: Disease outbreaks, Influenza, Human, Prevention and Control
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INTRODUCTION

On May 2, 2009, the Korea Centers for Disease Control and Prevention (KCDC) announced the first novel influenza A (H1N1) patient [1]. Ever since then, the number of cases in Korea has continued to rise. As of May 27, more than half (22 patients) of all novel influenza A (H1N1) cases in Korea had been confirmed among a group of trainees and trainers of an English language institute. This report describes the initial outbreak investigation by the Central Headquarters for Epidemic Response (CHER) and it provides the details of the index patient. In addition, the management strategies for containment of novel influenza A (H1N1) are presented.

METHODS AND MATERIALS

I. The Initial Investigation

On May 21, the CHER was notified of a woman (Patient E on Figure 1) with an acute febrile respiratory illness and who came from USA on May 16. The

community health center provided her oseltamivir and N95 masks. She was advised that she should always stay in her room and that she should wear a mask whenever she stepped out of the room and met anyone, if doing so was unavoidable. On May 22, she was classified as a probable patient as her test results showed she was positive for influenza A, but negative for seasonal H1 and H3. There was another notified patient (Patient G on Figure 1) who took the same course as Patient E and stayed at the same hotel as Patient E. On the early morning of May 23, the CHER dispatched the Rapid Response Team to the place (hotel C) where they stayed and the Rapid Response Team screened all the trainees in the hotel for acute febrile respiratory illness.

According to the C English language institute, a five day course (May 18-22) for training English instructors was opened in Korea. Most of the trainees entered Korea from May 14 to May 17. Some had come to Korea much earlier and there were some trainees who already lived in Seoul. On May 18, the trainees were divided into 4 groups and they were given a two-and-a-half-hour orientation. They were also given medical checkups. From May 19 to May 22, they were divided into groups of 3 to 6 trainees per group and they attended two classes

everyday. Each class lasted two and a half hours. Study groups of 3 or 4 trainees per group were formed in the evening.

II. Definitions

Acute febrile respiratory illness was defined as when a patient had any of the following symptoms: cough, sore throat, rhinorrhea or fever ($\geq 37.8^{\circ}\text{C}$). A person with an onset of acute febrile respiratory illness after May 16 2009 in this group (trainees, trainers and staff members) was classified as a suspected patient. We swabbed the throat of a suspected patient and provided the patient with oseltamivir. Confirmation of novel influenza A (H1N1) was done by real-time reverse transcriptase polymerase chain reaction (rRT-PCR) of the swabs taken while the patient was symptomatic.

III. The Public Health Response

We received the list of trainees, trainers and staff members from the institute. On May 23, we moved to the Seoul Human Resource Development Center the 2 staff members/ trainees who took the same course with the confirmed patient. The rest of the trainers and staff members were isolated in their own homes. The Rapid Response Team designated a single room to anyone with symptoms of acute febrile respiratory disease. Healthy people without any symptoms had to share rooms together due to a room shortage. The Rapid Response Team provided all the isolated people with N95 respirators and we trained them how to wear the N95 respirators. They were advised to wash their hands frequently, stay in their rooms at all times and to wear N95 respirators whenever they stepped out of their rooms. To minimize the possible contact, we delivered every meal to each room.

We checked the medical conditions of all the people in the facility (the Seoul Human Resource Development Center) twice a day and conducted rRT-PCR for novel influenza A (H1N1) for anyone with an acute febrile respiratory illness. For the sake of monitoring, we made a phone call every day to the people who were isolated in their own homes.

Because the people in the facility were not completely isolated from each other, confirmed patients continuously occurred until May 26. CHER decided to give oseltamivir to the people isolated in the facility for prophylactic purposes on May 26. We isolated them until May 31 and monitored them until June 3. There were no additional identified patients.

IV. Case Management and Contact Tracing

All the confirmed cases were isolated in the National Designated Isolation Room to stop the virus from spreading. Oseltamivir was given to all of the patients, except for one patient because of severe vomiting as a side effect of oseltamivir. Zanamivir was given instead to this patient. According to the protocol, all of the patients were isolated for 7 days after the onset of symptoms. All the confirmed patients were discharged without any complications.

We evaluated the contact history of the patients during the infectious period. The contact history includes sharing hotel rooms, participating in study groups, attending classes and spending time together.

V. Statistics

The generation time was estimated to be the period between the two peaks in the epidemic curve (Figure 2). To characterize the extent of transmission, we estimated the secondary attack rate among the trainees. The contact history was compared between the infected patients and non-infected persons by Fisher's exact test and using SPSS 12.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

I. The Index Case and Initial Investigation

After screening at the hotel, the Rapid Response Team found 6 patients with acute febrile respiratory illness. Among them, 4 patients were confirmed to have novel influenza A (H1N1) according to rRT-PCR. One (Patient A on Figure 1) of the 4 patients entered Korea on May 16 from Virginia, USA. Fever, cough, sneezing, and myalgia developed on May 17. She was a member of a study group of 3, which included Patient E. As Patient A had symptoms earlier than Patient E, Patient A is believed to be an index case. Patient A had no underlying medical condition.

Considering the incubation period and the onset of symptoms, Patient A seemed to be infected before entering Korea. In our database, there was no reported patient who took the same flight that Patient A took. Considering our database, it seems that she was infected in the US.

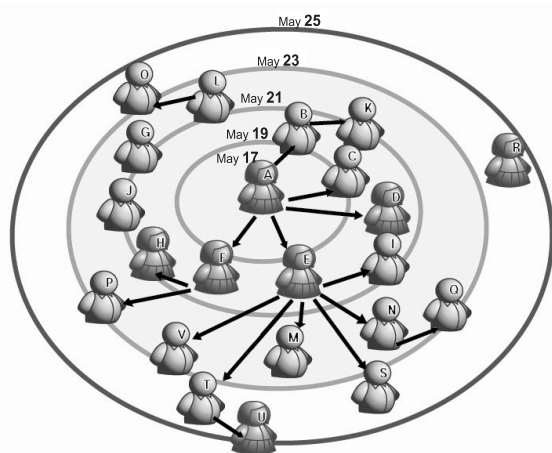


Figure 1. Possible chain of transmission of novel influenza A (H1N1) infection.

This chain of transmission was reorganized based on the patient's contact history and the development of symptoms. All the patients, except Patient V who was a trainer, were trainees. The numbers in this figure indicate the day of symptom onset.

II. Outbreak Description

There were 71 trainees, 17 trainers, and 11 staff members on the list. Among the persons on the list, 8 trainees dropped the course before the five day course started. As a result, with exclusion of these 8 people, 91 people were related to this outbreak.

Six trainees had already been diagnosed with novel influenza A (H1N1) and they were isolated in a hospital

before moving the others to the Seoul Human Resource Development Center. As the trainers and staff members lived in their homes and not in a hotel, each of them was isolated in their own homes. As a result, 59 people, including 57 trainees and 2 staff members, were isolated in the Seoul Human Resource Development Center on May 23.

We found 22 patients with novel influenza A (H1N1) out of 34 suspected patients. Among the confirmed patients, there were 21 trainees and only one trainer. The median age of the cases related with this outbreak was 25 (range: 22-41). There were 14 men and 8 women. Based on the contact history and the onset of symptoms, we reorganized the route of transmission as shown in Figure 1.

Figure 2 shows a curve of the person-to-person spread of novel influenza A (H1N1). The outbreak started on May 17 and it lasted 9 days. Two large peaks were observed. The generation time was calculated as 2 days in this outbreak. The attack rate in this outbreak was calculated as 24.2%. We estimated that the secondary attack rate was 4.7%.

Classmates and roommates of the infected patients were more likely to get infected with novel influenza A (H1N1) than were the trainees who were not classmates or roommates of the patients (OR: 3.19, 95% CI=0.91-11.11 for classmates and OR: 40.0, 95% CI=7.4-215.7 for the roommates).

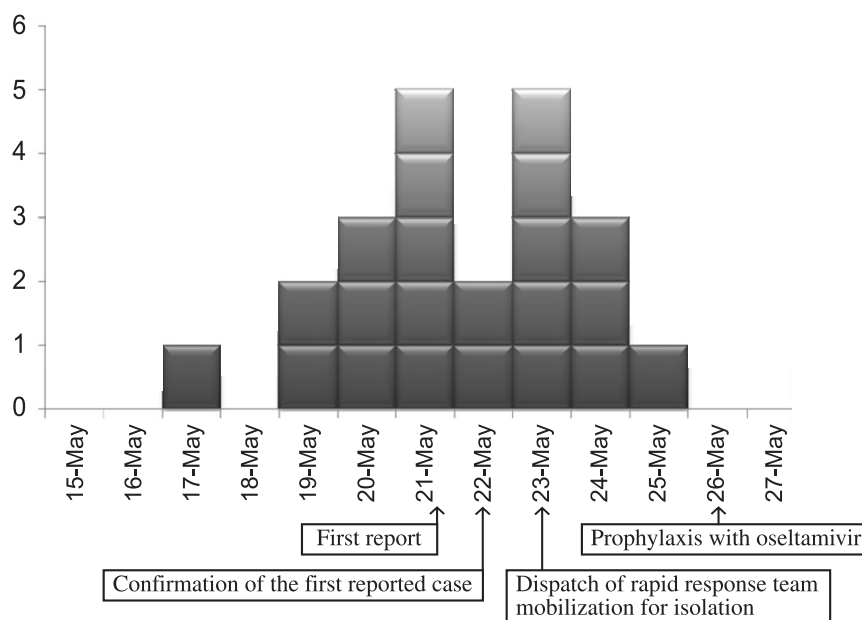


Figure 2. Date of illness onset for the confirmed cases of novel influenza A (H1N1) in the English language Institute. Mass prophylaxis with oseltamivir was performed on May 26.

Table 1. Symptoms reported by the confirmed cases of influenza A (H1N1)

Symptoms	No. of patients (%)
Fever	11 (50.0)
Rhinorrhea or stuffy nose	9 (40.9)
Sore throat	13 (59.1)
Cough	17 (77.3)
Dyspnea	5 (22.7)
Conjunctivitis	1 (4.5)
Diarrhea	3 (13.6)
Nausea	4 (18.2)
Vomiting	2 (9.1)
Headache	11 (50.0)
Myalgia	8 (36.4)
Arthralgia	1 (4.5)
Generalized weakness	1 (4.5)

Table 2. Incidence of novel influenza A (H1N1) in the trainees by age and nationality

Groups	Patient No./Total No. (%)
Nationality	
USA	17/49 (34.7%)
Australia	1/5 (20.0%)
Korea	1/4 (25.0%)
Canada	1/3 (33.3%)
United Kingdom	0/1 (0%)
South Africa	1/1 (100%)
Age (yr)	
20 - 24	11 / 21 (52.4%)
25 - 29	6 / 27 (22.2%)
30 - 34	3 / 11 (27.3%)
35 - 39	0 / 0 (0%)
40 - 44	1 / 4 (25.0%)

III. Clinical Epidemiology

The distribution of symptoms is demonstrated in Table 1. Two of the confirmed patients had a history of asthma, but novel influenza A (H1N1) infection did not exacerbate their asthma. The incidence of novel influenza A (H1N1) according to age and nationality is demonstrated in Table 2.

DISCUSSION

This is the first confirmed outbreak of novel influenza A (H1N1) infection reported in Korea with the possible chain of transmission.

Though there have been some reports on outbreaks in schools in other countries [2-5], the constituent members of this outbreak are different from those of the previous school outbreaks. There are 3 different groups (trainees, trainers and staffs) in this outbreak. The contact pattern of these 3 groups was different from that of each other. The trainees spent time studying or sightseeing together,

but the trainers spent time together only during lectures. The time that they spent together varied so widely that the rates of case development be different, resulting in different incidences between the trainees and the trainers or the staff members. Unlike other reports, this article reveals from whom the patients became infected, based on the onset of symptoms and the exposure histories.

We tried to determine the risk factors for infections among the trainees because the trainers and staff members did not share the same schedule as the trainees, and the contact patterns were totally different. Sharing hotel rooms or classes with patients was a risk factor for getting infected with novel influenza A (H1N1). We were not able to evaluate other factors, such as being in the same study groups or what they did in their free time because we could not investigate all the trainees.

The odds ratio of the roommates of the patients seems to be too high (OR = 40). This is because the English language institute arranged single rooms for the patients who complained of symptoms of influenza-like illness, although not all trainees with these symptoms reported to the institute and the patients who didn't report shared rooms with other trainees. This made a remarkably high odds ratio.

Because hotel C shared the building with apartments, we could not isolate the trainees in the hotel. Therefore, we had to move them to another separated place on May 23. The moving and arranging rooms for people with acute febrile respiratory illness was successful although the members in the new facility did not thoroughly protect themselves. According to Figure 2, the number of new patients decreased after the movement. Because confirmed patients occurred continuously despite a decreasing number of patients and because novel influenza A (H1N1) was not wide spread in the surrounding community, we had no choice but to conduct mass prophylaxis to minimize the spread of virus not only within the facility, but also outside the facility.

This investigation had some limitations. First, we assumed that the people who showed acute febrile respiratory illness earlier were infected earlier. Because the incubation period appears to range from one to seven days (median: two days) [6], there might have been patients who reported their symptoms later. However, there may not have been a large number of such patients. Therefore, we thought that the earlier people got infected, the earlier they showed symptoms. Second, if rRT-PCR showed negative results, then the patient was considered non-infected. Although the sensitivity of performing rRT-PCR on an upper respiratory tract specimen for influenza is not 100% [7], nucleic acid

amplification tests such as rRT-PCR are the most sensitive and specific tests for diagnosing influenza virus infection [8]. Hence, the persons with a positive result from only rRT-PCR were regarded as patients infected with novel influenza A (H1N1).

We failed to reveal the origin of the infection in four people. Asymptomatic patients might have had a role in the transmission. Three asymptomatic cases were identified in one report [3]. For seasonal influenza, asymptomatic infection is known to occur in approximately 33% of the cases [9]. Because we collected samples from only 34 patients with respiratory symptoms, there might have been asymptomatic patients in this outbreak. These four patients might have been infected from these asymptomatic patients. Another possible explanation is that these four patients didn't know or didn't remember whether they were exposed to one of the confirmed patients because they were not acquainted with all the English language institute's members. There was a limitation when tracing the contact history because we had no choice but to depend on the patient's memory.

Unlike other reports [2-5,10], only half of the patient had fever. This difference might be the result of differences of defining cases. For example, some researchers collected throat swabs only from patients with influenza like illness. Our investigation method might also have influenced the results. We interviewed all the involved patients face-to-face while other researchers performed telephone interviews [2]. Although this outbreak had only 22 confirmed patients, our results are sufficient to help understand the clinical aspects of novel influenza A (H1N1). The prevalence of H1N1 in other reports of fever might have been overestimated.

Control measures were implemented as soon as the index case was confirmed. Had the index case been detected earlier, we may have seen lower levels of transmission within this group. The fact that no secondary case was observed outside this group after quarantine, isolation of the confirmed cases and mass prophylaxis suggests that these complementary measures were effective to limit transmission to the surrounding community.

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