Detection of Influenza Virus Infections in an Institute for the Disabled.

Yi-Syue Li[1], Shu-Chun Chiu[2], Jih-Hui Lin[2], Shu-Fang Kuo[3], Guo-Ning Lin[3], Shu-Chuan Chuang[1], Shih-Hao Liu[1]

1. First Branch, Centers for Disease Control, Taiwan
2. Research and Diagnostic Center, Centers for Disease Control, Taiwan
3. Public Health Bureau, Taipei County Disease Control Section

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Abstract

From late December 2007 to early January 2008, an outbreak of upper respiratory tract infection (URI) was reported in an institution for the disabled in Taipei County. A total of 36 people, including one health care worker and 35 residents, developed symptoms of URI and showed signs of influenza. Respiratory specimens were taken from 27 patients and tested for influenza viruses by National Influenza Center and CDC Collaborating Lab. 16 (59.3%) influenza A viruses were found out of the samples collected. It was interesting to note that the outbreak of epidemic influenza infection occurred among residents with high influenza vaccination rates (95.1%). Further examination with phylogenetic tree analysis and HI tests told us why this is so; the influenza virus A/H3 isolated from this incident showed antigenic difference from the A/H3 strain in the trivalent vaccine for the 2007-2008 season.

Keywords: populous institution, clusters incident, influenza virus, vaccine, HI test

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Correspondence: Yi-Syue Li; Address: No.161, Kun-Yang Street, Taipei, Taiwan, R.O.C.
E-mail: liyihsueh@cdc.gov.tw

Introduction

Influenza is a highly infectious respiratory disease that is caused by influenza viruses, transmitted via droplets, and is most prominent during winter. The number of infected cases gradually increases in October and then decreases in March. Influenza spreads rapidly within a wide range and is usually accompanied by serious complications. Therefore epidemic prevention is very important[1]. Residents in more populous institutions are infected more easily since cluster infections occur once there is any pathogen in the environment. Within the Taiwan CDC, the Populous Institution Surveillance System is required to report the number of influenza–like cases weekly in order to prevent any major outbreaks[2].

Background

The handicapped institution in Taipei County is a populous institution. It provides services for the residents who are handicapped, disabled, have poor self-hygiene-care, and unable to treat themselves when sick. There were 114 health workers and 144 residents in the institution when the incident occurred. Residents were grouped into five sections depending on their situation. People with good perception and learning ability were in rooms 3A and 4A-1, the restless and active ones were in room 4A-2, and those who need more health care ones were arranged in room 5A and 6A.

Epidemic Investigation

The beginning of the outbreak occurred in room 4A-1 on the 4th floor of the institution which then spread to the 3rd, 5th and 6th floor. Upper respiratory infection (URI) symptoms such as fever, running nose, and coughing were first noticed on December 20, 2007. The next day (Dec 21, 2007), similar symptoms

were discovered in another resident. However there were no new cases on Dec 22, 2007 which did not meet the qualifications of a cluster infection. After 10 days, and increasing number of URI cases were continually reported: a new case occured on Jan 1, 2008; the first peak appeared on Jan 2 with an appearance of 6 cases; 2 more cases developed on Jan 3; 6 cases identified on Jan 4 causing a second peak of infection. The last case was reported on Jan 15, 2008.

The incident occurred in a span of 27 days, from the first case to the last, and a total of 36 cases (Figure 1). Of these cases 35 were residents and one was a healthcare worker. The healthcare worker was a 47-year-old woman in room 4A-2 who showed symptoms from January 10-11.

Figure 1. The Epidemic Curve of the Cluster Incident.

The other 35 cases were made up of 10 females and 25 males between the ages of 2 to 28 years old. The average age was 15 years old. All of them received medical care as soon as they were infected. Of these 35 cases, 9 were hospitalized for treatment with one of them hospitalized twice. The days of hospitalization for

the 9 patients were 3, (9, 6), 8, 6, 6, 5, 7, 5 and 10 days respectively.

Specimen collection and Laboratory results

After the incident the Public Health Bureau of Taipei County took control of the investigation. Specimens from those who suffered from URI were collected and sent to the Center for Research and Diagnostics, Taiwan CDC for further examination. In 11 specimens, the influenza virus A/H3 was found in 6 specimens while the rest were negative for A/H3. The results showed that the pathogen in this incident belonged to A- type influenza viruses.

From Jan. 3 to Jan. 18, The Health Bureau continued collecting specimens from cases that suffered from upper respiratory tract infection. A total of 27 specimens were collected. The laboratory results determined that 2 cases were influenza virus A/H1, 14 cases were influenza virus A/H3 and 11 cases were negative for influenza.

Speculation on the routes of transmission

Within the institution are shared activity spaces such as the rehabilitation room, art room, pottery room, and auditorium. Some residents also attend local schools in the area. They take school buses to the elementary, junior high, and special education schools; while many weak or disabled school-age residents are educated in the same classroom by teachers dispatched from the local Education Bureau. Therefore the shared activity spaces and school bus are the routes of transmission in this incident. The two different types of influenza viruses, A/H1 and A/H3, were analyzed and it was speculated that both pathogens had two different resources.

Prevention Strategies

When residents showed symptoms of upper respiratory tract infection, they were sent to a nearby clinic or hospital for medical treatment. The outbreak was reported as a cluster incident on Jan. 2 with the Public Health Bureau of Taipei County dispatching health officials to the institution for further details and discussions on preventative measures on Jan 3. Some strategies have been confirmed by the supervisor including: isolating the infected cases, restricting visitors access, disinfecting appliances and environment, completing the specimen collection, implementing body temperature monitoring and reporting, and etc.. The institution has stopped reporting in on the body temperature monitoring and infected cases isolation since Jan. 29, which was two weeks after the last onset case was reported.

Discussion

The causes of this incident can be broken down into the following:

1. Vaccination rate

The influenza vaccination rate of the residents is close to 95% (Table 1) with 32 out of 35 residents in this cluster incident having completed the vaccination. Thus, the incident in the institution was not caused by a low vaccination rate. However, only 39 residents in the institution received influenza vaccinations. After interviewing the health workers of the institution, officials of the Health Bureau said that most of the residents were negatively influenced by the media's claim that the influenza vaccine contained *thimerosal*[3], which may have resulted in a an overall low vaccination rate.

Table 1. The influenza vaccination rate in the institution

Identity	Number of Vaccination	Number of Unvaccinated	Total Number
Resident	137(95.1%)	7(4.9%)	144
Health Worker	39(34.2%)	75(65.8%)	114

2. Vaccine effect

According to the information provided by the seventh division of Taiwan CDC, the frozen-transportation temperature monitoring for vaccines during the transportation process was operated normally. Therefore, the problem of improper frozen transportation process for the vaccines can be excluded.

3. The immunity of the residents

The most scientific method to assess the effect of a vaccine in humans is to collect and examine the antibodies in vaccine serum before and after the injection. Unfortunately this method was not available for use for this incident. After checking references, no similar research related to influenza vaccination for disabled children and immunity changes could be found. Nevertheless, some researches showed that the influenza vaccine could activate antibodies in the elderly, children suffering from leukemia and asthma, and healthy children [4, 5]. It can be speculated that the influenza vaccine can raise the immunity and protection for the residents of the institution.

4. The influenza virus strain of this incident

A/Solomon Islands/3/2006(H1N1)-like virus、A/Wisconsin/67/2005(H3N2)-like virus、B/ Malaysia/2506/2004-like virus [6]

The influenza vaccines used in 2007 were applied to 2007-2008vaccine. Each dose contained the following antigen ingredients: A/Solomon Islands/3/2006 (H1N1)-like virus, A/Wisconsin/67/2005(H3N2)-like virus, B/ Malaysia/2506/2004-like virus [6]

The influenza strains A/H1 and A/H3 were tested from the cases that had URI symptoms in this cluster incident. After the RT-PCR and further HA genetic analysis for vaccine strains by the Research and Diagnostic Center of Taiwan CDC, results showed that there was not much variance between influenza virus

A/H1 and the trivalent vaccine used in 2007-2008(Solomon Islands). However there are some differences between virus A/H3 and the trivalent vaccine that used in 2007-2008 (Wisconsin). (Figure 2b)

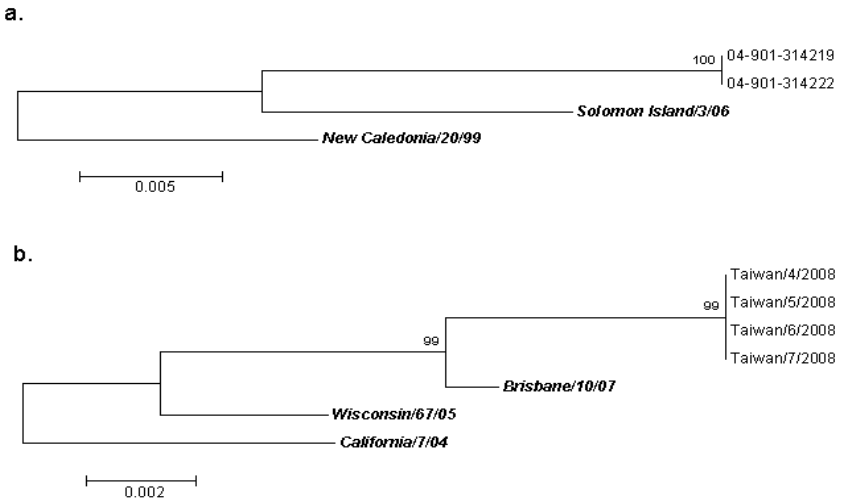

Figure 2. a. The figure of A/H1 strain HA phylogenetic analysis of the incident; b. The figure of A/H3 strain HA phylogenetic analysis of the incident. The words in *bold and italic font* are for the strain of virus used for reference, the words in normal font are for the strain of the virus related to the incident.

Since results of genetic analysis is unable to show differences between antigens, the Hemgglutination Inhibition Test (HI test) was implemented by the Research and Diagnostic Center of Taiwan CDC. Because the influenza strain A/H1 has no virus isolates, therefore no HI test result was found in this incident. The table 2 showed that the antigenicity is different between the influenza virus A/H3 isolated from this outbreak and the trivalent vaccine that was used in 2007-2008. The reaction results showed that there were 4-8 differences on the virus isolates and reference antisera. This meant that the antigen of the virus had

changed. Therefore, it can be speculated that the influenza vaccine for 2007-2008 has lower protection from the influenza virus A/H3.

Hemogglutination Inhibition Test (HI test) Result for Virus A/H3 Isolates of the incident.

	Reference Antisera	
Reference Antigens	TW/641	Hiroshima/52*
A/Taiwan/641/2007	**1280**	320
A/Hiroshima/52/2005	640	**1280**
Test Antigens		
A/Taiwan/4/2008	1280	320
A/Taiwan/5/2008	1280	320
A/Taiwan/7/2008	640	320
A/Taiwan/6/2008	640	160

＊Hiroshima/52 is the influenza virus of Wisconsin-like

Conclusion

The incident has aroused concern since 35 residents in the institution were infected with upper respiratory infection even though their vaccination rate was up to 95%. The laboratory results confirmed that the pathogens were influenza virus A/H3 and A/H1. After the investigation, the reasonable explanations for this incident would be: the residents of the institute were infected by “non-vaccine strain influenza virus” since the flu vaccine could not provide 100% protection from viruses. However, no influenza cases had severe complication because of the contribution of the high vaccination rate in the institution.

Gratitude

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officials and the health workers of the handicapped institution are also highly appreciated for smoothly alleviating the outbreak under the limited manpower.

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