Epidemiological Report

Epidemiology of Influenza from 2007 to 2008 in Naha Area, Okinawa Prefecture: Surveillance of Rapid Antigen Test Results

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SUMMARY: The incidence of influenza in the Naha city area in the southernmost part of Japan was surveyed in 2007 and 2008. Patients who had influenza-like symptoms and visited one of four general hospitals in Naha City, Okinawa, Japan were included in this study. The nasal or throat swab samples were applied to the rapid test for detecting influenza A and B virus antigens. The positive rate of influenza A and/or B virus antigen was 26.2% (8,480/32,380). Most cases (82.9%) were influenza A. In 2007, influenza A cases were detected during the entire year, and an epidemic peak was also noted in July, while no outbreak occurred in the summer of 2008. The surveillance of the rapid influenza virus antigen test seemed to provide reliable epidemiological data. This finding warrants further study in this region, including study of the influences of climate and socio-behavior patterns of the residents in the region on influenza epidemics.

INTRODUCTION

Seasonality in influenza epidemics is well known. Winter is the epidemic season in temperate and cold climates (1). The possible underlying causes of seasonality include biological, social, and environmental causes (1). Biological causes are viral evolution, the immune status of hosts, and seasonal host health. The environmental causes include decreased ambient temperature. The social behaviors of humans may also affect the seasonality of influenza epidemics (1). Lower temperature and absolute lower humidity can enhance the infectivity of influenza virus in the air (2). However, recent reports have documented that influenza outbreaks can occur during the summer in Southeast Asia (3), where the climate is tropical and subtropical. While influenza in mainland Japan (latitude 35° North) is prevalent during the winter, continuous influenza activity is noted in Taiwan (latitude 23° North). In Hong Kong (22° North) and Singapore (1° North), influenza activities during summer are high (3). It is important to understand what factors lead to summer outbreaks of influenza in tropical and subtropical areas because other strategies for influenza control might be required in those areas. The need of study is enhanced by the prevalence of highly pathogenic avian influenza H5N1 and the possible emergence of a novel pandemic virus in those areas (3).

The reasons for the different seasonality of influenza epidemics in Southeast Asia are not understood (3). The climate as well as pathogenicity of a virus, as well as the immune status and social behavior of people in an area may influence the seasonality (1). The Okinawa Islands are located in the southernmost part of Japan (latitude 26° North), where the climate is subtropical. The prevalence of vaccination against influenza in this region is high. This report describes a 2-year surveillance of the influenza incidence in Naha City, Okinawa Island during 2007-2008 by monitoring of the influenza virus antigen test results in the main hospitals in the city.

MATERIALS AND METHODS

Geometric and climatic background: Naha City is the capital of Okinawa Prefecture, which is located on Okinawa Island in the southernmost part of Japan. Okinawa Island is located between mainland Japan and Taiwan. The island is humid and is a mix of temperate and sub-tropical climates. Average temperatures are 18°C in winter and 28°C in summer. The climate data were retrieved from the Japanese Meteorological Agency website (http://www.jma.go.jp/jma/indexe.html).

Study population and diagnosis of influenza: Patients who had influenza-like symptoms and visited one of the four general hospitals in Naha City and Urasoe City, Okinawa, Japan were included in this study. Intranasal or throat swab specimens were obtained when influenza was clinically suspected by physicians. The nasal or throat swab samples were transported to the clinical laboratory. The samples were applied to the rapid test for detecting influenza A and B virus antigens (Denka Seiken, Osaka, Japan) for the diagnosis of influenza. These diagnostic procedures are conventional clinical practice in Japan and were performed with the informed consent of the patients. The test results were anonymously collected and sent to the Clinical Laboratory Center of the Medical Association in Naha City, Okinawa, from the four hospitals.
RESULTS

During the years 2007 and 2008, 32,318 patients were tested with the influenza virus antigen detection test. Among them, 8,480 (26.2% of those tested) patients were positive for the influenza virus antigen test. Most cases were influenza A (7,030 cases, 82.9%), with most of the remaining cases (1,458 cases, 17.2%) influenza B. Few patients tested positive for both influenza A and B (8 cases, 0.02%).

The numbers of positive cases of influenza A and B in each week during 2007 and 2008 are shown in Figure 1. An intensive influenza epidemic occurred during February and April in 2007 (Figure 1A). Most cases were influenza A. In the same year, influenza A cases were detected during the whole year, and an epidemic peak was also noted in July. In contrast, in 2008, an influenza epidemic was noted during January and March (Figure 1B). A small outbreak of influenza B occurred in April 2008. No outbreak of influenza was detected during the summer of 2008.

The difference in the pattern of summer epidemics might be due to different patterns of physician performance of the antigen test. To examine this possibility, an association between positive rates of the antigen test and positive numbers on the test was demonstrated (Figure 2). Positive rates of the tests were higher when the number of positive cases increased. This finding implied that physicians were willing to perform this antigen test even when no outbreak had occurred. The associations of the positive rates and positive numbers on the antigen test in 2007 and 2008 were similar, which suggests that physicians used the antigen test in the same manner during this 2-year period. Therefore, we believe that this method was reliable for epidemiological study of influenza prevalence.

We reviewed the weather conditions in the Naha area during the 2-year period and compared the influenza activity in the area (Figure 3). The mean ambient temperature for the month affected the incidence of influenza, while the mean relative humidity, rainfall, and sunlight were not associated with the incidence of influenza. In comparing the summer rainfall, the total rainfall between June and September in 2007 (1,735 mm) was almost three times that in 2008 (642 mm) (Table 1).

DISCUSSION

This epidemiological study collected the numbers of influenza virus antigen tests performed in the four main hospitals in the Naha area. The hospitals have emergency rooms, and many acutely ill patients visited these hospitals. Therefore, the present data can be representative of the epidemic patterns of influenza in this area. The positive results of the tests clearly demonstrated the epidemics in the city. Selection bias might have influenced the results, but the positive rates of the test were lower when the positive numbers of the
behavior patterns and the immune status of people are con-
when investigating the underlying causes of epidemics. Social
on mainland Japan and Okinawa is an important finding
influencing seasonality.
continuous monitoring is essential for identifying the factors
epidemics during the summer might vary every year, and that
summer in Okinawa. However, our study also suggested that
Our study supported the presence of epidemics during the
occurred in Taiwan (5), which neighbors the Okinawa Islands.
climate change. Influenza epidemics during summer have also
the change might be due to possible under-reporting and/or
influenza virus H1N1 with a swine origin has made it more
inhibitor oseltamivir. Furthermore, the emergence of the novel
influenza virus H1N1 and influenza A virus (H3N2) may behave in a different man-
and show different susceptibility to the neuraminidase
inhibitor oseltamivir. Furthermore, the emergence of the novel
influenza virus H1N1 with a swine origin has made it more
urgent to identify viruses using molecular techniques. Even
though, the antigen test may be trigger to identify outbreaks
of novel influenza A.
This study demonstrated that there was a small but defi-
nite peak of influenza A in the summer of 2007. A recent
report showed the changing pattern of seasonality in the
Okinawa Islands (4). Influenza epidemics during the sum-
mer were not previously recognized in the Okinawa Islands.
In the report on changing seasonality, the authors suggest that
the change might be due to possible under-reporting and/or
or climate change. Influenza epidemics during summer have also
occurred in Taiwan (5), which neighbors the Okinawa Islands.
Our study supported the presence of epidemics during the
summer in Okinawa. However, our study also suggested that
epidemics during the summer might vary every year, and that
continuous monitoring is essential for identifying the factors
influencing seasonality.
A distinct difference in the epidemic patterns of influenza
on mainland Japan and Okinawa is an important finding
when investigating the underlying causes of epidemics. Social
behavior patterns and the immune status of people are con-
sidered to be almost the same between mainland Japan and
Okinawa, and air travel enhances the frequent movement
between the mainland and Okinawa. Therefore, epidemics of
influenza may be influenced by weather conditions directly
and/or indirectly. We reviewed the weather conditions dur-
ing the 2-year period, and compared them to the influenza
activities, confirming that lower ambient temperature was
associated with a higher incidence of influenza in the Naha
area. However, the climate factors influencing summer epi-
demics are still unclear. There was an apparent outbreak in
the summer of 2007, but no outbreak in the summer of 2008.
Comparison of the weather conditions in 2007 and 2008 re-
vealed that total rainfall in 2007 was almost three times that
in 2008 (Table 1). The association of rainfall and influenza
was reported in Dakar, Senegal (6). Rainfall may be associ-
ated with summer epidemics in Okinawa, but this speculation
requires further studies.
In summary, this study was a 2-year surveillance of influ-
enza in a city located in the southernmost part of Japan, and
demonstrated an outbreak in the summer of 2007. This finding
warrants further study in this region, including the study of
the influences of climate and socio-behavior patterns of the
population on influenza epidemics.

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surveillance and molecular epidemiology of influenza virus in Taiwan.

Table 1. Influenza cases and weather condition at Naha City in summer 2007 and 2008

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<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
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<tbody>
<tr>
<td></td>
<td>Jun</td>
<td>Jul</td>
</tr>
<tr>
<td>No. of influenza cases</td>
<td>298</td>
<td>442</td>
</tr>
<tr>
<td>Average temperature (Celsius)</td>
<td>26.7</td>
<td>29.6</td>
</tr>
<tr>
<td>Average relative humidity (%)</td>
<td>81</td>
<td>77</td>
</tr>
<tr>
<td>Average osmotic pressure (hPa)</td>
<td>1,005.8</td>
<td>1,003.7</td>
</tr>
<tr>
<td>Total rainfall (mm)</td>
<td>472.0</td>
<td>229.0</td>
</tr>
<tr>
<td>Hours of sunlight (h)</td>
<td>137.1</td>
<td>262.0</td>
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