HKIOEH Round Table:

*Updates on Human Swine Influenza – Facts and Strategies on Disease Control & Prevention in Occupational Hygiene Perspectives*

9 July 2009

Ralph KY Lee
Honorary Secretary
HKIOEH
Influenza virus

A/H1N1 virus

Courtesy Inglis (1992)

Courtesy HPA (2009)
Influenza virus

- Orthomyxoviridae

- Spherical virions (80-120nm diameter)

- 2 major antigenic glycoproteins:
  - Haemagglutinin (HA) (H1-16)
  - Neuraminidase (NA) (N1-9)

- Antigenic Drift
  - Change of genetic material due to lack of proof-reading during replication
  - Responsible for annual epidemic

- Antigenic Shift
  - reassortment and merging of genetic materials from different influenza strains
  - novel viral subtype, most human lack immunity
  - Responsible for pandemics
Types of Influenza

- Ordinary / Seasonal Influenza
- Pandemic Influenza

- Occurrence
- Cause
- Severity
Common Human Influenza

- Influenza A (H3N2, H1N1)
- Influenza B
- Droplet transmission
- Typical Incubation Period (IP) 2-4 days with average of 2 days
- Symptoms: fever, headache, myalgia, running nose, cough, sore throat, usually subside in 2-7 days)
Swine-Origin Influenza A (H1N1)

- A respiratory disease of pigs regularly causes outbreaks of influenza among pigs
- Influenza virus was first isolated from pigs in 1930
- The H1N1 swine flu viruses are antigenically different from human H1N1 viruses and do not normally infect human
- First isolation of a swine influenza virus from a human occurred in 1974
Human Case of Swine Flu

- From 1958 – 2005
- 50 cases of apparent zoonotic swine influenza virus infection
  - 37 of which involved civilians and 13 of which involved military personnel
- Case-fatality rate of 14% (7 of 50 persons)
- 61% reported exposure to swine
- ~ 1/3 had probably or possible person-to-person transmission
- 33/37 (89%) H1N1; 4/37 (11%) H3N2

Human Case of Swine Flu

- From Dec 2005 to Feb 2009
- 11 cases reported in US
- Triple-reassortant swine influenza A (H1) viruses: Human, Avian, Swine
- Age: 16M to 48y
- 7 male 4 female
- Incubation period: 1-10d, Common 3-4d
- 8 had swine contact, 3 unknown

**Triple Reassortment**

(Garten R et al. Scienceexpress 22 May 2009)
# Clinical Features

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>H1N1 virus(^1,2) (n= 175 - 642)</th>
<th>Seasonal flu(^3) (n= 2470)</th>
<th>H5N1(^4,5) (n= 8 - 108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>92-94%</td>
<td>68%</td>
<td>93-100%</td>
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<tr>
<td>Cough</td>
<td>75-92%</td>
<td>93%</td>
<td>32-100%</td>
</tr>
<tr>
<td>Sputum</td>
<td>42%</td>
<td>NS</td>
<td>30-76%</td>
</tr>
<tr>
<td>Sore throat</td>
<td>66-79%</td>
<td>84%</td>
<td>25-71%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>25%</td>
<td>NS</td>
<td>7-70%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>25-33%</td>
<td>NS</td>
<td>7-33%</td>
</tr>
<tr>
<td>Nasal congestion</td>
<td>66%</td>
<td>91%</td>
<td>17-58%</td>
</tr>
<tr>
<td>Malaise</td>
<td>78%</td>
<td>94%</td>
<td>NS</td>
</tr>
<tr>
<td>Myalgia</td>
<td>62%</td>
<td>91%</td>
<td>1-53%</td>
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<tr>
<td>Headache</td>
<td>77%</td>
<td>94%</td>
<td>6-100%</td>
</tr>
<tr>
<td>Nausea</td>
<td>NS</td>
<td>NS</td>
<td>13%</td>
</tr>
<tr>
<td>Depressed consciousness</td>
<td>3%</td>
<td>NS</td>
<td>8-50%</td>
</tr>
<tr>
<td>SOB</td>
<td>24%</td>
<td>NS</td>
<td>9-100%</td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>15%</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS: Not stated  
Red: > 50%  

2. HPA. Euro Surveill 2009;14:1-3  
Mode of Transmission

- Most likely when in close proximity to infected pigs
  - Human-to-human transmission can occur through coughing or sneezing of people infected
  - By touching something with flu viruses on it and then touching mouth or nose
- Not transmitted by food
- Eating properly handled and cooked pork and pork products is safe
Infectivity and Transmissibility

- Incubation period appears to range from 1 to 7 days
  - Studies of viral shedding to define the infectious period are under way
- Secondary attack rate ~ 22 – 33% (c.f. 5 – 15% for seasonal flu)
- Reproductive ratio in the Mexico < 2.2 – 3.1 (c.f. 2 – 5 in 1918 pandemic, 1.3 for seasonal flu); may increase in successive wave(s) of spread
Global Situation
Global Situation

- WHO named the virus as **influenza A (H1N1) virus**
  - [N.B. the term human swine influenza (HSI) is used in HK to ease communication]
- WHO declared the **pandemic (i.e. phase 6)** on 11 June 2009.
- According to WHO (as of 09:00 GMT, 7 July 2009), 94512 **cases** of confirmed HSI were reported, including 429 **deaths**.
26 April 2009: 2 countries, reporting 38 cases

USA: 20 cases
Mexico: 18 cases

Total: 38 cases
27 April 2009: 4 countries, reporting 73 cases

- Canada: 6 cases
- USA: 40 cases
- Mexico: 26 cases, 7 deaths
- Spain: 1 case

Total: 73 cases, 7 deaths
28 April 2009, 19:15 GMT: 7 countries, reporting 105 cases

- USA: 64 cases
- Canada: 6 cases
- Mexico: 26 cases, 7 deaths
- UK: 2 cases
- Spain: 2 cases
- Israel: 2 cases
- New Zealand: 3 cases

Total: 105 cases, 7 deaths

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29 April 2009, 18:00 GMT: 9 countries, reporting 148 cases

- USA: 91 cases, 1 death
- Mexico: 26 cases, 7 deaths
- Canada: 13 cases
- UK: 5 cases
- Germany: 3 cases
- Austria: 1 case
- Israel: 2 cases
- New Zealand: 3 cases

Total: 148 cases, 8 deaths

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30 April 2009, 17:00 GMT: 11 countries, reporting 257 cases

- USA: 109 cases, 1 death
- Canada: 19 cases
- Mexico: 97 cases, 7 deaths
- Brazil: 1 case
- UK: 8 cases
- Austria: 1 case
- Switzerland: 1 case
- Norway: 1 case
- Germany: 3 cases
- New Zealand: 3 cases

Total: 257 cases, 8 deaths

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01 May 2009, 23:30 GMT: 13 countries, reporting 367 cases

Total: 367 cases
10 deaths

Canada: 34 cases
USA: 141 cases, 1 death
Mexico: 156 cases, 9 deaths
UK: 8 cases
Spain: 13 cases
Netherlands: 1 case
Germany: 4 cases
Denmark: 1 case
Austria: 1 case
Switzerland: 1 case
Israel: 2 cases
China, Hong Kong SAR: 1 case
New Zealand: 4 cases
02 May 2009, 18:00 GMT: 16 countries, reporting 658 cases

Total: 658 cases 17 deaths
03 May 2009, 16:00 GMT: 18 countries, reporting 898 cases
04 May 2009, 18:00 GMT: 21 countries, reporting 1085 cases

Total: 1085 cases, 26 deaths
06 May 2009, 16:00 GMT: 23 countries, reporting 1893 cases
07 May 2009, 18:00 GMT: 24 countries, reporting 2371 cases

Total: 2371 cases, 44 deaths
Timeline of influenza A(H1N1) cases
Laboratory confirmed cases and deaths
As reported to WHO

08 May 2009, 16:00 GMT: 25 countries, reporting 2500 cases

Total: 2500 cases
46 deaths

Canada: 214 cases
USA: 896 cases, 2 deaths
Mexico: 1204 cases, 44 deaths
Guatemala: 1 case
El Salvador: 2 cases
Costa Rica: 1 case
Colombia: 1 case
Brazil: 4 cases

UK: 34 cases
Ireland: 1 case
Netherlands: 3 cases
Sweden: 1 case
Denmark: 1 case
Germany: 11 cases
Poland: 1 case
Portugal: 12 cases
Austria: 1 case
South Korea: 3 cases
China, Hong Kong SAR: 1 case
Israel: 7 cases
Italy: 6 cases
New Zealand: 5 cases

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09 May 2009, 06:00 GMT: 29 countries, reporting 3440 cases
11 May 2009, 06:00 GMT: 30 countries, reporting 4694 cases

- **Canada**: 284 cases, 1 death
- **USA**: 2532 cases, 3 deaths
- **Mexico**: 1626 cases, 48 deaths
- **Guatemala**: 1 case
- **El Salvador**: 4 cases
- **Costa Rica**: 8 cases, 1 death
- **Panama**: 1 case
- **Total**: 4694 cases, 53 deaths
- **Argentina**: 3 cases
- **Brazil**: 8 cases
- **Switzerland**: 1 case
- **Spain**: 95 cases
- **France**: 13 cases
- **Ireland**: 1 case
- **UK**: 3 cases
- **Netherlands**: 2 cases
- **Sweden**: 2 cases
- **Denmark**: 1 case
- **Norway**: 2 cases
- **China**: 2 cases
- **Japan**: 4 cases
- **Republic of Korea**: 3 cases
- **Australia**: 1 case
- **New Zealand**: 7 cases
- **Germany**: 11 cases
- **Poland**: 1 case
- **Austria**: 1 case
- **Italy**: 9 cases
13 May 2009, 06:00 GMT: 33 countries, reporting 5728 cases
15 May 2009, 06:00 GMT: 34 countries, reporting 7520 cases

Total: 7520 cases, 65 deaths
20 May 2009, 06:00 GMT: 41 countries, reporting 10 243 cases
22 May 2009, 06:00 GMT: 42 countries, reporting 11,168 cases

Total: 11,168 cases, 86 deaths
25 May 2009, 06:00 GMT: 46 countries, reporting 12,515 cases

Chinese Taipei has reported 1 confirmed case of influenza A (H1N1) with 0 deaths. Cases from Chinese Taipei are included in the cumulative total provided.
27 May 2009, 06:00 GMT: 48 countries, reporting 13,398 cases

Timeline of influenza A(H1N1) cases
Laboratory confirmed cases and deaths
As reported to WHO

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New Influenza A (H1N1),
Number of laboratory confirmed cases as reported to WHO

Status as of 15 June 2009
06:00 GMT

Total: 35928
Death: 163
76 Countries

Case fatality rate: 0.45%

<table>
<thead>
<tr>
<th>Name of Influenza events</th>
<th>Date</th>
<th>Deaths</th>
<th>Case fatality rate</th>
<th>Subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asiatic (Russian) Flu</td>
<td>1889-1890</td>
<td>1 million</td>
<td>?</td>
<td>Possible H2N2</td>
</tr>
<tr>
<td>1918 Spanish flu</td>
<td>1918-1920</td>
<td>20-40 million</td>
<td>&gt; 2.5%</td>
<td>H1N1</td>
</tr>
<tr>
<td>Asian flu</td>
<td>1957-1958</td>
<td>1-1.5 million</td>
<td>0.1-0.5%</td>
<td>H2N2</td>
</tr>
<tr>
<td>Hong Kong flu</td>
<td>1968-1969</td>
<td>0.75-1 million</td>
<td>0.1-0.5%</td>
<td>H3N2</td>
</tr>
<tr>
<td>Avian flu</td>
<td>1997-2009</td>
<td>262</td>
<td>60.5%</td>
<td>H5N1</td>
</tr>
</tbody>
</table>
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Map produced: 06 July 2009 09:00 GMT
Daily Update of Local Situation
As of 2:30 pm, 8 July 2009
Situation in Hong Kong

- The Emergency Response Level under the Government's Preparedness Plan for Influenza Pandemic is activated.
- There have been 1055 confirmed cases of human swine influenza (Influenza A/H1N1) since the first case was diagnosed on 1 May 2009.
The cumulative number of patients tested positive for swine influenza is 1055

On 7 July 2009, 41 patients tested positive for swine influenza.

As at 2:30 pm 8 July 2009, a total of 584 cases have been discharged and 7 cases are still in hospital

None required intensive care and there were no fatal cases.
Human Swine Influenza A/H1N1 in Hong Kong

本港人類豬型流感個案

Daily Number of Confirmed Cases
(每日確診個案數字)

No. of cases 個案數

Date 日期

1st local case

(CHP, 2009)
Number of discharged cases and cases remaining in hospital
出院及住院数字

Daily Number of discharged cases
(每日出院数字)

Number of cases remaining in hospital
(住院数字)

No. of cases

Date 日期

(CHP, 2009)
What is Pandemic?
Endemic
- stable pattern of occurrence of the disease.

Epidemic
- occurrence of the disease greatly in excess of the expected rate.

Pandemic
- worldwide spread of a disease, outbreaks or epidemics occurring in many countries & in most regions of the world
### Previous Influenza Pandemics

<table>
<thead>
<tr>
<th>Year</th>
<th>Subtype</th>
<th>Source</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>H1N1 Spanish Flu</td>
<td>Swine &amp; Birds</td>
<td>40–50 million death</td>
</tr>
<tr>
<td>1957</td>
<td>H2N2 Asian Flu</td>
<td>Human &amp; Birds</td>
<td>&gt;2 million excess mortality</td>
</tr>
<tr>
<td>1968</td>
<td>H3N2 Hong Kong Flu</td>
<td>Human &amp; Birds</td>
<td>1 million excess mortality</td>
</tr>
</tbody>
</table>
Prerequisites for the start of flu pandemic

1. Emergence of new Haemagglutinin subtype of influenza A virus
2. General population have no or little immunity
3. Cause human disease in a high proportion of people infected
4. Efficient human to human transmission
Local Response Plan
Hong Kong Government Response Systems

- The Government’s plan includes a three-level response system:
  - Alert Response Level
  - Serious Response Level
  - Emergency Response Level

- Basing on different risk-graded epidemiological scenarios relevant to Hong Kong

- Designed to match with the World Health Organization (WHO)’s guideline for pandemic influenza planning.
Alert Response Level

- Alert Response Level depicts the scenarios of confirmation of highly pathogenic avian influenza (HPAI) outbreaks in poultry populations outside Hong Kong; confirmation of HPAI in Hong Kong in imported birds in quarantine, in wild birds, in recreational parks, in pet bird shops or in the natural environment.

- Upon the advice of the Director of Agriculture, Fisheries and Conservation (DAFC), the Secretary for Food and Health (SFH) will activate this Response Level.
Another scenario depicts confirmation of human case(s) of avian influenza outside Hong Kong.

SFH will activate this Response Level upon the advice of Director of Health (DoH).
Serious Response Level

Serious Response Level depicts two possible scenarios:

- The first scenario depicts confirmation of HPAI outbreaks in the environment of or among poultry population in retail markets, wholesale markets or farms in Hong Kong due to a strain with known human health impact. Upon the advice of DAFC or Director of Food and Environmental Hygiene, SFH will activate this Response Level.
The second scenario depicts the confirmation of human case(s) of avian influenza in Hong Kong without evidence of efficient human-to-human transmission. Upon the advice of DoH, SFH will activate this Response Level.
Emergency Response Level

Emergency Response Level depicts two possible scenarios:

In the first scenario:

- There is evidence confirming efficient human-to-human transmission of novel influenza occurring overseas or in Hong Kong.

- Efficient human-to-human transmission is defined as the ability of the virus to readily spread from person to person in the general population and cause multiple outbreaks of disease leading to epidemics.
• Clear evidence of human-to-human spread in the general population may be inferred when secondary cases result from contact with an index case, with at least one outbreak lasting over a minimum 2-week period in one country.
The second scenario under Emergency Response Level is **pandemic influenza**.

- The declaration of pandemic comes from WHO means the influenza strain is beginning to cause several outbreaks in at least one country, and spread to other countries, with consistent disease patterns indicating serious morbidity and mortality is likely in at least one segment of the population.
Risk Assessment…

● Increasing number of cases in many countries

● Based on the situation in Hong Kong
  □ The virus has been widely circulating in Hong Kong and has become the dominant strain of influenza virus
    • Relatively mild disease
    • No report of severe / fatal case so far
  □ No evidence for large-scale environmental transmission

● Rate of evolution of human swine influenza virus no faster than other influenza virus
The virus is sensitive to both oseltamivir and zanamivir

Globally, most cases have been mild

Vast majority of cases in all countries have occurred among adolescents and young adults

Secondary household attack rates of new influenza A (H1N1) range from 22% to 33% (The rates of secondary attack of seasonal influenza range from 5% to 15%)
Monthly consultation rates of influenza-like illness reported by General Out-patient Clinics (GOPC) and General Practitioners (GP) 2008

<table>
<thead>
<tr>
<th>Month</th>
<th>Rate (per 1000 consultations)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GOPC</td>
</tr>
<tr>
<td>Jan</td>
<td>3.8</td>
</tr>
<tr>
<td>Feb</td>
<td>6.9</td>
</tr>
<tr>
<td>Mar</td>
<td>8.6</td>
</tr>
<tr>
<td>Apr</td>
<td>3.7</td>
</tr>
<tr>
<td>May</td>
<td>3.0</td>
</tr>
<tr>
<td>Jun</td>
<td>3.3</td>
</tr>
<tr>
<td>Jul</td>
<td>4.8</td>
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<tr>
<td>Aug</td>
<td>3.7</td>
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<tr>
<td>Sep</td>
<td>3.4</td>
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<tr>
<td>Oct</td>
<td>3.4</td>
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<tr>
<td>Nov</td>
<td>3.8</td>
</tr>
<tr>
<td>Dec</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Data Courtesy: CHP
**Monthly consultation rates of influenza-like illness reported by General Out-patient Clinics (GOPC) and General Practitioners (GP) 2009**

<table>
<thead>
<tr>
<th>Month</th>
<th>GOPC</th>
<th>GP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>4.7</td>
<td>34.3</td>
</tr>
<tr>
<td>Feb</td>
<td>5.8</td>
<td>49.8</td>
</tr>
<tr>
<td>Mar</td>
<td>3.8</td>
<td>37.3</td>
</tr>
<tr>
<td>Apr</td>
<td>2.8</td>
<td>37.4</td>
</tr>
<tr>
<td>May</td>
<td>3.4</td>
<td>40.0</td>
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<tr>
<td>Jun</td>
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<td>Dec</td>
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</tbody>
</table>

Data Courtesy: CHP
## Monthly summary tables of influenza virus isolation 2009

<table>
<thead>
<tr>
<th>Month</th>
<th>No. of specimens</th>
<th>No. of Isolates</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>H3N2</td>
<td>H1N1</td>
<td>H5N1</td>
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<tr>
<td>Jan</td>
<td>3643</td>
<td>101</td>
<td>444</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Feb</td>
<td>4108</td>
<td>162</td>
<td>883</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mar</td>
<td>3695</td>
<td>92</td>
<td>228</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apr</td>
<td>3388</td>
<td>45</td>
<td>45</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>14834</td>
<td>400</td>
<td>1600</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Data Courtesy: CHP
However...WHO cautions

- New diseases (especially when the causative agent is an influenza virus) are often poorly understood when they emerge.
- The same virus that causes mild illness in one country can result in much higher morbidity and mortality in another.
- The inherent virulence of the virus can change over time as the pandemic goes through subsequent waves of national and international spread.

*Continuous assessment with more understanding of the disease required*
Strategies of Local Government
Public Health Strategies

- Community spread of human swine influenza and the virus has been widely circulating locally.
- Moving from the containment phase into the mitigation phase of our strategy.
- Aim at relieving disease burden through hygiene measures, social distancing, medical resource mobilization, self-care and other measures.
- Continue to refine the strategy and measures based on latest knowledge and risk assessment to make it sustainable.
Implementation of mitigation measures depends on Epidemic progression

- Disease severity (indicated by proportion of those infected with complications, requiring hospitalization and case fatality)
- Burden to medical services, resource capacity
- Effectiveness of containment
- Broader considerations in the community
Mitigation measures employed at present

- Activation of 8 Designated Flu Clinics for managing patients with fever and influenza-like illnesses (ILI)
  - Priority would be given to pregnant women, those aged two or below, and high risk groups
  - Tamiflu would only be given to ILI patients with chronic diseases or in immuno-compromised states

- New hospital admission criteria
  - Based on clinical conditions of patients
  - Confirmed patients with mild symptoms would not be required for admission and would be provided with symptomatic treatment
Focus epidemiological investigations on severely ill patients as well as outbreaks involving schools and institutions

Contact tracing for individual cases no longer necessary

Port health measures

Temperature screening, health declarations and broadcast of health messages at the control points would remain unchanged

Starting June 29, travelers with mild symptoms and intercepted at all boundary control points would be provided with face mask and guidance notes for seeking medical consultation
Class suspension / early summer breaks for:
- All primary schools, kindergartens, child-care centres and special schools
- Secondary schools with confirmed case(s)

Active promotion and adoption of basic measures on personal and environmental hygiene.

To further step up the cleansing and environmental hygiene efforts of the community.
Vaccine Strategies

When available, provision of human swine influenza vaccines for:
- healthcare workers in both the public and private sectors
- Children aged > 6 months and below 6 years old
- Elderly persons aged > 65; and
- Persons at higher risk of death and complications from human swine influenza due to pre-existing medical conditions
  - Give elderly aged > 65 pneumococcal and seasonal influenza vaccines for free
What’s our role as occupational health and hygiene practitioners?
To be continued…

Stay tuned!