Epidemiology and Characteristics of Influenza A H7N9 Infections

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Objectives

- Background on H7 influenza infections
- Epidemiologic findings
- Comparison of H7N9 and H5N1
- Live poultry markets and human illness
Human Infections with H7 subtype Influenza A Viruses

- H7 virus infection in humans is uncommon, but has been documented in persons who have direct contact with infected birds, especially during outbreaks of H7 virus among poultry.
- Reported human H7 infections have been generally mild, causing conjunctivitis and influenza-like illness.

Table. Cases of human subtype H7 influenza A virus infection since 1996

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Subtype</th>
<th>IVPI</th>
<th>No. human infections</th>
<th>Symptoms</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK (England)</td>
<td>1996</td>
<td>H7N7</td>
<td>LPAI</td>
<td>1</td>
<td>Conjunctivitis</td>
<td>(8,9)</td>
</tr>
<tr>
<td>USA (Virginia)</td>
<td>2002</td>
<td>H7N2</td>
<td>LPAI</td>
<td>1†</td>
<td>Respiratory</td>
<td>(10)</td>
</tr>
<tr>
<td>USA (New York)</td>
<td>2003</td>
<td>H7N2</td>
<td>LPAI</td>
<td>1</td>
<td>Respiratory</td>
<td>(11)</td>
</tr>
<tr>
<td>Italy</td>
<td>2002–03</td>
<td>H7N3</td>
<td>LPAI</td>
<td>7†</td>
<td>Conjunctivitis, respiratory</td>
<td>(12)</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>2003</td>
<td>H7N7</td>
<td>HPAI</td>
<td>89</td>
<td>Conjunctivitis, respiratory</td>
<td>(6,13)</td>
</tr>
<tr>
<td>Canada (British Columbia)</td>
<td>2004</td>
<td>H7N3</td>
<td>LPAI/HPAI</td>
<td>2</td>
<td>Conjunctivitis, respiratory</td>
<td>(14,15)</td>
</tr>
<tr>
<td>UK (Norfolk)</td>
<td>2006</td>
<td>H7N3</td>
<td>LPAI</td>
<td>1</td>
<td>Conjunctivitis</td>
<td>(16)</td>
</tr>
<tr>
<td>UK (Wales)</td>
<td>2007</td>
<td>H7N2</td>
<td>LPAI</td>
<td>4</td>
<td>Conjunctivitis, respiratory</td>
<td>(17)</td>
</tr>
</tbody>
</table>

*IVPI, intravenous pathogenicity index (1); LPAI, low pathogenicity avian influenza; HPAI, highly pathogenic avian influenza.
†Serologic evidence only.

Human Infections with H7 subtype Influenza A Viruses

- Netherlands – H7N7
  - In early 2003, an outbreak of HPAI H7N7 fowl plague occurred in the Netherlands\(^1\)
  - Detection of H7N7 in 86 humans with poultry exposure and in three of their family members
    - Most (91%) had conjunctivitis
    - One death in 57 yo veterinarian
  - >30 million birds either died or were culled

- Mexico – H7N3
  - In mid 2012, outbreaks with HPAI H7N3 reported in Mexico\(^2\)
  - Two human H7N3 cases were reported of conjunctivitis without fever or respiratory symptoms in persons exposed to poultry
  - 3.8M birds either died or were culled

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2. CDC. MMWR 2012 Sep 14;61(36):726-7
4. Tam, Getty Images
Initial Influenza A(H7N9) Cases in China

- On 31 March 2013, the China Health and Family Planning Commission notified WHO of three cases of human infection with influenza A(H7N9)\(^1,2\)

- Cases were from:
  - Shanghai Municipality: 87yo M, 27yo M
  - Anhui Province 35yo F

- All three cases presented with respiratory tract infection with progression to severe pneumonia and breathing difficulties

- Two deaths, one in critical condition – subsequently died

- No poultry die-offs

1. MMWR / May 10, 2013 / Vol. 62 / No. 18
Initial Influenza A(H7N9) Cases in China

- In this region, around 575 million people
  - 45% of China
  - 8% of World\(^1\)
- In the 50 km around the 60 early cases of H7N9, there were an estimated\(^2\):
  - 131M people
  - 241M domestic chickens
  - 47M domestic ducks
  - 22M pigs

2. Butler D. Mapping the H7N9 avian flu outbreaks. www.nature.com
1) Factors Leading to Emergence: Increasingly Crowded
2) Factors Leading to Emergence: Increasingly Connected

- One can travel to almost any major urban center in the world within the incubation period of most infectious diseases\(^1\)
- In 2011, 2.75B airline passengers globally

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3. Michael Markieta/ Arup
Passenger Volumes from Shanghai, Hangzhou, Nanjing, and Wuxi (April - June)
With Direct Flights from Shanghai and Poultry Density
3) Factors Leading to Emergence: Increasingly Converging Poultry Consumption and Population – Hong Kong, Shanghai, and China

Figure 4: Comparison of poultry meat consumption between mainland China and Hong Kong and human population between Shanghai and Hong Kong. (A) Poultry meat consumption in Hong Kong peaked just before 1997 but markedly decreased after the H5N1 outbreak. Poultry meat consumption in China is catching up. (B) Similar human population growth rates in Shanghai and Hong Kong. Data of poultry consumption for China are not available before 1987. Data from references 75, 93, and 96.
Domestic Air Travel within China from Shanghai, Hangzhou, Nanjing, and Wuxi (April - June)
With Poultry Density

Data Source: FAO 2007, IATA 2010
Avian Influenza A (H7N9) Update – China March 17, 2014

Epidemic Curve for Confirmed Cases of Avian Influenza A(H7N9), 18 Feb 2013 – 17 Mar 2014 (N=392)*

* Onset date unknown for 6 cases
H7N9 in a Post-SARS, Post-H1N1 World

- Long History of CDC Collaboration with China and Beijing
  - Sustainability CoAgs
  - Laboratory Training/Exchange
  - National Influenza Center support
  - WHO Collaborating Center Initiated

- Global Response
  - WHO GISRS – virus sharing
  - HHS funds through CDC CoAgs provide rapid resources China’s neighbors
  - H7N9 kits developed and manufactured by CDC, FDA-cleared, distributed globally
  - Vaccine candidates synthesized, trials initiated

www.influenzareagentresource.com
Surveillance Sources: Chinese National Influenza-Like Illness Surveillance Network (CNISN)

- CNISN: >900 sentinel facilities, submit swabs
- Mar – Apr 2013
- ~60K swabs from all provinces from ILI patients and hospital labs
- 6 positive for PCR in affected provinces
Severe Acute Respiratory Infection (SARI) Surveillance and Pneumonia of Unknown Etiology (PUE) Surveillance

- **Severe Acute Respiratory Infection (SARI) Surveillance**
  - 10 sites in major locations
  - Only one site with cases identified

- **Pneumonia of Unknown Etiology Surveillance**
  - A testing and reporting system established following SARS/H5
  - Routinely used for accessing testing for novel influenza and other rare respiratory pathogens, only following rigorous review
  - March 2013, lowered requirements for improving access to testing following emergence of H7N9
  - Most common means by which H7N9 cases identified

Avian Influenza A (H7N9) Update – China March 17, 2014

Epidemic Curve for Confirmed Cases of Avian Influenza A(H7N9), 18 Feb 2013 – 17 Mar 2014 (N=392)*

- Onset date unknown for 6 cases

67yo F from Guangdong, traveled to Sabah, Malaysia
Geographic Distribution of Cases of Influenza A(H7N9) in China for Spring and Fall Waves
As of March 13, 2014

H7N9 Spring Cases (n=135)
- Shanghai (n=33)
- Zhejiang (n=46)
- Jiangsu (n=28)
- Hunan (n=2)
- Hebei (n=1)
- Guangdong (n=1)
- Fujian (n=5)
- Anhui (n=4)
- Beijing (n=2)

H7N9 Fall Cases (n=253)
- Guangdong (n=86)
- Zhejiang (n=92)
- Shanghai (n=8)
- Shandong (n=1)
- Jiangsu (n=15)
- Hunan (n=15)
- Guangxi (n=3)
- Fujian (n=16)
- Hong Kong (n=6)
- Jilin (n=1)
- Taiwan (n=1)
- Anhui (n=6)
- Guizhou (n=1)
Number of Cases of Influenza A(H7N9) in Chinese Provinces North to South and Spring to Fall

Cases Spring

Cases Fall

100
50
Number of Cases of Influenza A(H7N9) in Chinese Provinces North to South and Spring to Fall

Cases Spring: Jilin, Hebei, Beijing, Shandong, Henan, Jiangsu, Anhui, Shanghai, Zhejiang, Jiangxi, Hunan, Fujian, Taiwan, Guizhou, Guangxi, Guangdong, Hong Kong

Cases Fall: Zhejiang, Jiangxi, Hunan, Fujian, Taiwan, Guizhou, Guangxi, Guangdong, Hong Kong
High Risk Areas for H7N9 Emergence in Asia

- Identifying areas with a high risk of human infection with the avian influenza A(H7N9) virus in East Asia
- Geospatial mapping with surveillance data used to develop risk maps
- Northern Vietnam has high risk of virus spread
Age of Patients with Influenza A(H7N9) in China, Categorized by Spring and Fall Occurrence

- 0-17 years: Spring 0% / Fall 40%
- 18-34 years: Spring 30% / Fall 0%
- 35-59 years: Spring 0% / Fall 40%
- 60-74 years: Spring 30% / Fall 0%
- >=75 years: Spring 30% / Fall 0%

Legend: Spring % in blue, Fall % in orange.
## Avian Influenza A (H7N9) Update
### March 17, 2014

<table>
<thead>
<tr>
<th>Cumulative counts by Report Date</th>
<th>30 Mar–30 Sept, 2013</th>
<th>1 Oct 2013 – present</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td><strong>Countries affected</strong></td>
<td>China</td>
<td>China, Malaysia</td>
<td>China, Malaysia</td>
</tr>
<tr>
<td>Number of confirmed cases*</td>
<td>135</td>
<td>257</td>
<td>392</td>
</tr>
<tr>
<td>Number of confirmed cases hospitalized</td>
<td>131</td>
<td>256</td>
<td>387 (98%)</td>
</tr>
<tr>
<td>Number of fatal confirmed cases</td>
<td>45</td>
<td>80</td>
<td>125 (32%)</td>
</tr>
<tr>
<td>Cases of confirmed human to human transmission**</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of confirmed clusters††</td>
<td>5</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Number of asymptomatic infections</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

* Confirmed cases include persons with laboratory confirmation of H7N9 infection through report from China CDC or Provincial CDC

** Represents transmission from between confirmed cases

†† Confirmed clusters are two or more confirmed cases of H7N9 that are close contacts of one another.

‡‡ Includes the asymptomatic infection who was discharged from quarantine
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<tr>
<td>Number of asymptomatic infections</td>
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<td>0</td>
<td>1</td>
</tr>
</tbody>
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Prior human illness due to H7 has been mild (conjunctivitis), and only one death

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*Confirmed cases include persons with laboratory confirmation of H7N9 infection through report from China CDC or Provincial CDC

**Represents transmission from between confirmed cases

††Confirmed clusters are two or more confirmed cases of H7N9 that are close contacts of one another.

Includes the asymptomatic infection who was discharged from quarantine

Special administrative region of the People’s Republic of China
### Demographic Characteristics of H7N9 Cases

<table>
<thead>
<tr>
<th></th>
<th>Spring cases (n=135)</th>
<th>Fall cases (n=152)</th>
<th>Overall (n=287)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (N, %)</td>
<td>94 (69.6)*</td>
<td>161 (67.4)</td>
<td>255 (68.2)†</td>
</tr>
<tr>
<td>Days from Onset to Hospitalization (median, IQR)</td>
<td>5 (3-7)§</td>
<td>4 (3-6)¥</td>
<td>5 (3-7)«</td>
</tr>
<tr>
<td>Days from Onset to Report (median, IQR)</td>
<td>8 (6-11)**</td>
<td>8 (7-11)††</td>
<td>8 (7-11)§§</td>
</tr>
<tr>
<td>Poultry Exposure (N, %)¹</td>
<td>59 (77) ¥¥,²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Type of residence — no. (%)**
  - Urban 101 (73)
  - Rural 38 (27)

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1 Overall poultry exposure is not included here as exposure data is not available for most cases reported between 30 Mar-30 Sept 2013.

Four family clusters described in depth
- All involved significant and prolonged exposures caring for ill relatives or close family setting
Contact Evaluations

- For 139 cases, 2,675 contacts were followed
- Among 1,953 contacts with demographic information:
  - 53% healthcare workers
  - 26% family members or relatives
  - 20% social contacts
- All 2,675 were followed for 7 days
  - 28 developed respiratory symptoms
  - All were PCR negative for H7N9

Transmission Dynamics

- Incubation Period:
  - H7N9: 3.3 days (1.4-5.7)\(^1\)
  - H3N2v: 2.91 days (2.7–3.1 days)\(^5\)
  - Seasonal Flu: 2 days (1-4)\(^4\)

- \(R_0\):
  - H7N9: 0.1 (95%CI 0.01 – 0.49)\(^2\)
  - H3N2v: 0.2 (95%CI 0.1–0.4)\(^3\)
  - Novel Flu: 0.34 (IQR: 0.05–0.98)\(^4\)
  - Seasonal Flu: 1.28 (IQR: 1.19–1.37)\(^4\)

- Time to first 100 cases
  - H5N1 < H7N9 < H3N2v

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Epi-curve of Avian Influenza A (H5N1) Virus Cases by Onset of Illness for 2003-2012

- Azerbaijan (n=8)
- Nigeria (n=1)
- Cambodia (n=21)
- China (n=43)
- Djibouti (n=1)
- Egypt (n=169)
- Indonesia (n=192)
- Iraq (n=4)
- Thailand (n=25)
- Turkey (n=12)
- Vietnam (n=123)

100 cases reached in 18 months
Epi-curve of Avian Influenza A(H7N9) Virus Cases
February—May 2013

100 cases reached in 2 months
Epi-curve for Influenza A (H3N2) Variant Virus Cases, July—September, 2012 (N=306)

These slides contain unpublished data, please DO NOT distribute or reproduce.
## Underlying Conditions of Confirmed H7N9 Cases in China (N=111)

<table>
<thead>
<tr>
<th>Coexisting condition</th>
<th>no. (%)</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>68 (61.3)</td>
<td>[1]</td>
</tr>
<tr>
<td>Hypertension</td>
<td>51 (45.9)</td>
<td>[1]</td>
</tr>
<tr>
<td>Diabetes</td>
<td>18 (16.2)</td>
<td>[1]</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>11 (9.9 )</td>
<td>[1]</td>
</tr>
<tr>
<td>Immunosuppression*</td>
<td>10 (9.0 )</td>
<td>[1]</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>8 (7.2)</td>
<td>[1]</td>
</tr>
<tr>
<td>Cancer†</td>
<td>4 (3.6)</td>
<td>[1]</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>4 (3.6)</td>
<td>[1]</td>
</tr>
<tr>
<td>Hepatitis B infection‡</td>
<td>2 (1.8)</td>
<td>[1]</td>
</tr>
<tr>
<td>Chronic renal disease</td>
<td>2 (1.8)</td>
<td>[1]</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>27 (24.3)</td>
<td>[1]</td>
</tr>
<tr>
<td>Current Smoker</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Immunosuppression may have been caused by the presence of human immunodeficiency virus infection, chemotherapy or radiotherapy within 1 month before the onset of illness, or glucocorticoid therapy (equivalent of 30 mg of prednisone per day) for 15 days before the onset of illness.

† Cancers included breast cancer, colorectal cancer, thyroid cancer, thymoma, and lymphoma. Of these cancers, only one case of lymphoma was active, whereas the other cases were stable disease.

‡ Hepatitis B infection was defined as a positive assay for hepatitis B surface antigen, with or without an elevated level of alanine aminotransferase.

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## Clinical Complications of Confirmed Cases – China

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>108 (97.3)</td>
</tr>
<tr>
<td>ARDS</td>
<td>79 (71.2)</td>
</tr>
<tr>
<td>ICU Admit</td>
<td>85 (76.6)</td>
</tr>
<tr>
<td>Mechanical Ventilation</td>
<td></td>
</tr>
<tr>
<td>Noninvasive</td>
<td>31 (27.9)</td>
</tr>
<tr>
<td>Invasive</td>
<td>65 (58.6)</td>
</tr>
</tbody>
</table>

Gao, Lu, Cao, et al. Clinical findings in 111 cases of influenza A (H7N9) virus infection. NEJM June 13, 2013
## Comparison of Symptoms at Illness Onset for H7N9 and H5N1 Cases

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Influenza A H7N9 (n=85)</th>
<th>Influenza A H5N1 (n=37)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever $\geq 38^\circ C$</td>
<td>67 (79%)</td>
<td>24 (65%)</td>
</tr>
<tr>
<td>Cough</td>
<td>60 (71%)</td>
<td>20 (54%)</td>
</tr>
<tr>
<td>Sputum</td>
<td>28 (33%)</td>
<td>12 (32%)</td>
</tr>
<tr>
<td>Chills</td>
<td>17 (20%)</td>
<td>13 (35%)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>18 (21%)</td>
<td>9 (24%)</td>
</tr>
<tr>
<td>Arthralgia</td>
<td>15 (18%)</td>
<td>12 (37%)</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>11 (13%)</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Sore throat</td>
<td>8 (9%)</td>
<td>2 (5%)</td>
</tr>
<tr>
<td>Coryza</td>
<td>3 (4%)</td>
<td>5 (14%)</td>
</tr>
<tr>
<td>Nasal congestion</td>
<td>3 (4%)</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Headache</td>
<td>3 (4%)</td>
<td>7 (19%)</td>
</tr>
<tr>
<td>Chest pain</td>
<td>2 (2%)</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

Data are n (%).
Comparison of Days of Hospitalization for H7N9, H5N1, and pH1N1 Cases

Figure 2. Distribution of the number of days of hospitalization for patients with H7N9, H5N1, and pH1N1.

Age Distribution of H5N1 Compared to Avian Influenza A(H7N9) cases in China

Median (IQR):
H5N1: 26 years (19-25)
H7N9: 61 years (48-73)
Is H7N9 New, or Just Newly Recognized?

- One seroepidemiologic study found 13.9% of poultry workers and 0.8% of general population in Zhejiang province had HI titers >40
- Another serosurvey of 1544 poultry workers did not find any evidence for human infection with the novel avian-origin influenza A (H7N9) virus in poultry workers before November 2012 in eastern China
- Phylogenetic studies suggest little to no dissemination of H7N9 by waterfowl, and “Influenza A(H7N9) virus probably emerged after a long silent circulation in live poultry markets in eastern Asia”

1. Yang JID 2013
Evaluation of Pre-Existing Immunity in US

- Studies using the HAI and MN assays and serum from individuals vaccinated with the 2012-13 seasonal trivalent inactivated influenza vaccine show no existing cross-reactive antibodies to H7N9 either before or after vaccination in young children, adult and older adults.

- Preliminary results of NHANES sera collected from the general US population in 2010 suggest there are very little to no pre-existing cross-reactive antibodies against H7N9 in all age groups tested (6-80+ yrs)
Shanghai Live Bird Markets and Human Illness
## Animal Exposure among Cases of H7N9

<table>
<thead>
<tr>
<th>History of exposure to animals — no./total no. (%)</th>
<th>107/131 (82)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickens</td>
<td>88/107 (82)</td>
</tr>
<tr>
<td>Ducks</td>
<td>24/107 (22)</td>
</tr>
<tr>
<td>Pigeons</td>
<td>13/107 (12)</td>
</tr>
<tr>
<td>Quail</td>
<td>2/107 (2)</td>
</tr>
<tr>
<td>Geese</td>
<td>2/107 (2)</td>
</tr>
<tr>
<td>Pet birds</td>
<td>3/107 (3)</td>
</tr>
<tr>
<td>Wild birds</td>
<td>7/107 (7)</td>
</tr>
<tr>
<td>Swine</td>
<td>6/107 (6)</td>
</tr>
<tr>
<td>Cats</td>
<td>2/107 (2)</td>
</tr>
<tr>
<td>Dogs</td>
<td>3/107 (3)</td>
</tr>
</tbody>
</table>

| Type of exposure to animals — no./total no. (%)    | 63/107 (59)  |
| Direct contact with poultry                        | 63/107 (59)  |
| Direct contact with swine                          | 4/107 (4)    |
| Visit to live poultry market                       | 70/107 (65)  |

Burden of H7N9 on Humans and Poultry Industry

- Qi et al\(^1\)
  - The total direct medical cost was $2.6M.
  - The mean cost for each patient was $1,619 for mild patients, $22,292 for severe cases without death and $32,956 for severe cases with death.
  - The total cost of DALYs was $2.8M.
  - The poultry industry losses amounted to $1.24B in 10 affected provinces and $0.59 billion in eight non-affected adjacent provinces.

- Wu et al\(^2\)
  - Economic loss associated with LPM closures about $8B

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Epi-Curve of Avian Influenza A (H7N9) Virus Cases by Onset of Illness Date and Province, Municipality, or Area, 18 Feb – 13 Jun 2013 (N=132)

Number of Cases

- Hunan (n=2)
- Fujian (n=5)
- Jiangxi (n=6)
- Taiwan (n=1)
- Shandong (n=2)
- Henan (n=4)
- Beijing (n=2)
- ZheJiang (n=46)
- Jiangsu (n=27)
- Anhui (n=4)
- Shanghai (n=33)

Shanghai LBMs closed
Nanjing, (Jiangsu province) LBMs closed
Qidao (Shandong province) LBMs closed
Hangzhou (ZheJiang province) LBMs closed
All ZheJiang province LBMs closed
ZuZhuang (Shandong province) LBMs closed

Median days onset to report: 8 (IQR: 6-11)

1 Onset dates not available for all cases
Effect of Closure of Live Poultry Markets


Closure of LPMs dramatically reduced the mean daily number of infections in four studied cities

Other factors, media, shopping behaviors, may have contributed

<table>
<thead>
<tr>
<th></th>
<th>Nanjing</th>
<th>Shanghai</th>
<th>Hangzhou</th>
<th>Huzhou</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected daily number of</td>
<td>0.48</td>
<td>1.30</td>
<td>0.98</td>
<td>0.20</td>
</tr>
<tr>
<td>infections before LPM</td>
<td>(0.19–0.95)</td>
<td>(0.79–2.1)</td>
<td>(0.62–1.5)</td>
<td>(0.07–0.47)</td>
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<tr>
<td>closure that would be</td>
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<td></td>
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<tr>
<td>ascertained</td>
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<tr>
<td>Expected daily number of</td>
<td>0.01</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>infections after LPM</td>
<td>(&lt;0.01–0.07)</td>
<td>(&lt;0.01–0.09)</td>
<td>(&lt;0.01–0.08)</td>
<td>(&lt;0.01–0.04)</td>
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<tr>
<td>closure that would be</td>
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<tr>
<td>ascertained</td>
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<tr>
<td>Reduction in mean daily</td>
<td>97%</td>
<td>99%</td>
<td>99%</td>
<td>97%</td>
</tr>
<tr>
<td>number of infections</td>
<td>(81–100%)</td>
<td>(93–100%)</td>
<td>(92–100%)</td>
<td>(68–100%)</td>
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<tr>
<td>associated with complete</td>
<td></td>
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<tr>
<td>LPM closure</td>
<td></td>
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</tbody>
</table>

Data in parentheses are 95% credibility intervals. LPM = live poultry market.

Table: Posterior mean estimates from Bayesian analysis of incidence of avian influenza A H7N9 infection before and after LPM closures
Epi-Curve of Avian Influenza A (H7N9) Virus Cases by Onset of Illness Date and Province, Municipality, or Area of China, 1 Oct 2013 — 17 Mar 2014 (N=256)*

- Jilin (n=1)
- Guangdong (n=88)
- Fujian (n=16)
- Shandong (n=1)
- Zhejiang (n=92)
- Shanghai (n=8)
- Guangxi (n=3)
- Guizhou (n=1)
- Hebei (n=0)
- Henan (n=0)
- Jiangxi (n=0)
- Jiangsu (n=15)
- Anhui (n=6)
- Hunan (n=15)
- Taiwan (n=1)
- Beijing (n=2)

* Onset date unknown for 1 case
Traders sidestep ban by selling live poultry online

By Yang Meiping | February 28, 2014, Friday | PRINT EDITION

Live chicken is being sold online despite a three-month ban on live poultry in the city.

To beat the H7N9 bird flu virus, Shanghai authorities have closed all live poultry markets in the city from January 31 to April 30, when the virus tends to be at its peak.
What’s Next?

- **Is H7N9 here to stay?**
  - The new H5N1?

- **Detection**
  - Improved surveillance in bird markets needed
  - Surveillance for H7N9 in humans as sentinel for animal disease?

- **Prevention**
  - Role of vaccine for humans

- **Response**
  - Continued global coordination needed
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China CDC

WHO HQ and Reg Offices