SARS and Avian Influenza: Public Health Priorities

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Chest Xray, Day 2
Chain of transmission among guests at Hotel M—Hong Kong, 2003

* Health-care workers; † All guests except G and K stayed on the 9th floor of the hotel. Guest G stayed on the 14th floor, and Guest K stayed on the 11th floor; § Guests L and M (spouses) were not at Hotel M during the same time as index Guest A but were at the hotel during the same times as Guests G, H, and I, who were ill during this period.

Data as of 3/28/03
Airline Transmission of SARS

- No illness (person interviewed)
- No illness (person not interviewed)
- Probable case
- "Index" Case
- Crew
- Empty seat

Olsen et al. NEJM 2003;349:2414
Measures to Reduce Airline Transmission of SARS

Aircraft Decontamination

Voluntary Use of Masks

Fever Screening
Chest X-ray, Day 13
Clues to the Causative Agent

- Epidemiology – highly transmissible respiratory pathogen
- Clinical – unusually severe disease
- Laboratory – generally consistent with virus
- Pathology – possibly paramyxovirus
- No known agent could explain all features
Coronavirus – EM appearance
Personal Protective Equipment

- N-95 or better respirator
- Head cover
- Goggles or face shield
  - eyeglasses not adequate
- Double gown
- Double gloves
- Double shoe covers
# SARS on Hospital Surfaces

<table>
<thead>
<tr>
<th>Surface, Hospital B, Taiwan</th>
<th># Positive/# Tested</th>
</tr>
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<tbody>
<tr>
<td><strong>Patient rooms (71%)</strong></td>
<td></td>
</tr>
<tr>
<td>Endotracheal tube</td>
<td>3/3</td>
</tr>
<tr>
<td>Bedrail</td>
<td>3/4</td>
</tr>
<tr>
<td>Ventilator panel</td>
<td>1/3</td>
</tr>
<tr>
<td>Other</td>
<td>3/4</td>
</tr>
<tr>
<td><strong>Nursing stations (56%)</strong></td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>1/3</td>
</tr>
<tr>
<td>Computer mouse</td>
<td>2/2</td>
</tr>
<tr>
<td>Doorknob</td>
<td>1/2</td>
</tr>
<tr>
<td>Other</td>
<td>1/2</td>
</tr>
<tr>
<td><strong>Public areas of hospital (20%)</strong></td>
<td></td>
</tr>
<tr>
<td>Elevator handrail</td>
<td>1/1</td>
</tr>
<tr>
<td>Other</td>
<td>0/4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16/28 (57%)</td>
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</table>

Dowell et al. CID 2004;39:652
Intubation of a SARS Patient
Sars: Four months that shook Asia

After four traumatic months, Asia appears to have brought SARS under control, ending for now early fears the outbreak would escalate into a pandemic to rival the 1918 influenza.

But as the region breathes a sigh of relief and a palpable optimism returns to Asia's streets, its leaders have begun picking through the economic and psychological damage caused by the worst epidemic in the region's history.

Everyone is feeling a lot better the epidemic is dying down, but a full recovery cannot be expected for quite some time yet. In the meantime, there has been the silver lining of Beijing being more open with the world.

A team of its experts from travelling there to investigate and even denied any SARS problem on the mainland.

The April 2 advisory, however, turned international ire on China and pressure to come clean on a cover-up arguably responsible for what had by then become a full-blown worldwide outbreak with 180 dead and 3,000 infected was immense.

A team of international experts
Influenza – “Drift”
Influenza – “Shift”

Spanish Flu, 1918

CDC
US Infectious Disease Mortality: The Impact of Influenza and AIDS

Armstrong. JAMA 1999;281:61
Avian Influenza in Thailand?

Newin denies bird flu cover-up

Rivals spread rumour “to hurt local market”

Post reporters

The Ministry of Agriculture and Cooperatives insists Thailand is free of bird flu and denies allegations staff concealed a report on its outbreak.

“A report that poultry farms have been contaminated with bird flu disease is groundless,” said Deputy Agriculture Minister Newin Chidchob. “The rumour may have been spread by our competitors who want to ravage the (Thai) poultry export industry, which has a bright market opportunity since the bird flu outbreak hit many Asian countries.”

He also criticised farmers and local politicians who claimed their chickens were infected with the disease, saying they hoped to get compensation from the Livestock Department.

Poultry farmers say the department is hiding the fact that avian influenza has attacked hundreds of poultry farms. They say the department is trying to protect giant poultry exporters.

Bird flu has swept through several Asian countries, including Vietnam, Japan, Taiwan, and South Korea.

Prime Minister Thaksin Shinawatra said the government had put in place measures to prevent the possible spread of the disease to the poultry industry.

Agencies had not found any infections in chickens that were related to bird flu. Bird flu is an animal type of influenza. The disease can range from a mild disease with only minor effects to a highly infectious fatal version.

It can be transmitted to humans by contaminated feed, water, and equipment. However, human fatalities from avian influenza are rare and were unknown before 1997.

The latest cases were reported on Tuesday, when the World Health Organisation confirmed that three Vietnamese...
Avian Influenza in Asia
(10 February, 2004)
Intensive Pneumonia Surveillance

- Active
- Population-based
- CXR-confirmed
- Laboratory testing
  - Influenza
  - Other viruses
  - Bacterial agents
- Community surveys
Locations of Registered Poultry Farms
Sa Kaeo, Thailand

Sa Kaeo Province

Districts
- Aran Yaprathet
- Khao Chakan
- Khlong Hat
- Kiew Amphoe Khok Sung
- Kiew Amphoe Wang Sonbun
- Mueang Sa Kaeo
- Petchaburi
- Wang Nam Yen
- Wat Thana Nakhon

+ Hospitals
★ Poultry farms
Poultry Exposure is Common

- There are ~6 birds to every person in Sa Kaeo Province

- 1.3% of poultry is on commercial farms
  - 178 farms
  - 31,221 poultry

- 98.7% of poultry is in backyards
  - 2,410,820 poultry
A Cluster of H5 Cases

- Three family members linked coincidentally during investigation of another pneumonia case
- Urgent concern about person-to-person transmission
- At the time cluster was recognized;
  - Index case dead, cremated
  - Mother dead, body embalmed
  - Aunt admitted to hospital
- Interviews rapidly conducted on family, contacts, neighbors, and healthcare workers
Investigation at Home of Index Patient
Timeline of Exposures and Illness

- 28 August: Household chickens ill
- 29 August: Last household chicken buried
- 1 September: Index fever onset
- 2 September: Index admitted to hospital
  - **Aunt provides bedside care**
- 7 September: Mother arrives at hospital
  - **Mother provides bedside care**
- 8 September: Index dies
- 9 September: Neighborhood chickens killed, houses disinfected
- 11 September: Funeral in different, unaffected village
- 12 September: Fever in mother
- 13 September: Mother returns to Bangkok
- 16 September: Fever in Aunt
- 17 September: Mother admitted with pneumonia
- 20 September: Mother dies
- 23 September: Aunt admitted with pneumonia
Laboratory Investigation

- Immediate and urgent effort to collect specimens
- Specimens promptly shared with WHO network
- Index patient dead, cremated
  - 0.5ml serum from day 6 of illness
  - Mother’s body embalmed
    - Lung and other tissues tested by PCR
- Aunt survived
  - NP and OP swabs tested by cell culture, RTPCR
  - Acute and convalescent serum (neutralization, ELISA)
Mother: Lung Tissue Pathology

Photo courtesy of S. Zaki
HA Gene Sequence:

- Genotype Z
- Resistant to amandatine
Conclusions from Family Cluster

• Probable person-to-person transmission
• No further spread to contacts
• No significant mutation of virus
  – All gene segments were of avian origin
  – Critical binding and cleavage sites unchanged
• Isolation precautions needed for H5 patient care
• Future clusters also warrant intensive investigation
Summary: SARS and Avian influenza

• SARS redefined emerging zoonoses
  – Broad economic and public health impact

• Avian flu: unprecedented & unpredictable
  – Scale of the epizootic unprecedented
  – Ongoing potential for re-assortment event