

Why all the concern about avian influenza?

BC Centre for Disease Control

December 15, 2005

The art and science of risk analysis, risk communication and public policy

- Evidence
- Speculation
- Doubt
- Inform
- Prepare
- Theory
- Skepticism
- Decisiveness
- Alarm
- Panic

What are the main messages?

- Pandemics constitute rapid spread of severe illness
 - Overwhelming demand for health care
 - Civic and economic emergency
- All influenza viruses in humans have their origin in avian species
- H5N1 avian influenza is the largest and most ominous outbreak of avian influenza on record
- Represents a potential concern but hasn't happened yet
- The chances for a British Columbian to become ill with avian influenza today are as close to zero as you can get
 - Few infections worldwide despite likely millions of exposures
 - No evidence sustained person-to-person transmission

Influenza

- An illness recognized for centuries
 - Since the 1500s at least
 - Name comes from 16th century Italian: *influenza di freddo*
- Cause was unknown so various names given to the syndrome:
 - “a touch of liver”
 - “the jolly rant”
 - “the newe acquayantance”
 - “the new delight”
 - “gallants’ disease”
 - “the fashionable illness”
 - “the flu”
- The cause was finally identified in 1930s as a virus
 - Influenza virus causes influenza
 - Flu can mean illness with similar symptoms due to any unknown cause
 - We live in the modern era
 - When we mean influenza, we should say influenza
 - A fever and cough illness due to the influenza virus

Influenza virus

- In humans, influenza virus causes illness in the upper airways
 - The virus is mostly confined to the upper respiratory tract
 - Hijacks cells of the respiratory tract
- In birds, influenza virus infects the gut
 - Hijacks cells of the gut

Influenza virus: Why so much grief?

- Highly transmissible
 - Respiratory spread
 - Survives in the environment
- High rates of clinical infection
 - Short incubation period of just 1-3 days
 - Abrupt onset
 - Shedding virus 24 hours before symptom onset
- Escapes long-lasting immunity
 - Mutations
- Reservoir of new subtypes
 - Waterfowl and other avian species

Two Types of Influenza Activity in Humans

- **Inter-pandemic**

- Influenza A or B
- Seasonal (annual)
- Minor changes in the virus (drift)
 - Varying severity – relatively more or less

- **Pandemic**

- Influenza A only
- Irregular occurrence (10-40 years)
- Big changes in the virus (shift)

Inter-pandemic Activity

- **Seasonal - A and B**

- Winter activity

- Northern Hemisphere: Oct – Apr
- Southern Hemisphere: May- Sep

- Occurs abruptly

- Increases over 2 wks; peaks for 2 wks; decreases over 2 wks

- Attack Rates

- 10-20% overall; 40-60% in select populations

Influenza in Healthy Adults

- Monto et al (2000) ICID Abstract
 - Analysis of medical claims from US, 1995 – 1997
 - Average number of MD visits per case = 1.7
 - 13% had one outpatient hospital or emergency room visit
 - 40% of influenza cases associated with antibiotic prescription

Influenza in Healthy Adults

- Most confined to bed at least couple days
(Kasch M et al (1998) Occ Med 48(2): 85-90)
 - Upon return to work, 60% productive
- Employee survey: (Smith AP et al (1990) Phil Trans R. Bot Lond)
 - Average length of influenza illness 5.25 days
 - 74% required time off work
- Ill up to two weeks (Briggs(1997) Canadian Pharm Journal 26-30)
 - Effect on concentration
 - 57% decrease in reaction time test

Pandemics

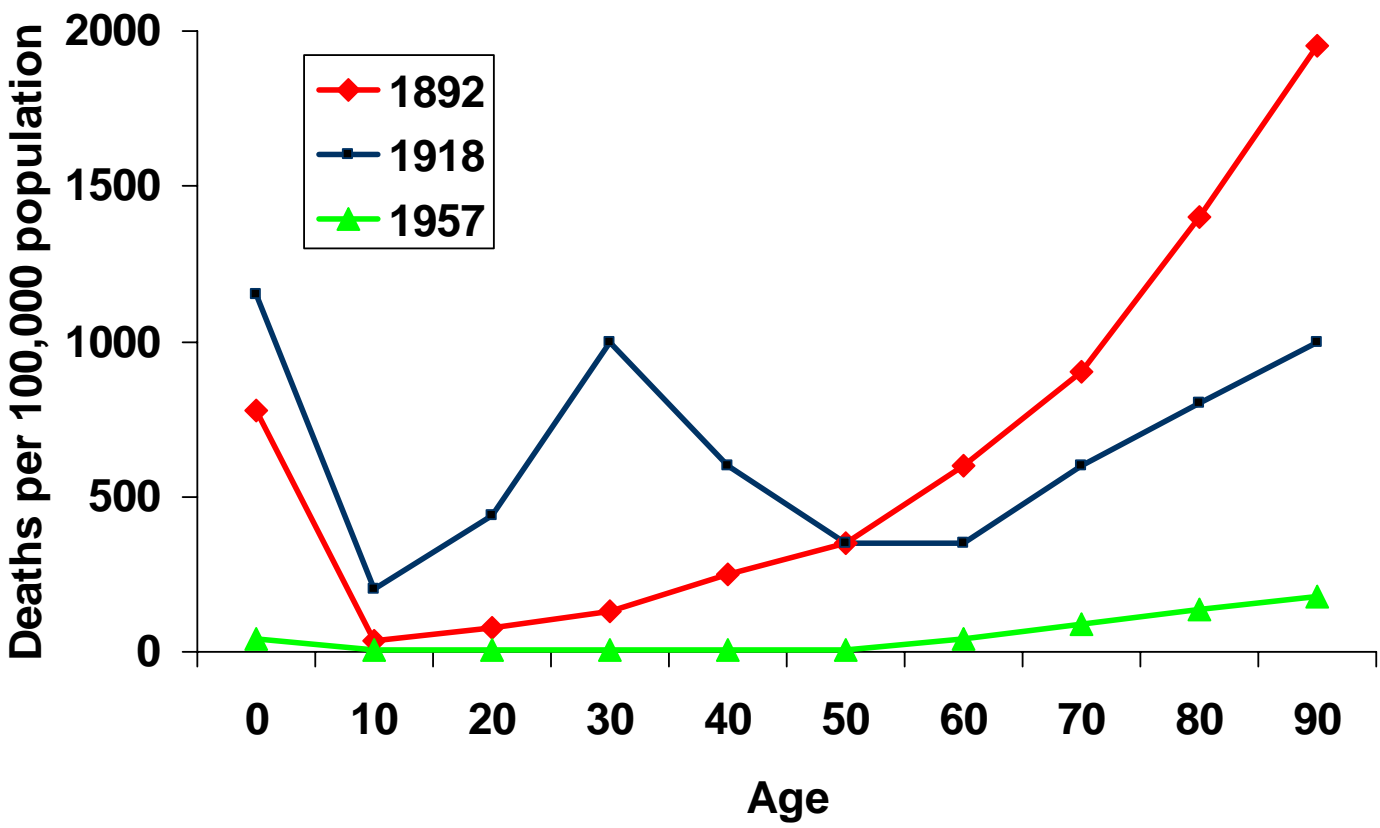
- Prerequisites:
 - Big change in the virus - new subtype jumps species from birds to humans
 - Little or no immunity in general population
 - Able to replicate in humans and cause serious illness
 - Efficiently transmitted from one human to another
- Spread rapidly to every part of the world within a year
 - Illness in more than 25% of the total population
- Characterized by:
 - Sudden explosive nature
 - High attack rates but low fatality rates
 - Sharp increase in need for medical care

Influenza: kinds of change

- Point mutation
 - Annual year-to-year variation
 - 1918 pandemic
- Recombination
 - Internal shuffling of genes within the same virus
 - Conversion of a low pathogenic avian influenza virus to high pathogenicity in British Columbia
- Genetic reassortment
 - External swapping of the segmented genome between different viruses
 - Co-infection with human and avian strains in people or pigs
 - 1957 and 1968 pandemics

| Year | # Years Circulating | Viral Subtype | Common Name | Avian Composition | Mortality Worldwide |
|-------------|----------------------------|----------------------|--------------------|------------------------------|----------------------------|
| 1918 | 39 | H1N1 | Spanish | Entirely avian | 40 million |
| 1957 | 11 | H2N2 | Asian | 3 avian genes HA, NA, PB1 | 2 million |
| 1968 | Ongoing | H3N2 | Hong Kong | 2 avian genes HA, PB1 | <1 million |

Deaths from influenza and pneumonia in USA in three pandemics



What is the link between avian influenza and pandemics?

Influenza A virus subtypes are most diversified in birds

Infect more than 90 species of apparently healthy wild birds

Limited subtypes infect humans and other mammals

All influenza viruses in humans came from birds including all previous pandemics

- Birds have carried influenza A viruses without developing symptoms for thousands of years: example of optimal virus adaptation to its host

- Infection in wild birds is:

LOW PATHOGENICITY AVIAN INFLUENZA VIRUS

- Huge, stable, benign and perpetual reservoir of influenza A viruses that is highly mobile over vast distances
- When LPAI is introduced into domestic poultry housed in dense populations, readily mutates to a HIGHLY PATHOGENIC AVIAN INFLUENZA
 - Intense outbreaks in close proximity to dense human populations
 - Accelerated amplification and evolution of the virus through error prone replication

Wild birds with avian influenza are a threat in terms of pandemic influenza through the intermediary of domestic poultry

Why are we concerned about poultry outbreaks?

- The influenza virus
 - Spontaneous error and mutation
- Economic and trade implications
- The density of poultry population
 - Accelerated evolution
 - Toward more virulent or transmissible variant
- Close proximity to humans
 - Adaptive mutation
 - Genetic reassortment during coinfection

HPAI in Poultry A Rare Event

| | | |
|---------|------------------------|------|
| 1959 | Scotland | H5N1 |
| 1963 | England | H7N3 |
| 1966 | Ontario | H5N9 |
| 1976 | Victoria, Australia | H7N7 |
| 1979 | Germany | H7N7 |
| 1979 | England | H7N7 |
| 1983-85 | Pennsylvania* | H5N2 |
| 1983 | Ireland | H5N8 |
| 1985 | Victoria | H7N7 |
| 1991 | England | H5N1 |
| 1992 | Victoria | H7N3 |
| 1994 | Queensland | H7N3 |

| | | |
|-----------|--------------|------|
| 1994-95 | Mexico* | H5N2 |
| 1994 | Pakistan | H7N3 |
| 1997 | New S. Wales | H7N4 |
| 1997 | Hong Kong* | H5N1 |
| 1997 | Italy | H5N2 |
| 1999-2000 | Italy* | H7N1 |
| 2002 | Hong Kong | H5N1 |
| 2002 | Chile | H7N3 |
| 2003 | Netherlands* | H7N7 |
| 2004 | Pakistan | H7N3 |
| 2004 | Texas USA | H5N2 |
| 2004 | BC, Canada* | H7N3 |
| 2004 | South Africa | H5N2 |

Before 2004: 21 HPAI outbreaks in poultry; 7 involved numerous farms;
only 1 spread to other countries

H5N1 in Asia: unprecedented
poultry outbreaks involving > 15
countries in Europe and Asia

Human Infections due to Avian Influenza are even more Rare

| Date | Area | Strain | Cases | Deaths | Symptoms | Source |
|-----------|-------------|--------|-------|--------|------------------------------|-----------|
| 1959 | USA | H7N7* | 1 | 0 | respiratory | Overseas |
| 1995 | UK | H7N7 | 1 | 0 | conjunctivitis | Pet ducks |
| 1998 | Hong Kong | H9N2 | 5 | 0 | unknown | Unknown |
| 1999 | Hong Kong | H9N2 | 2 | 0 | respiratory | Poultry |
| 2003(Mar) | Netherlands | H7N7* | 89 | 1 | Conjunctivitis, pneumonia | Poultry |
| 2003(Dec) | Hong Kong | H9N2 | 1 | 0 | respiratory | Unknown |
| 2004 | Canada | H7N3 | 2 | 0 | conjunctivitis | Poultry |

Human cases of avian influenza (current to December 15, 2005)

| VIRUS | CASES | DEATHS |
|------------------------------|-------|----------|
| H5N1 (since Dec 2003) | 138 | 71 (51%) |
| All other AI (since 1959) | 101 | 1 (<1%) |

H5N1 in humans is exceptional in its severity and extent (current to December 15, 2005)

| | CASES | DEATHS |
|-----------|-------|--------|
| Thailand | 22 | 14 |
| Viet Nam | 93 | 42 |
| Cambodia | 4 | 4 |
| Indonesia | 14 | 9 |
| China | 5 | 2 |
| Total | 138 | 71 |

- 89 cases and 36 deaths have occurred in 2005

Assessing the pandemic threat in Asia

- H5N1= largest & most ominous AI OBs on record
 - Never before so many countries so widely affected
 - Never before so many human cases
 - » Direct contact with infected poultry
 - » Consumption of raw poultry products
 - » Family clusters
 - Never before such high fatality in humans
 - Note: No sustained person-to-person transmission
 - Evolution of the virus since 1997
 - » More deadly in poultry and mammalian mouse model
 - » New animals (cats/tigers) infected for the first time
 - » Domestic ducks excreting large quantities without symptoms
 - » Surviving longer in the environment

Next Pandemic:

What we might expect:

- Based on previous pandemics:
 - Short lead time
 - First identification to full scale pandemic: 1-5 months
 - Appearance in Canada: Within 3 months
 - Peak morbidity: 5-7 months (2-4 months after arrival)
 - Peak mortality: 6-8 months (1 month after peak morbidity)
 - Expect even shorter timelines now given air travel
- Several waves
 - Second wave within three to nine months
 - In the same season

How to Prepare?

- Maintain a global perspective
 - Per capita health expenditure Vietnam: \$8 US
- Advice for travelers
- Biosecurity around poultry operations
- Early detection and intervention
 - To slow the spread in the initial stages
- Universal pandemic preparedness at all levels
 - National, provincial and municipal preparedness plans
 - Vaccines, antivirals, surveillance, emergency preparedness, clinical health services

- BC Pandemic Influenza Preparedness Plan <http://www.bccdc.org/content.php?item=150>
- BC Infection control guidelines for physicians' offices
 - <http://www.bccdc.org/content.php?item=194>
- BC Health Guide Health Files on Influenza and Pandemic Influenza
 - www.bchealthguide.org/healthfiles
 - What is Pandemic Influenza? <http://www.bchealthguide.org/healthfiles/hfile94a.stm>
 - Staying Healthy during a Pandemic: <http://www.bchealthguide.org/healthfiles/hfile94b.stm>
 - Self Care During an Influenza Pandemic: <http://www.bchealthguide.org/healthfiles/hfile94c.stm>
 - Immunization During a Pandemic: <http://www.bchealthguide.org/healthfiles/hfile94d.stm>
 - Antiviral Drugs During a Pandemic: <http://www.bchealthguide.org/healthfiles/hfile94e.stm>
- PHAC Travel Health Advisories
 - http://www.phac-aspc.gc.ca/tmp-pmv/prof_e.html
- World Health Organization:
 - www.who.int/csr/disease/avian_influenza/en/
- Centers for Disease Control and Prevention:
 - www.cdc.gov/flu/avian/index.htm
- Travel advice:
 - www.cdc.gov/travel/seasia.htm
- OIE countries with avian outbreaks
 - http://www.oie.int/downld/AVIAN%20INFLUENZA/A_AI-Asia.htm