

# Avian Influenza

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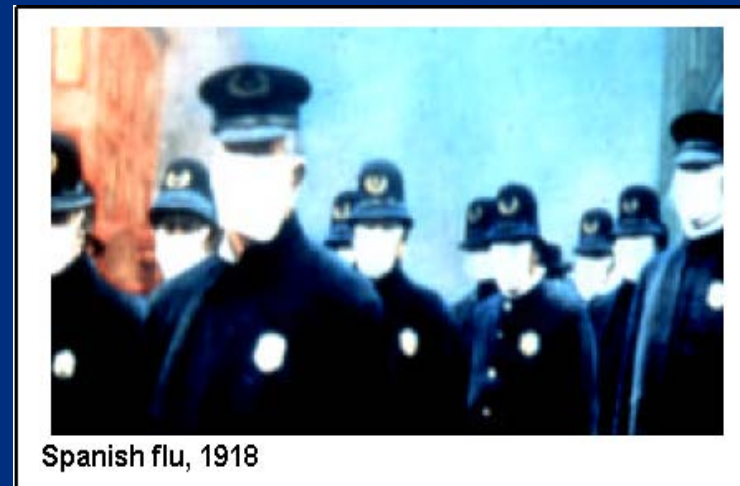
October 20, 2005

# Objectives

- Define Avian Flu
- Define Pandemic
- Contrast normal flu vs. pandemic flu
- Explore the current Avian Flu issue
- Discuss strategies to protect yourself, your family and your place
- Answer your questions

# Avian Influenza

- Avian Influenza is an infection caused by avian (bird) influenza (flu) viruses
- Flu viruses occur naturally among birds worldwide
- Wild birds carry the viruses in their intestines, but usually do not get sick
- Easily transmitted to domesticated birds like chickens, ducks, and turkeys and usually acquire them by coming in contact with contaminated excretions—they usually die.
- May be transmitted to other species
- May mutate to cause human to human infections



# What is a Pandemic?

- An epidemic occurring over a very wide area (several countries or continents) and usually affecting a large proportion of the population.



Pandemic



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# The Seasonal or “Regular” Flu

Centers for Disease Control and Prevention (CDC)

- “Normal” flu season about 200,000 Americans are hospitalized
- 38,000 die from the disease
- overall mortality rate of .008 percent for those infected.
- Most deaths occur among people older than 65 (90%)
  - on average, 98 of every 100,000 seniors with the flu die.
- Prevention-competent vaccine & good hygiene practices
- Influenza costs the U.S. economy about \$12 billion annually in direct medical costs and loss of productivity.



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# What Makes an Influenza Pandemic?

- More cases than expected
- Sudden shift in strain
  - Not expected
- Medical infrastructure capacity compromised



# Pandemic Challenges

- Pandemics are different from other emergencies because it's likely that almost all locations will be affected simultaneously
- Resources cannot be shifted geographically as in other emergencies
- Every country will be affected, but countries with better plans will be less vulnerable to terrorism and other threats during a pandemic

# 20<sup>th</sup> Century Influenza Pandemics

1918: Spanish Flu

U.S. deaths: 500,000

Worldwide deaths: 20-50 million

1957: Asian Flu

U.S. deaths: 70,000

Worldwide deaths: 1-2 million

1968: Hong Kong Flu

US deaths 34,000

Worldwide deaths: 700,000



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# Estimated Impact of next Pandemic Influenza - US

## 200 million people affected

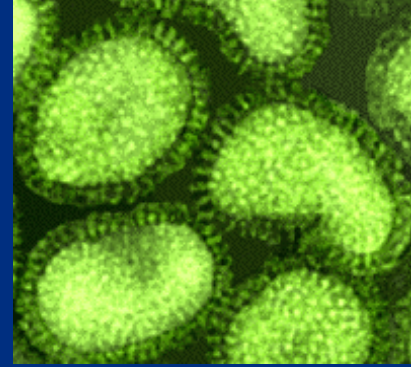
- Sick
- Caregivers/Families
- Up to 40 million outpatient visits
- Up to 700,000 hospitalized
- 89,000 - 200,000 deaths

**Approximately 15-35% of Americans ill**

Source: CDC



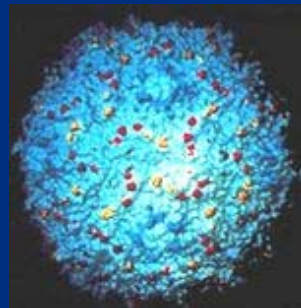
# Influenza A, B and C



**Influenza A, B and C virus is differentiated by:  
Antigenic difference in nucleoprotein and matrix (M) protein**

- **Type A undergoes antigenic shift and drift.**
- **Type B undergoes antigenic drift only.**
- **Type C is relatively stable**

**Flu vaccines are selected each year to address this mix.  
This year's vaccine is 2As and a B**



# Influenza A Subtypes:

Human Influenza Virus: H1N1, H2N2, H3N2  
H5N1, H7N7, H7N3, H7N2, H9N2, H10N7

Avian Influenza Virus: H1N1, H2N2, H3N2, H3N8, H4N8,  
H5N1, H5N2, H5N3, H6N1, H6N2,  
H6N9, H7N2, H7N3, H7N4, H7N7,  
H8N4, H9N2, H10N7, H11N1,  
H11N8, H11N9, H12N5, H13N6,  
H14N5, H15N6

Swine Influenza Virus: H1N1, H3N2, H5N1

Equine Influenza Virus: H3N8, H7N7

Cats, Tigers and Leopards: H5N1

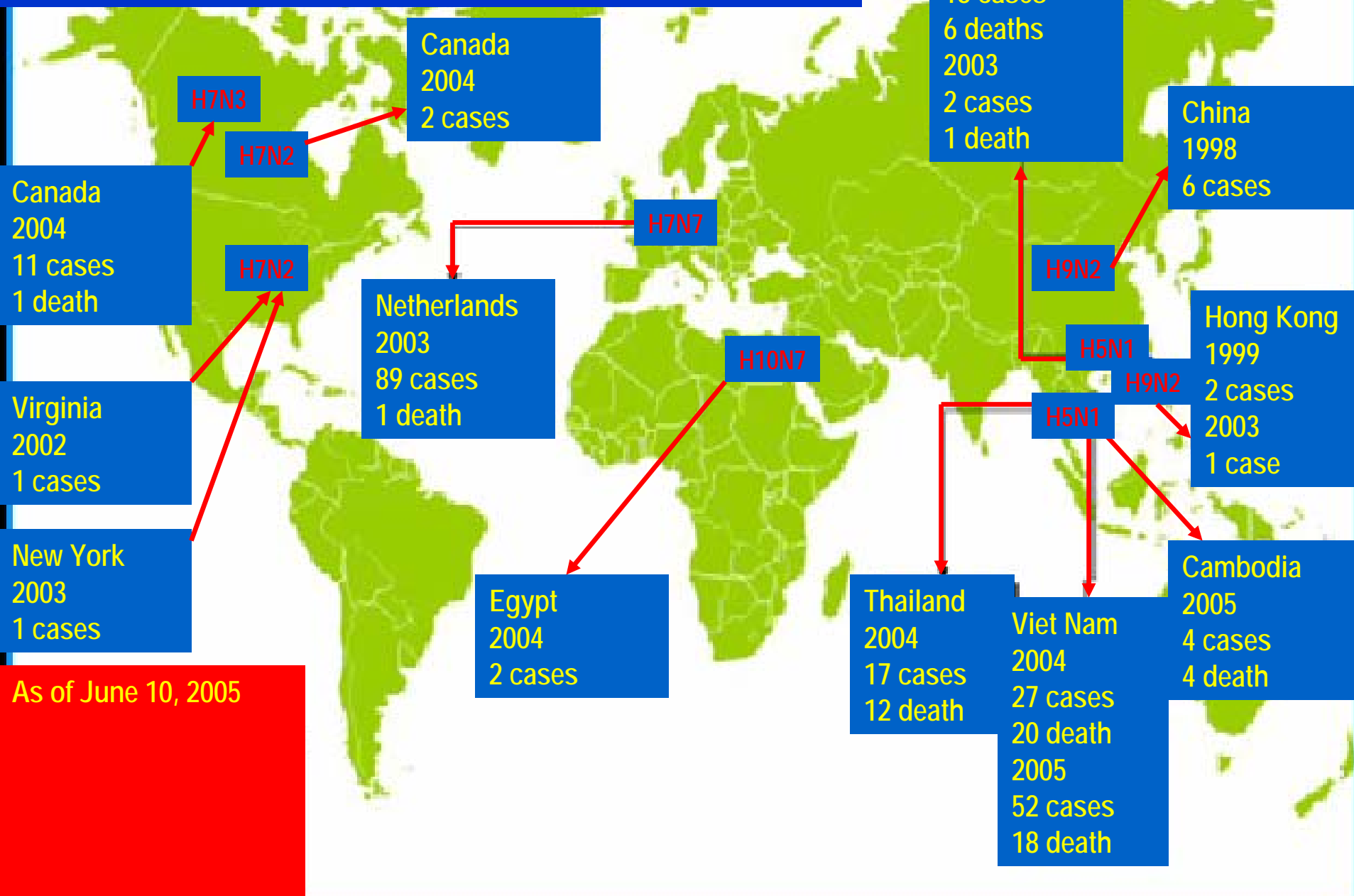
Dogs: H3N8

Seals: H4N7, H7N7



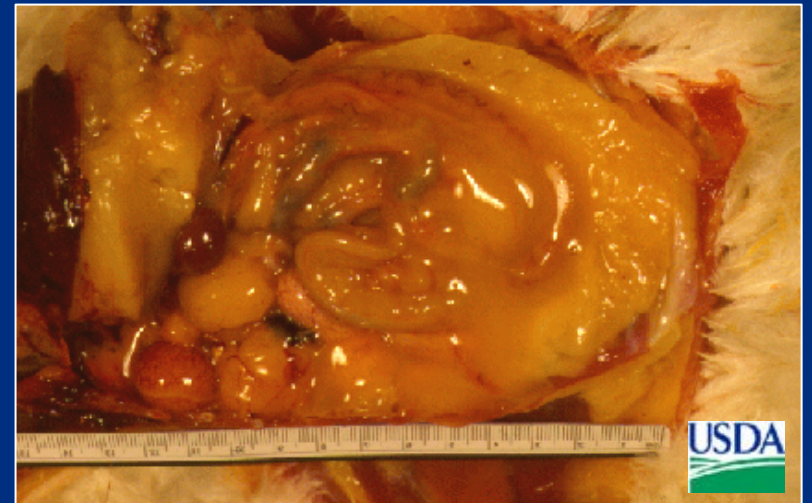
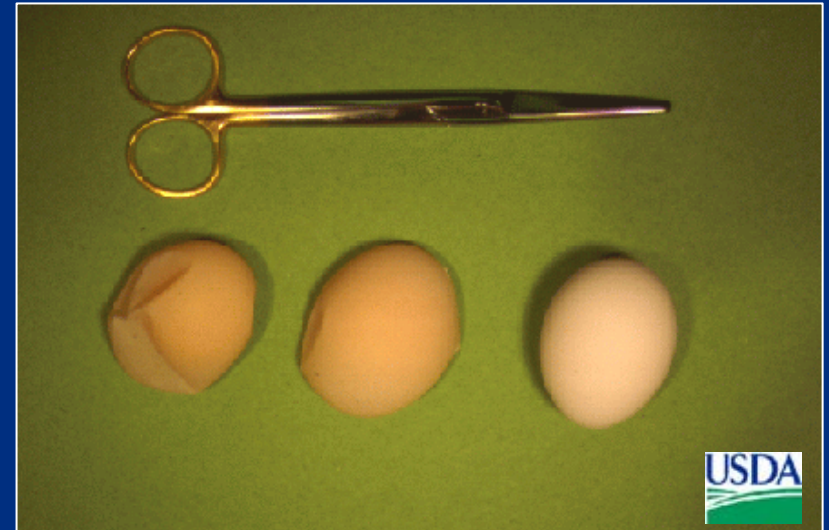
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# Documented Avian Influenza infections in humans



# Low Pathogenicity Avian Influenza

- Rhinitis & tracheitis
- Ocular discharge



# High Pathogenicity Avian Influenza

## High death losses

- Severe depression, no feed consumption
- Swollen comb/wattle, head & legs
- Hemorrhage of legs



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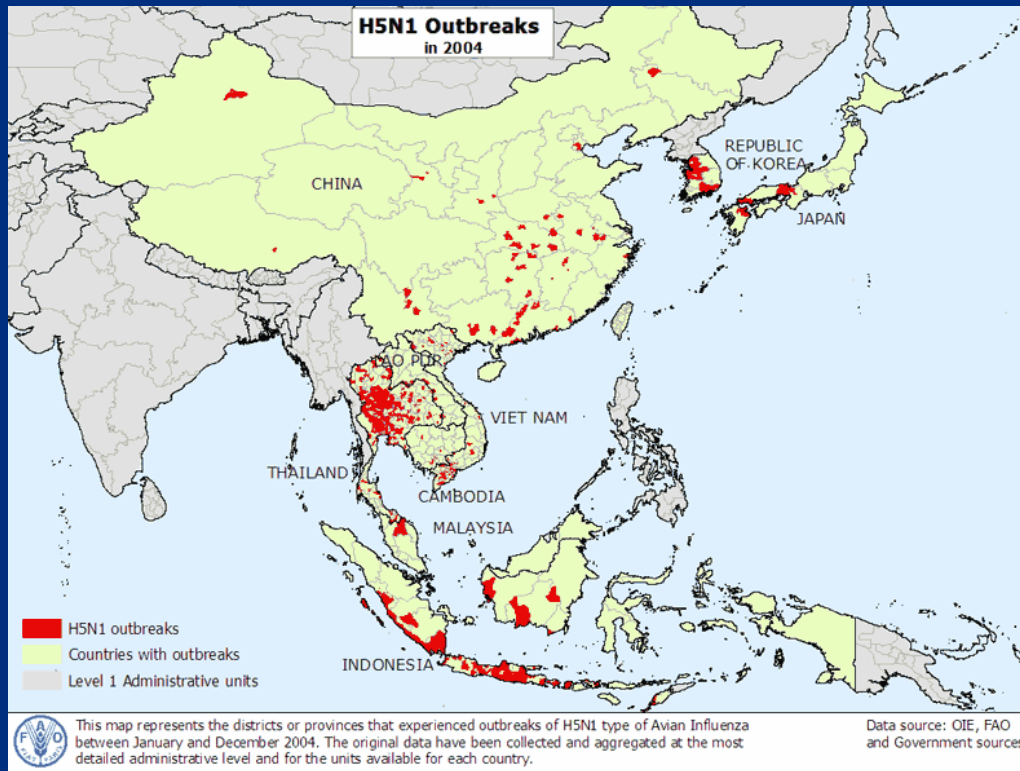


# 24 HPAI Epizootics§

1. 1959-Scotland, H5N1
2. 1961-S. Africa, H5N3
3. 1963-England, H7N3
4. 1966-Canada, H5N9
- 5.1975-Australia, H7N7
6. 1979-England, H7N7
- \*7. 1983-84 - USA, H5N2**
8. 1983-Ireland, H5N8
9. 1985-Australia, H7N7
10. 1991-England, H5N1
11. 1992-Australia, H7N3
12. 1994-Australia, H7N3
- \*13. 1994-95-Mexico, H5N2**
14. 1995, 2001 & 2004 – Pakistan, H7N3
15. 1997-Australia, H7N4
16. 1997-Italy, H5N2
- \*\*17. 1996- Asia, H5N1**
- \*18. 1999-2000 - Italy, H7N1**
- \*19. 2002 - Chile, H7N3**
- \*20. 2003 – Netherlands, H7N7**
- \*21. 2004 – USA, H5N2**
- \*22. 2004 – Canada, H7N3**
23. 2004 – S. Africa, H5N2
24. 2005 – N. Korea, H7N?
- \*LPAIV ⇒HPAIV**
- \*\*Largest epizootic in 50 yrs**



# Asian HPAI Epizootics



- Hong Kong: 1997, 2001-3 (H5N1)
- S. Korea: 2003-4 (H5N1)
- Vietnam: 2004-5 (H5N1)
- Japan: 2004 (H5N1)
- Thailand: 2004-5 (H5N1)
- Cambodia: 2004-5 (H5N1)
- Laos: 2004-5 (H5N1)
- Taiwan: 2003 (H5N1), 2004 (H5N2 LPAI)
- Indonesia: 2003-5 (H5N1)
- China: 1996-2005 (H5N1)
- Malaysia: 2004 (H5N1)
- Russia: 2005 (H5N1)
- Kazakhstan: 2005 (H5N1)
- Mongolia; 2005 (H5N1)

## H5N1 HPAI

- Total dead or culled: 100-200m
- Endemic in village poultry and domestic ducks

# Countries Affected by H5N1 Avian Influenza Strain in Poultry:

**Cambodia**

**China (both Taipei China and the People's Republic of China)**

**Hong Kong**

**Indonesia\***

**Japan**

**Laos**

**Malaysia**

**South Korea**

**Thailand**

**Vietnam\***

**Russia\***

**Mongolia**

**Turkey**

**Bulgaria**

**(Serbia\*)**

**(Macedonia\*)**

**Kazakhstan**

**Romania**

**Iran\***

**Greece**

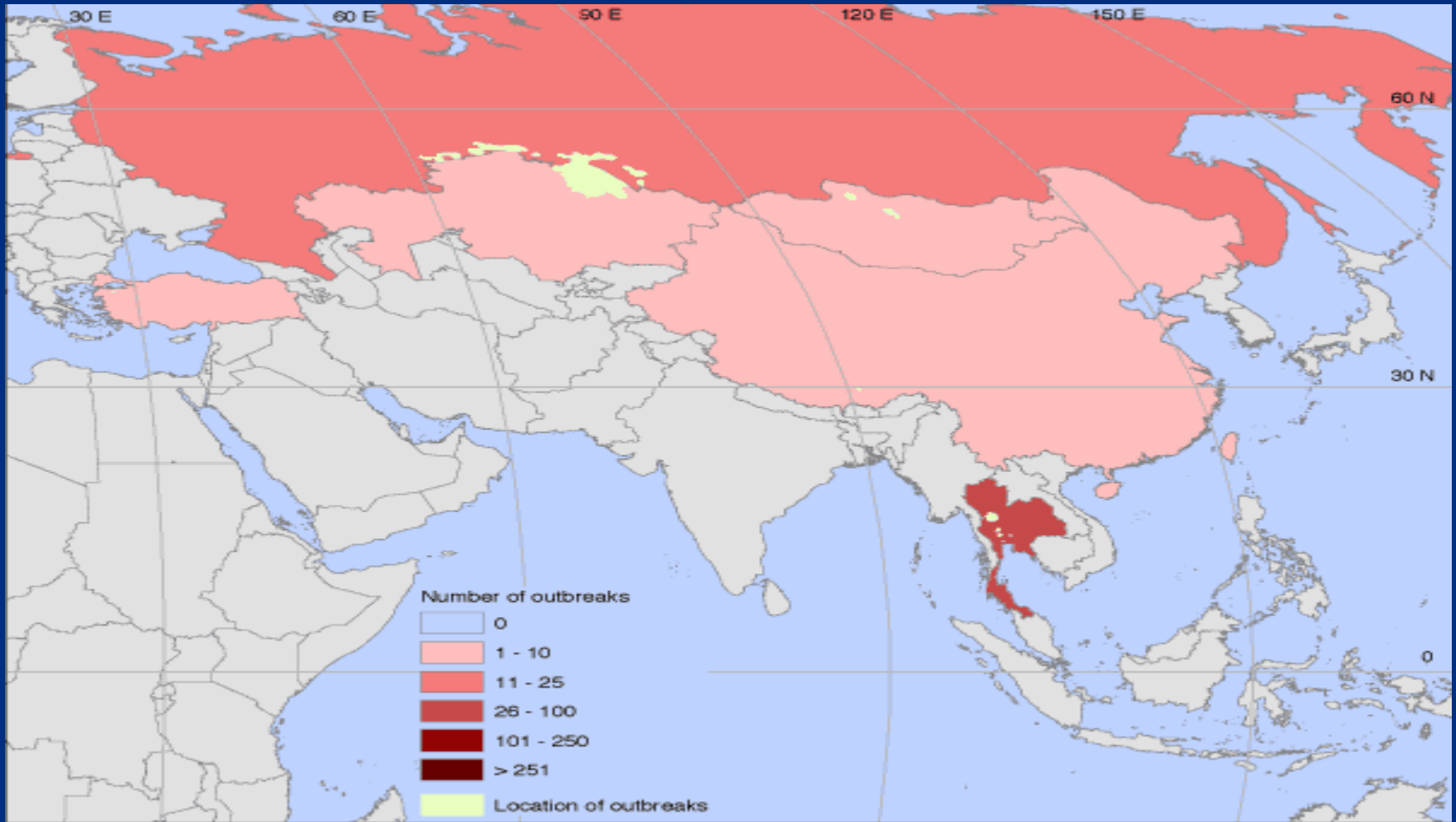
**(Croatia\*)**

**Documented cases of human infections have been observed only in Cambodia, Hong Kong, Indonesia, Thailand, and Vietnam to date.**



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# Latest Map of Reported Outbreaks



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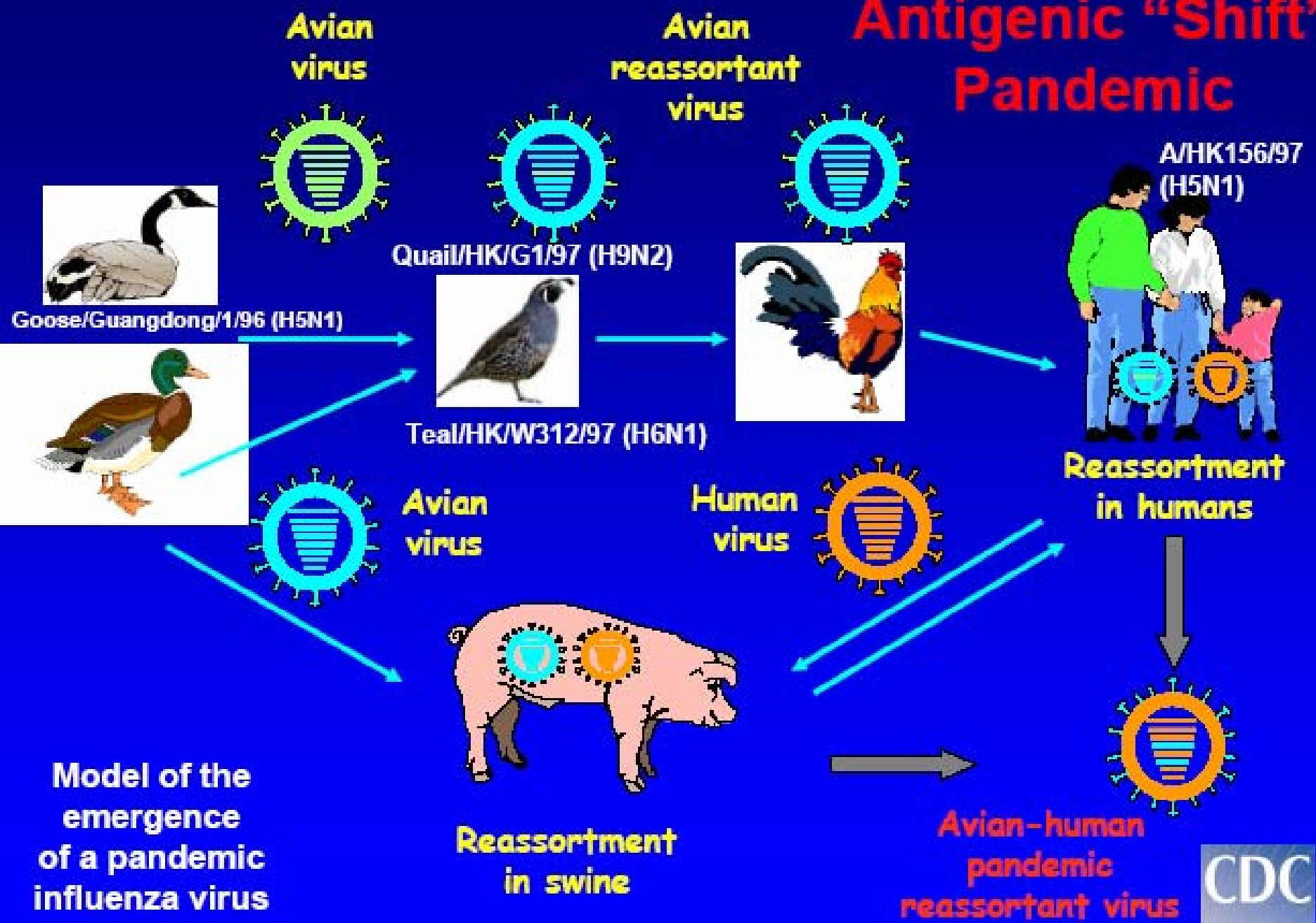
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As of 15 Sep 05

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# Antigenic "Shift" Pandemic



# Asian H5N1 HPAI Epizootic

## Unique Features

Integrated Industrial: variable



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# Asian H5N1 HPAI Epizootic

## Unique Features

### Village Poultry

- Native Chickens – free-range/semi-confined 5-20 birds at household level. Traded in local markets

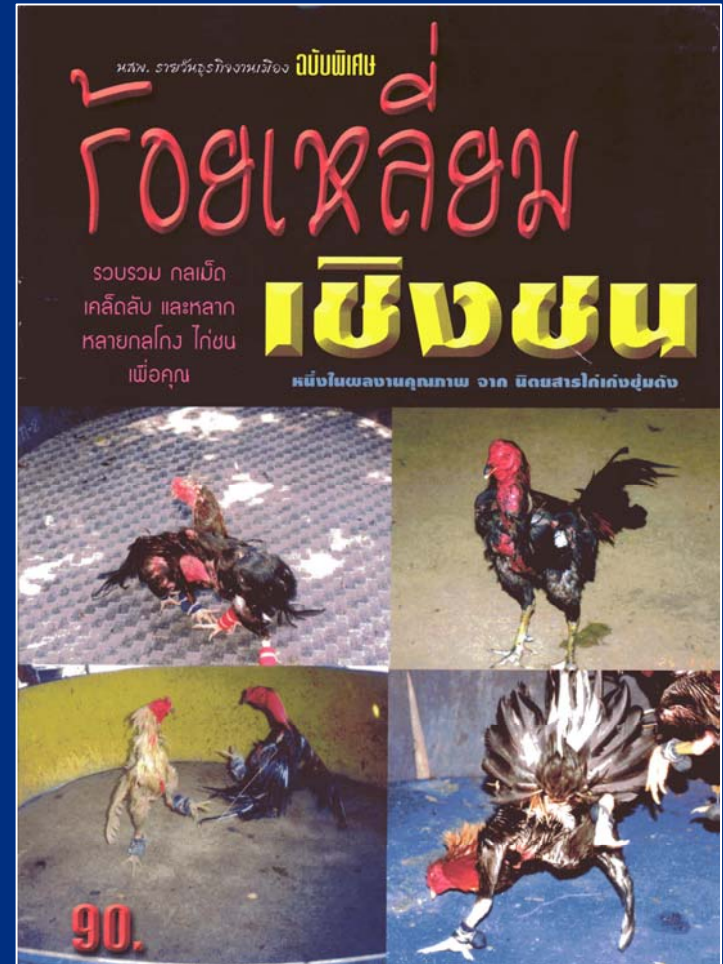


# Asian H5N1 HPAI Epizootic

## Unique Features

### Village Poultry

- Fighting cocks



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# Clinical Signs and Symptoms Associated with Birds

The clinical signs of birds affected with all forms of Avian Influenza may show one or more of the following:

Sudden death without clinical signs

Lack of energy and appetite

Decreased egg production

Soft-shelled or misshapen eggs

Swelling of the head, eyelids, comb, wattles, and hocks

Purple discoloration of the wattles, combs, and legs

Nasal discharge

Coughing, sneezing

Lack of coordination

Diarrhea



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# Intervention strategies for Birds:

Control measures aimed at preventing spread of the virus in a poultry population.

According to World Health Organization (WHO)

- quarantine for infected farms
- destruction of infected or potentially exposed flocks are standard

Avian influenza viruses are readily transmitted from farm to farm by mechanical means, such as by contaminated equipment, vehicles, feed, cages, or clothing.

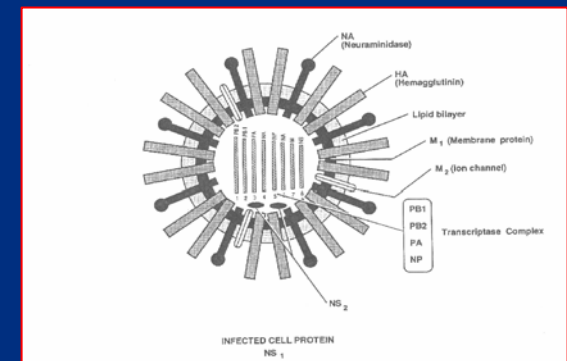
Stringent sanitary measures on farms can confer some degree of protection.



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# Human Influenza

- Most are endemic influenza viruses, adapted to humans
  - Influenza A (H3N2, some H1N1), influenza B viruses
  - Drift: genetic changes little-by-little each year – reason to change vaccine strains
- Pandemics – shift: abrupt replacement of gene segment (reassortment of 8 gene segments)
  - 1918: Spanish Flu (H1N1) - ?AIV genes
  - 1957: Asian Flu (H2N2) - 3 AI & 5 human **flu genes**
  - 1968: HK Flu (H3N2) - 2 AI & 6 human **flu genes**
- Pandemic virus production in 2 steps:
  - AI virus infection of humans – limited infections
  - Sustained human-to-human transmission – reassortment (hybrid virus)



# Human AI Virus Infections

Year	Country	Subtype	Cases	Deaths
1959	USA	H7N7 LPAI	1	0
1978-9	USA	H7N7 LPAI	?	0
1996	U. Kingdom	H7N7 LPAI	1	0
1997	Hong Kong	H5N1 HPAI	18	6
1999	China	H9N2 LPAI	5	0
1999	Hong Kong	H9N2 LPAI	2	0
2002	Hong Kong	H5N1 HPAI	5	3
2002-3	USA	H7N2 LPAI	2	0
2003	Netherlands	H7N7 HPAI	89	1
2004	Canada	H7N3 HPAI	2	0
2004-5*	Cambodia	H5N1 HPAI	4	4
2004-5*	Thailand	H5N1 HPAI	17	12
2004-5*	Vietnam	H5N1 HPAI	90	40
2004-5*	Indonesia	H5N1 HPAI	1	1
<b>Total</b>			<b>227</b>	<b>67</b>



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# AI Virus Infections: Public Health Consequences

## Potential Modes of Transmission to Humans

- Inhalation:
  - Contaminated dust from farming operations
  - Fine water droplets generated during slaughtering, defeathering, eviscerating and preparing
- Contact with oral/nasal mucus membrane or conjunctiva:
  - Hand-transplantation of virus from contaminated surface (poultry feces, respiratory secretions or other contaminated products)
  - Direct oral exposure in cleaning fighting cocks?
- Consumption of raw products?
  - Duck blood pudding & internal organs
  - No epidemiological evidence at this time



# Clinical Symptoms—Humans

## Disease presentation:

In humans, it has been found that avian flu causes similar symptoms to other types of flu:

- fever
- Cough
- Sore throat
- Muscle aches
- Conjunctivitis
- Meningitis
- In severe cases of avian flu, it can cause severe breathing problems and pneumonia, and can be fatal
- 3 – 7 day Incubation period (based on limited studies)
- Other influenza types show patients shedding cells from 3-21 days (contagious)



# Current Diagnostics Methods:

Virus isolation in tissue culture:	Gold Standard (2+ days)
Immunofluorescence test (IFA):	Rapid and Sensitive Method. New antibodies provide the potential for sub-typing.
Real-Time PCR:	Rapid Assay. Has the potential for strain specific detection.
Hemagglutination Inhibition (HI):	Test of choice by WHO for antigenic characterization.
Microneutralization Test:	Sensitive and specific assay to detect virus specific antibody to avian influenza A (H5N1) virus in human serum and potentially, for detecting antibody to other avian subtypes. (Requires paired serum)



# Intervention Strategies: Anti-Virals

- Four anti-viral drugs are available for influenza A viruses: amantadine, rimantadine, oseltamivir, and zanamivir
- You can develop resistance
- In 2004, isolated H5N1 viruses from poultry and humans in Asia that were resistant to two of the medications (amantadine and rimantadine) in Asia
- Monitoring of avian viruses for resistance to influenza antiviral medications is ongoing

# Intervention Strategies for Avian Flu: Vaccines

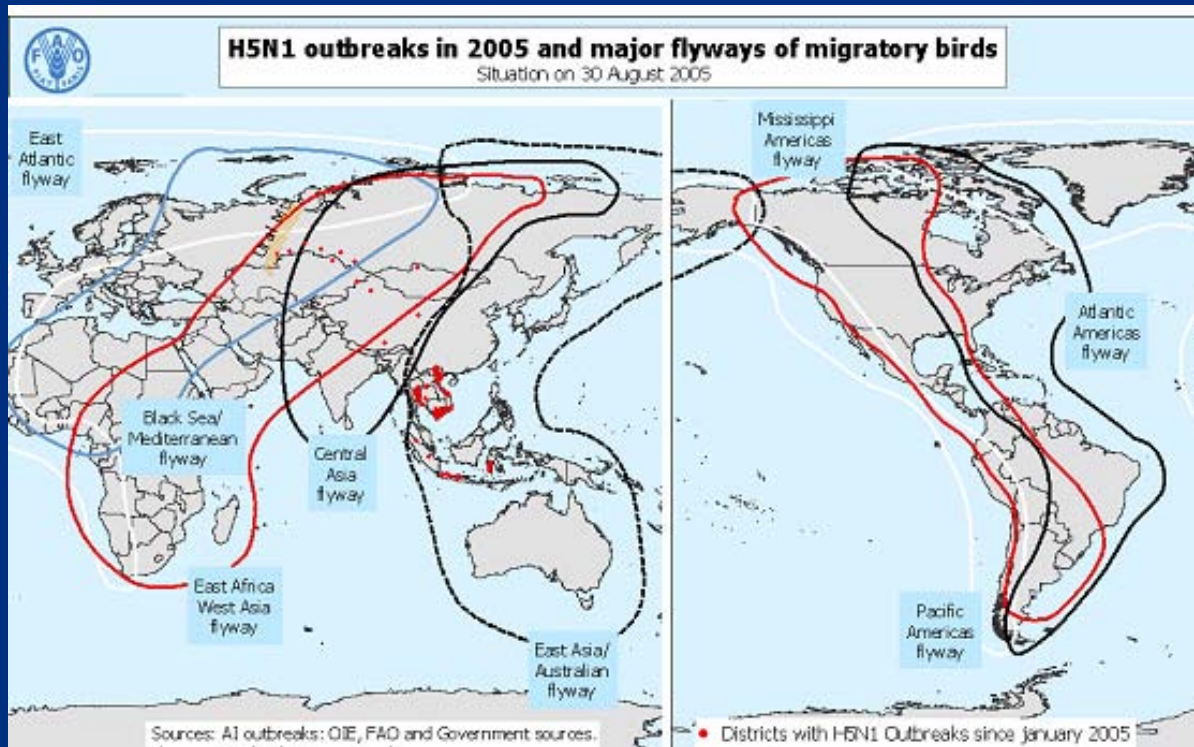
- There are currently no avian influenza vaccines approved in the U.S. for use on humans
- Vaccine candidate under development

# Viability in the Environment:

The World Health Organization Communicable Disease Surveillance & Response (CSR) group reports:

- Preliminary results on the environmental stability indicate that H5N1 viruses from the 2004 outbreaks have become more stable.
- H5N1 viruses from 2004 survived at a higher temperature for a longer period of time, compared to the viruses from the 1997 outbreak.

# How Could H5N1 Get to USA?



• **Migratory Birds - Overlap of summer breeding grounds in Alaska between East Asia/Australasian and Pacific American flyways**

- **Genetic separation of H5 AI viruses between New & Old World**
- **Asian birds rarely get off course and go to N. America**
- **Risk from wild birds is low**



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# Commercial Meat Imports

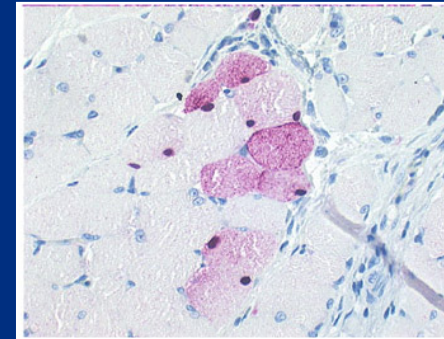


- **2001 H5N1 isolated from duck meat exported to S. Korea**

- Isolated from meat juice - thawed and refrozen meat
- Meat from south China

- **AI virus:**

- HP, chickens
- LP, mice
- NP, ducks



- **2003: H5N1 isolated in Japan from imported duck meat from China**

**Risk is low – no imports from outbreak countries of raw products**



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# Illegal Commerce

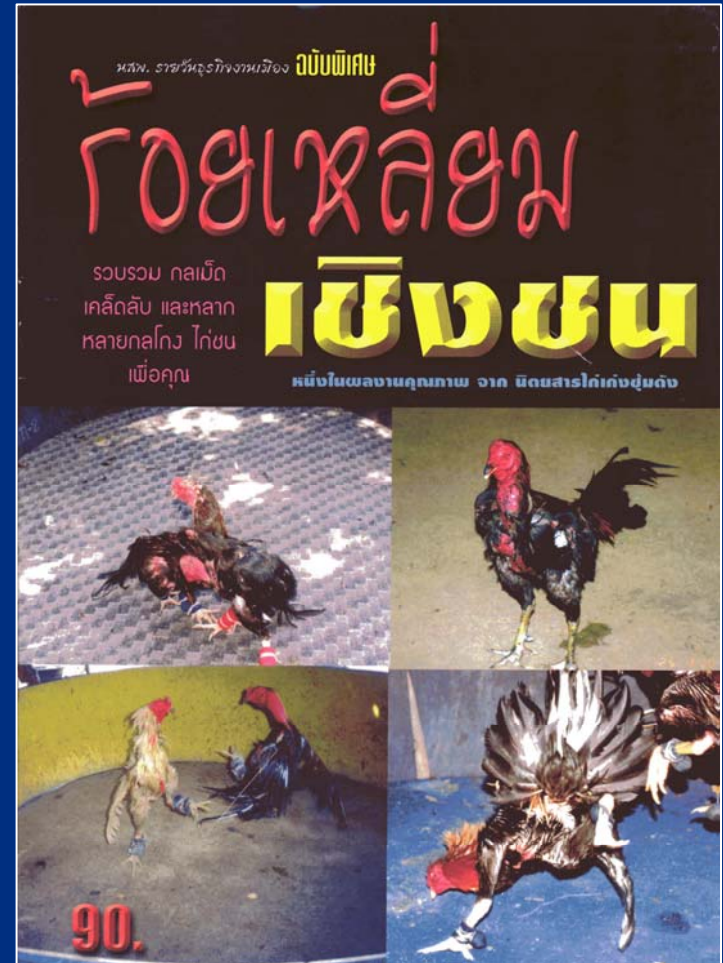
- **Captive birds**
  - Example: 2 eagles from Thailand through Germany to Belgium
- Possible but great distances reduce chances



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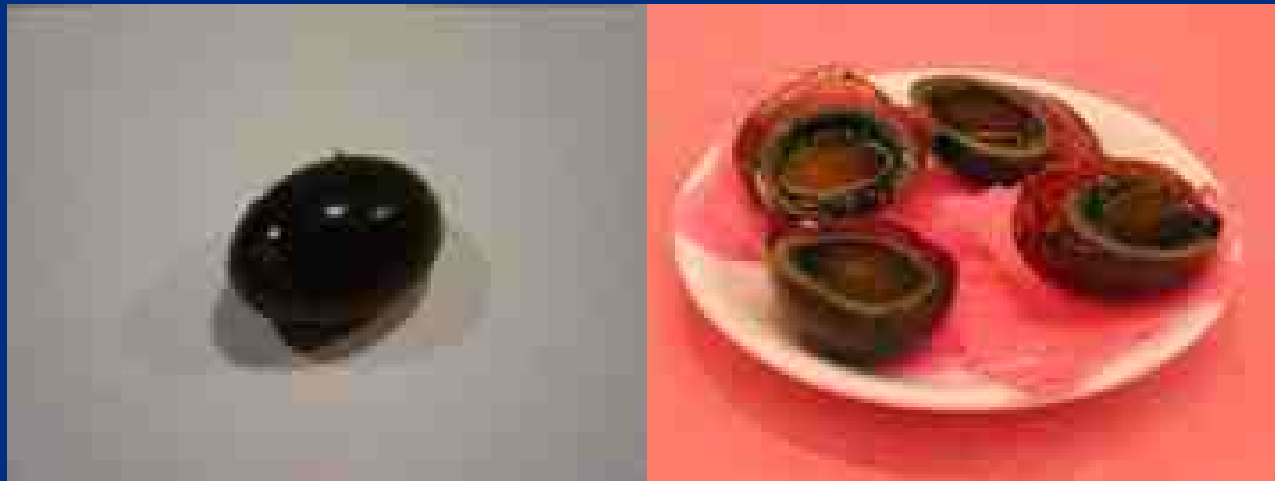
# Illegal Commerce

- **Fighting cocks**
  - Entry mechanism from Thailand to Malaysia
- **Possible risk**
  - vvNDV in Fresno CA in 2000, Asian Fighting Cocks



# Illegal Commerce

- **Raw or undercooked products**
  - DHS/PPQ – confiscation of products from Asia (pickled eggs, 1000 year eggs)
- **Possible risk but would require feeding of scraps to birds**



# International Movement



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# Human Vectors

- **Humans – infected (biological vectors)**
  - CDC surveys negative on passengers with respiratory symptoms
  - Most infections in poor rural people
  - Risk low – low probability of entry to USA
- **Humans – mechanical vectors (shoes & clothing)**
  - Low risk – poor rural unlikely to travel but tourist do. US tourist who travel to rural areas and could bring it back on shoes/clothes



# When a pandemic first appears...

- There will not be enough vaccine
- There will not be enough antivirals
- The health care system will be stretched beyond its limits
- Many sectors of society will begin to be affected: schools, businesses, large public gatherings, “just-in-time” commerce, air travel, and so on...

Source: HHS, William Hall, Director Press Office, 29 July, 2005



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# Recap—Avian Influenza

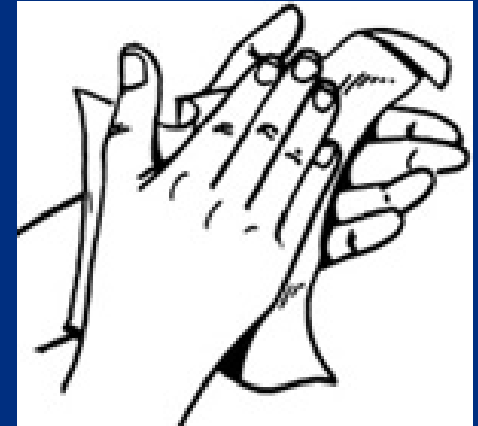
## Why is Avian Flu dangerous

- May infect large populations of birds and poultry
- Has infected humans exposed to diseased birds
- May mutate to cause human infection
  - At least 3 known cases determined in Asia
  - Human to human transmission potential
  - No natural human immunity
  - No current approved vaccine
  - Potential for a pandemic influenza
  - High mortality rate (100% poultry / 80% human)
  - Current antiviral drugs somewhat ineffective



# So...What YOU Can Do-Personally

- Wash your hands
  - Every opportunity with soap and water
  - Every opportunity with waterless hand cleaner
- Cover your mouth when you cough or sneeze
- Keep your environment clean
  - Disinfect surfaces
  - Common use items—door handles
  - Personal use items—your phone
- Teach your kids—they will likely bring it home to you
- Stay home when you are sick



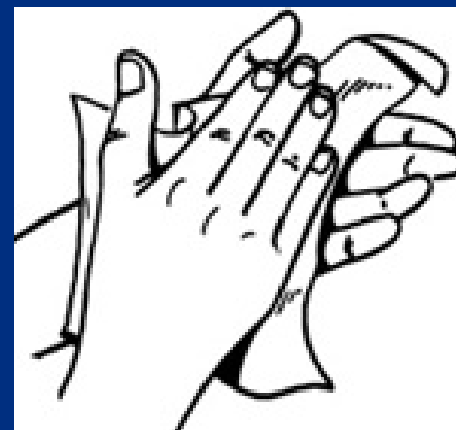
# So...What YOU Can Do- At Work

- Begin your planning **NOW**
  - What will you do if 1 out of 3 workers isn't there?
    - Determine essential operations (and which can be suspended)
    - Determine essential staff and cross-training of others for back-up
    - Personal Protective Equipment (PPE) for selected staff
    - Limit environmental exposures
      - avoid high risk areas
  - Basic policies like--who should people call when ill?



# So...What YOU Can Do- At Work

- Coordinate plans with others in community, business partners, essential services
- Explore alternate plans
  - Telecommute?
- Have the discussion (teach) your staff
  - Hand washing
  - Staying well
  - Keeping the environment clean
  - Staying home when sick



# If You Have People Traveling— Asian H5N1 HPAI

- **Exposure Risks for Infection: Assessment of H5N1 HPAI - human cases [HK 1997, Vietnam & Thailand early 2004]**
  - **Risk: exposure 1 week before illness to live poultry, direct contact w/sick poultry**
  - **Not a risk: travel, preparing or eating poultry meat, or exposure to human AI cases**
  - **Not involved in organized culling or large poultry farms**
  - **Cases were associated with Village (smallholder) poultry or Live Poultry Market**



# N-95 Mask



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# N-95 Mask



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# N-95 Mask



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# N-95 Mask



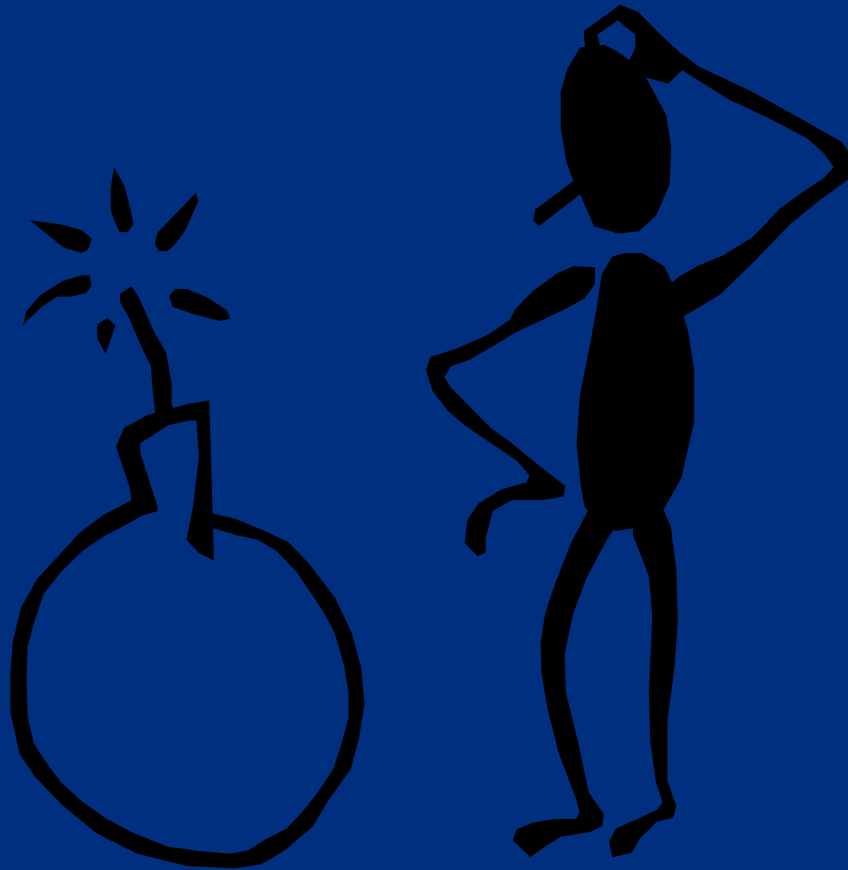
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# N-95 Mask



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# Questions ?????



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# Special THANKS to....

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