PANDEMIC INFLUENZA

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AVIAN INFLUENZA

- Influenza A viruses
- Birds are the reservoir
- Low pathogenicity strains (LPAI)
- High pathogenicity strains (HPAI)
- Domestic birds infected by wild birds
- Outbreaks in domestic birds lead to exposure of humans
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ORIGIN OF THE DISEASE

- H5N1, Hong Kong, 1997
- H9N2, China and Hong Kong, 1999
- H7N2, Virginia, 2002
- H5N1, China and Hong Kong, 2003
- H7N7, Netherlands, 2003
- H9N2, Hong Kong, 2003
- H7N2, New York, 2003
- H7N3, Canada, 2004
- H5N2, Texas, 2004
# AVIAN INFLUENZA

**Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO**

12 May 2006

| Country     | 2003 |         | 2004 |         | 2005 |         | 2006 |         | Total |
|-------------|------|---------|------|---------|------|---------|------|---------|-------|
|             | Cases| Deaths  | Cases| Deaths  | Cases| Deaths  | Cases| Deaths  | Cases| Deaths |
| Azerbaijan  | 0    | 0       | 0    | 0       | 0    | 0       | 8    | 5       | 8    | 5      |
| Cambodia    | 0    | 0       | 0    | 0       | 4    | 4       | 2    | 2       | 6    | 6      |
| China       | 0    | 0       | 0    | 0       | 8    | 5       | 10   | 7       | 18   | 12     |
| Djibouti    | 0    | 0       | 0    | 0       | 0    | 0       | 1    | 0       | 1    | 0      |
| Egypt       | 0    | 0       | 0    | 0       | 13   | 5       | 13   | 5       | 13   | 5      |
| Indonesia   | 0    | 0       | 0    | 0       | 17   | 11      | 16   | 14      | 33   | 25     |
| Iraq        | 0    | 0       | 0    | 0       | 0    | 0       | 2    | 2       | 2    | 2      |
| Thailand    | 0    | 0       | 17   | 12      | 5    | 2       | 0    | 0       | 22   | 14     |
| Turkey      | 0    | 0       | 0    | 0       | 0    | 0       | 12   | 4       | 12   | 4      |
| Viet Nam    | 3    | 3       | 29   | 20      | 61   | 19      | 0    | 0       | 93   | 42     |
| **Total**   | **3**| **3**   | **46**| **32**  | **95**| **41**  | **64**| **39**  | **208**| **115** |

Total number of cases includes number of deaths.

WHO reports only laboratory-confirmed cases.
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ETIOLOGY

- Influenza virus, types A, B and C
  - Single stranded RNA virus
  - Genome is segmented
  - Surface glycoproteins
    - Hemagglutinin (H), 16 antigenically distinct types
    - Neuraminidase (N), 9 antigenically distinct types
ETIOLOGY
- Avian influenza
  - H5, H7, H9
  - Transmission to humans
    - Close contact with fowl or excreta is necessary for infection of humans
    - Disease severity in humans is related to the pathogenicity of the avian virus
    - Humans have no immunity to these avian viruses
- Pandemic influenza A
  - When a human or an animal is infected with a human and an avian influenza virus, the segmented genome allows for reassortment of genes
  - Reassortment of genes between strains may produce a new strain which is readily transmitted among humans
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- EPIDEMIOLOGY
  - Epidemic and pandemic strains of influenza virus usually emerge in the Far East and other areas in Asia
    - Each year, the CDC identifies the likely strains of virus that may circulate in the U.S.
    - Epidemic strains emerge as the result of small changes in the antigenic make-up of influenza A viruses (drift)
    - When a major antigenic change occurs (shift), this may be due to a reassortment of genes between a human virus and an avian virus, and this may result in a pandemic
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- EPIDEMIOLOGY
  - Outbreaks of avian influenza in domestic birds in North America and Europe have led to limited transmission to humans who have usually developed conjunctivitis.
  - Outbreaks of influenza in domestic birds in North America and Europe have been rapidly contained.
  - The greatest concern is that reassortment will occur in the Far East and lead to a pandemic strain that will be rapidly transmitted around the world by air travel.
| Bird population | Human population |
|-----------------|------------------|
| Poultry with influenza A (H5N1) | Coflowected human cell |
|                  | Influenza A (human strain) |
|                  | New reassorted virus strain |
|                  | Coflowected pig cell |
| Pig population | New reassorted virus strain |
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- Epidemiology
  - Reservoir – birds
  - Source – infected people
    - Persons with clinical manifestations
    - Persons in late incubation period not yet manifesting signs and symptoms
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- EPIDEMIOLOGY
  - Modes of transmission
    - Large droplets
    - Direct contact with infectious secretions
    - Airborne (droplet nuclei) transmission may occur but is less common than the other 2 modes of transmission
  - Portals of entry
    - Nose
    - Mouth
    - Conjunctivae
  - Risk factors
    - No data
Acute respiratory distress syndrome
Necrosis
Tissue destruction
Influx of leukocytes
Dilatation of blood vessels

H5N1 influenza virus
Epithelial cells
Macrophage
Virus replication and release
Activated macrophage

Viral peptide
Immunoreceptor
Activated T cell
Uncontrolled exuberant immune response

Chemoattractants proinflammatory cytokines
Proinflammatory cytokines

Activated macrophage

Acute respiratory distress syndrome
Necrosis
Tissue destruction
Influx of leukocytes
Dilatation of blood vessels
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CLINICAL MANIFESTATIONS

- Fever most common first symptom
- Dyspnea occurs at a median of 5 days (range 1-16 days)
- All patients have fever, cough and dyspnea during the initial evaluation
- Almost half have diarrhea and myalgia
- Intermittent high fevers and persistent cough productive of thick sputum during hospital course
- Later course
  - Respiratory failure (75%)
  - Cardiac failure (42%)
  - Renal dysfunction (33%)
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- LABORATORY TESTS
  - Leukopenia (58%)
  - Lymphopenia (58%)
  - Thrombocytopenia (33%)
  - Serum Creatinine rise to > 1.5 mg/dL (33%)

- CHEST X-RAYS
  - All patients had abnormal chest x-rays
  - Progressed to ARDS in two thirds of patients, all of whom died
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DIAGNOSIS

- Culture of nasopharyngeal specimen obtained by swab or wash
- Detection of antibodies to influenza virus
- Detection of influenza in nasopharyngeal specimen by rapid antigen test
- New real-time RT-PCR test recently approved by the FDA
  - Test distributed to the Laboratory Response Network (LRN) laboratories
  - Results available in 4 hours
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- TREATMENT
- Adamantanes
  - Amantadine
  - Rimantadine
  - Effective only against influenza A viruses
  - Many strains of avian influenza virus are resistant to the Adamantanes
- Neuraminidase inhibitors
  - Effective against both influenza A and B
  - Effective against strains of avian influenza
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- TREATMENT
- Neuraminidase inhibitors
  - Zanamivir
    - Administered by inhalation
    - Recently approved for prophylaxis (March 29, 2006)
  - Oseltamivir
    - Administered orally
    - Approved for prophylaxis
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PREVENTION

- Emerging Infectious Diseases Response Program:
  - Patients who present with fever, cough and dyspnea will be queried about travel to a country or exposure to a person who traveled to a country with known avian influenza activity in the 10 days before onset of symptoms
  - Patients will remain on isolation for 14 days
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PREVENTION

- Emerging Infectious Diseases (EID) Response Program:
  - Healthcare workers will be under surveillance for 7 days after last contact with a patient with avian influenza
  - Healthcare workers will be immunized against epidemic influenza
  - Oseltamivir may be used for prophylaxis of patients and healthcare workers
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PREVENTION

Emerging Infectious Disease Policies (EIDs)

3.1 – Screening Policy for Persons with a Possible Emerging Infectious Disease (EID)

3.2 – Isolation of Patients with an Emerging Infectious Disease (EID) or Possible EID

3.3 – Transportation of Patients with an Emerging Infectious Disease (EID) or Possible EID

3.4 – Imaging Studies for Emerging Infectious Disease (EID) Patients
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PREVENTION
Emerging Infectious Disease Policies (EIDs)

3.5 – Emerging Infectious Diseases (EID) Protocol for Pediatrics
3.6 – Admission of Patients with an Emerging Infectious Disease (EID) to the Hospital
3.7 – Visitation Policy for Patients with an Emerging Infectious Disease (EID)
3.8 – Protection During the conduct of High-Risk Respiratory Procedures in Patients with an Emerging Infectious Disease (EID)
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PREVENTION
Emerging Infectious Disease Policies (EIDs)

3.9 – Post Exposure Monitoring of UTMB Employees for an Emerging Infectious Disease (EID)
3.10 – Communication on Emerging Infectious Diseases (EIDs) Between the Department of Healthcare Epidemiology and the Galveston County Health District
3.11 – Communications with the Media and the Public About an Emerging Infectious Disease (EID)
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PREVENTION

Emerging Infectious Disease Policies (EIDs)

3.12 – Environmental Cleaning and Disinfection of Rooms Where Patients with an Emerging Infectious disease (EID) Have Been Hospitalized or Treated

3.13 – Detection and Disposition of Outpatients with a Suspected Emerging Infectious Disease (EID)

3.14 – Processing Equipment and Instruments Contaminated by an Emerging Infectious Disease (EID) Agent in the Sterile Processing Department
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PREVENTION
Emerging Infectious Disease Policies (EIDs)

3.15 – Laundry Protocol for Washing Linens Contaminated with an Emerging Infectious Disease (EID)
3.16 – Protection Against an Emerging Infectious Disease (EID) in the Dietary Service
3.17 – Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Emerging Infectious Diseases (EIDs)
3.18 – Investigation and Management of Incidents of Unprotected Exposure to Cases of an Emerging Infectious Disease (EID)
3.19 - Preparation and Transport of Deceased Patients with an Emerging Infectious Disease (EID)
Exit Room & Wash Hands
(or alcohol gel)
Wash Hands
(or alcohol gel)