Preparation For A Possible Human Outbreak Of Avian Flu

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Outline of Presentation

- Understanding Flu and Avian Flu
- The Threat of Avian Flu for Human
- Current status of the spread of Avian Flu
- Preventive measures
- Protection against Avian Flu
- The WHO and HK Flu Alert Schemes and the Singapore Flu Pandemic Business Continuity Guide
- Organizational effort
- Individual Effort

Influenza: the Virus and the Illness

INFLUENZA: BIOLOGY & IMPACT

Regular seasonal flu causes 3 - 5 million serious illness cases with 10% fatalities world wide, affecting mostly people >65 years old

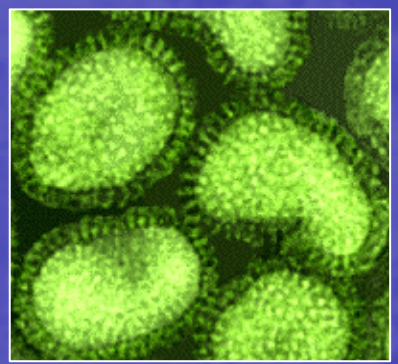
Single-stranded, enveloped, RNA viruses (orthomyxoviridae family)

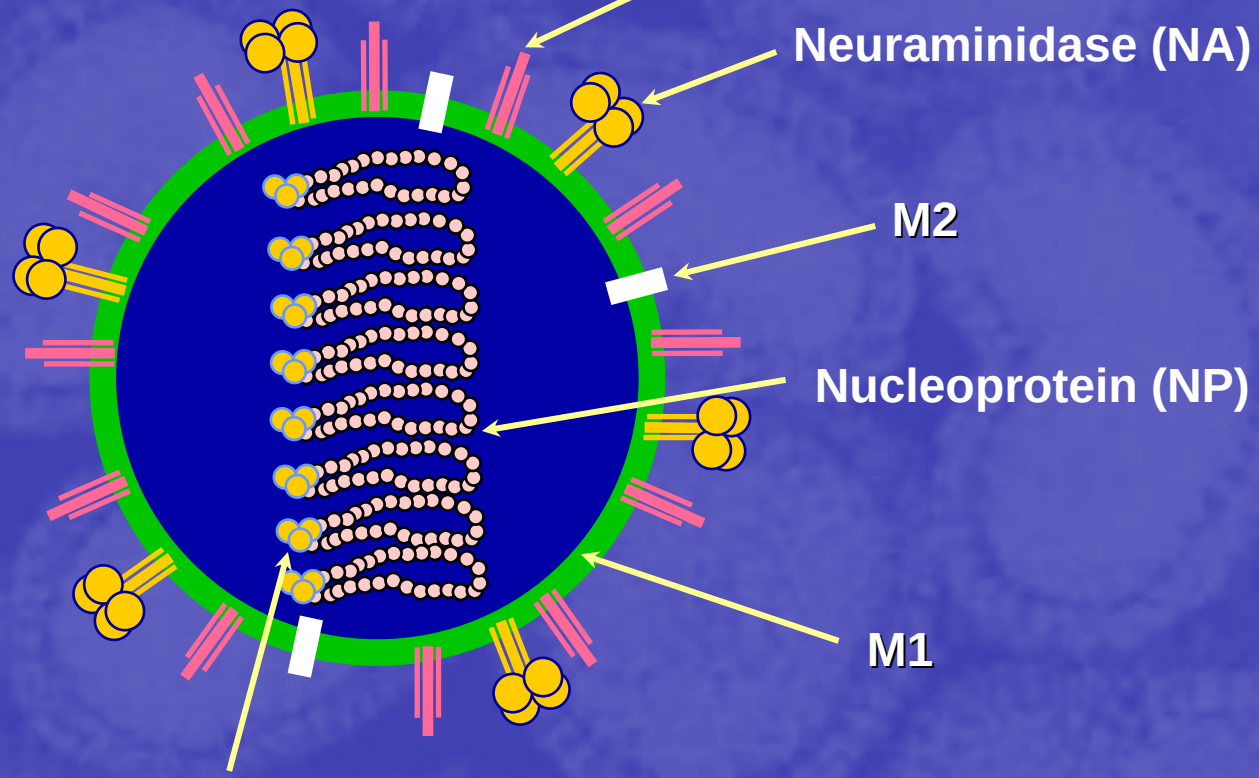
- Influenza A
  - Potentially severe illness; epidemic and pandemics
  - Rapidly changing
- Influenza B
  - Usually less severe illness; may cause epidemics
  - More uniform
- Influenza C
  - Usually mild or asymptomatic illness

Influenza A – Special Characteristics

- Most worrisome of established infection diseases
- Includes circulating seasonal flu and avian flu
- “Sloppy, Capricious and Promiscuous”
  - Poor job in copying genetic material during self replication
  - Genetic materials divided into 8 gene segments for easy exchange of genetic material with another virus
  - Infect many hosts: man, pig, horses, sea mammals, birds, etc
- Keeps on changing genetic materials to evade host immunological defense mechanisms

Structure of the Influenza Virus





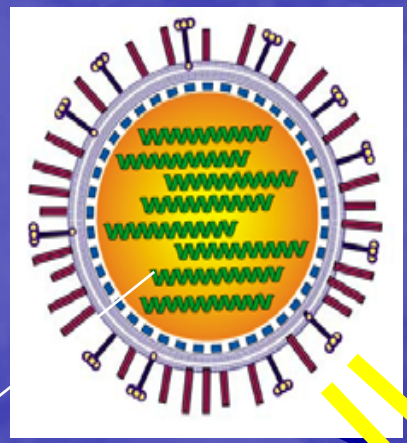
Adapted from: Hayden FG et al. *Clin Virol.* 1997:911-42.

What are “H” and “N”?

Antigenic determinants of different viral strains

- Hemagglutinin (HA, H)
  - Spike protein on viral envelop
  - 16 types (H1 – H16)
  - Only some of H5 & H7 cause serious diseases
  - Responsible for viral attachment onto host cells to start infectious process
- Neuraminadase (NA, N)
  - Spike protein on viral envelop
  - 9 types (N1 – N9)
  - Responsible for viral detachment from host cells to further execute the infection process.

Viral Nomenclature



Type of Nuclear Material

Hemagglutinin

Neuraminidase

A / Sydney / 184 / 93 (H3N2)

Virus type

Geographic origin

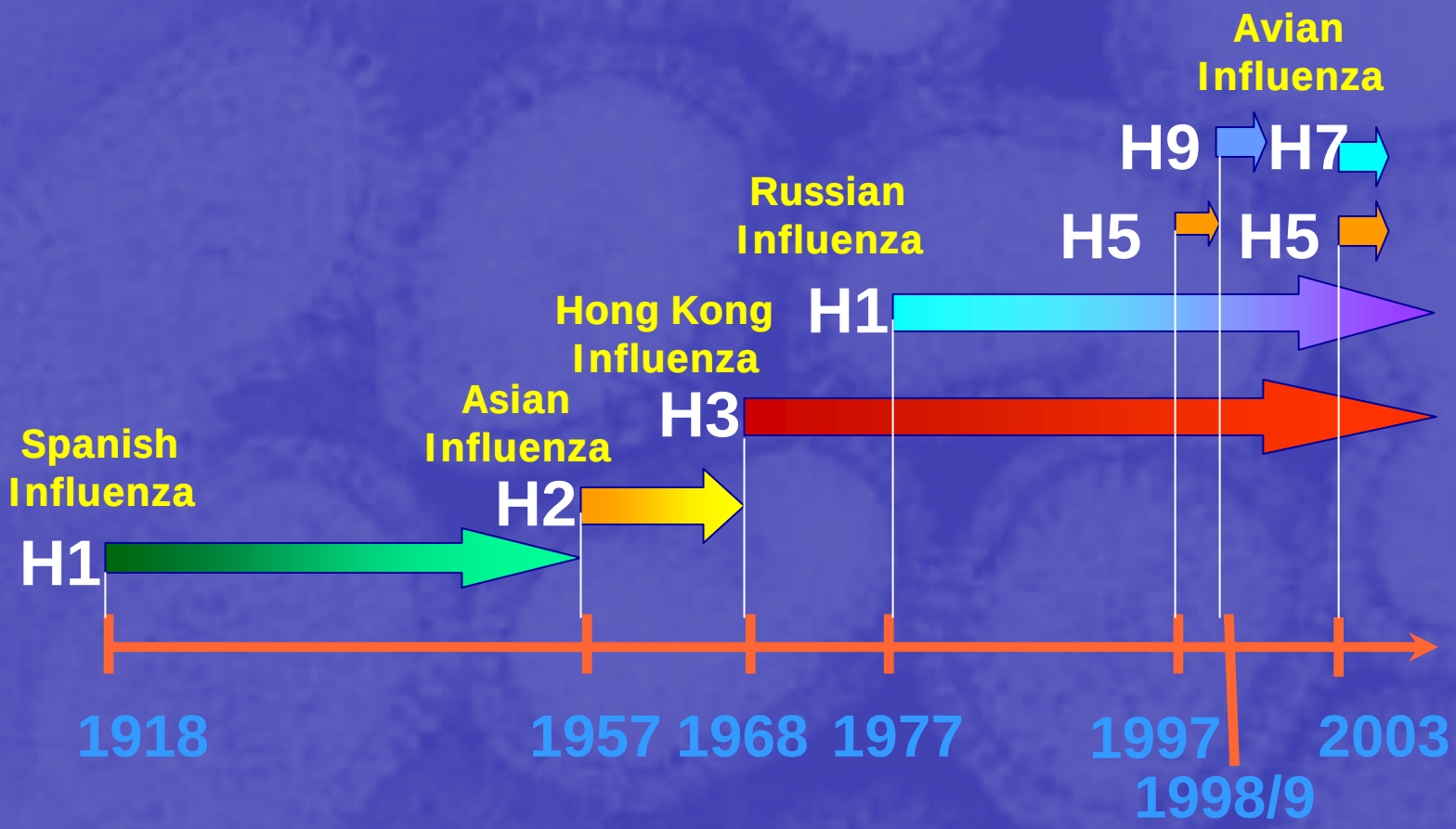
Strain number

Year of isolation

Virus subtype

CDC. Atkinson W, et al. Chapter 13: Influenza. In: Epidemiology and Prevention of Vaccine-Preventable Diseases, 4th ed. Department of Health and Human Services, Public Health Service, 1998, 220

Timeline of Emergence of Influenza A Viruses in Humans

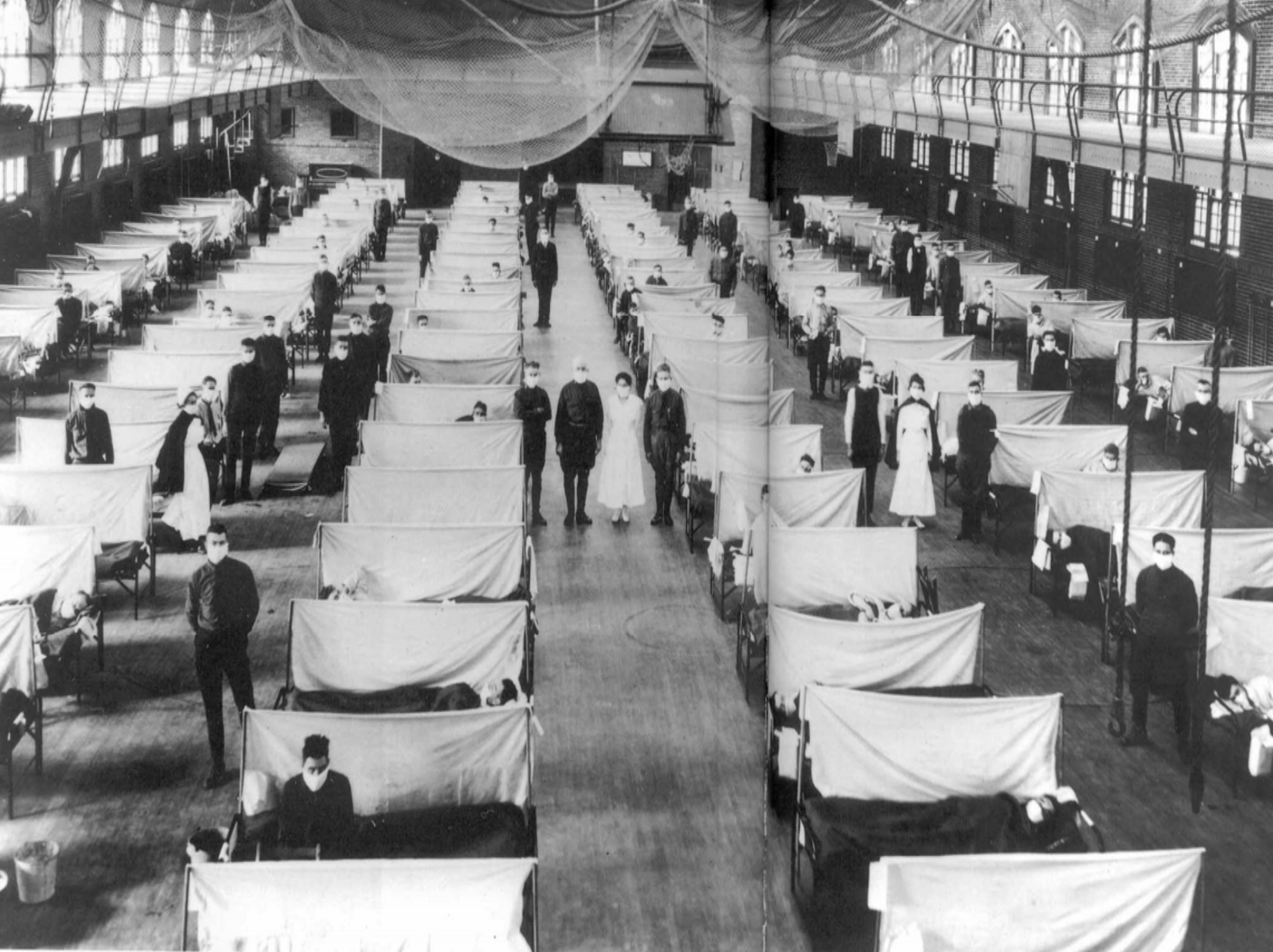


INFLUENA PANDEMICS IN THE 20th CENTURY

Years	Virus	Mortality	Greatest Risk	Spread from Asia to US
1918-1919 "Spanish"	Type A H1N1	20,000,000 to 40,000,000	Young, healthy adults	Unknown
1957-58 "Asian"	Type A H2N2	>1,000,000	Infants, elderly	4-5 mo
1968-69 "Hong Kong"	Type A H3N2	700,000	Infants, elderly	2-3 mo

Note: Total WWI fatalities from all sides - 8.3 million

HHS Pandemic Influenza Plan, October 2005

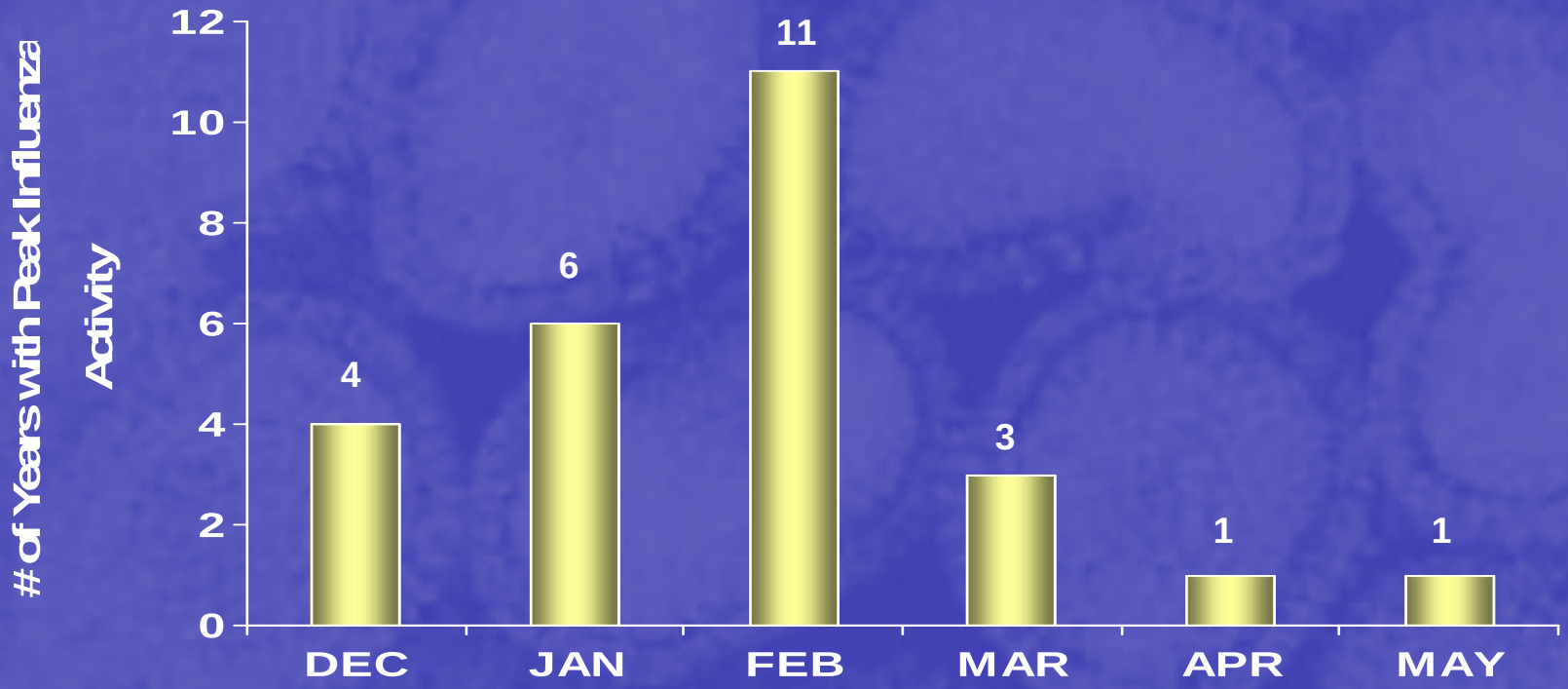


Criteria For A Start Of Pandemic Flu

- New virus for which the general population has no immunity against (H5N1 has never circulated in man)
- Ability for virus to replicate in humans and cause serious health effects (human cases confirm this ability)
- Ability for virus to spread efficiently from human to human (?)

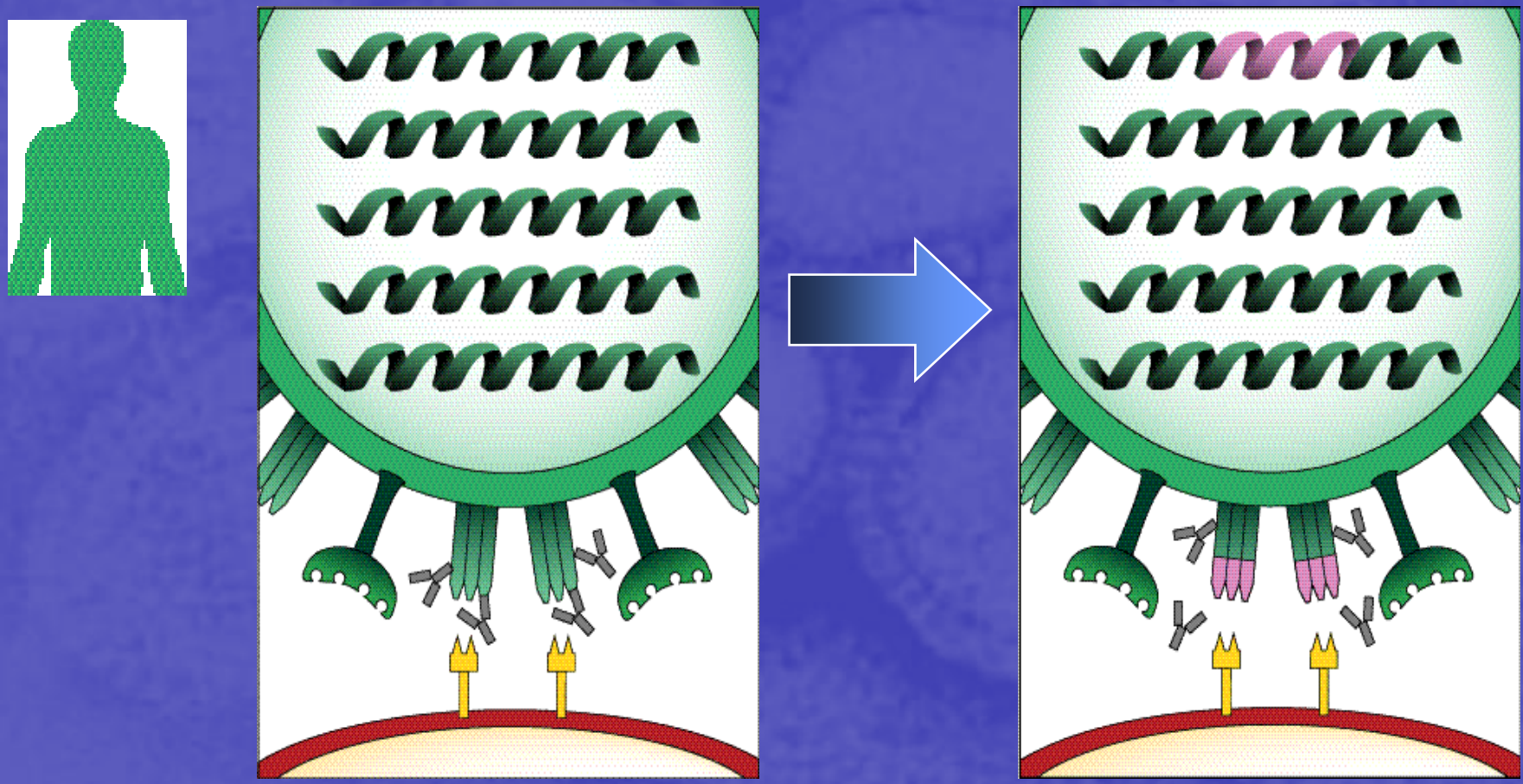
Influenza Activity Can Peak From December Through May

Month of peak influenza activity during influenza seasons in the United States, 1976–2002

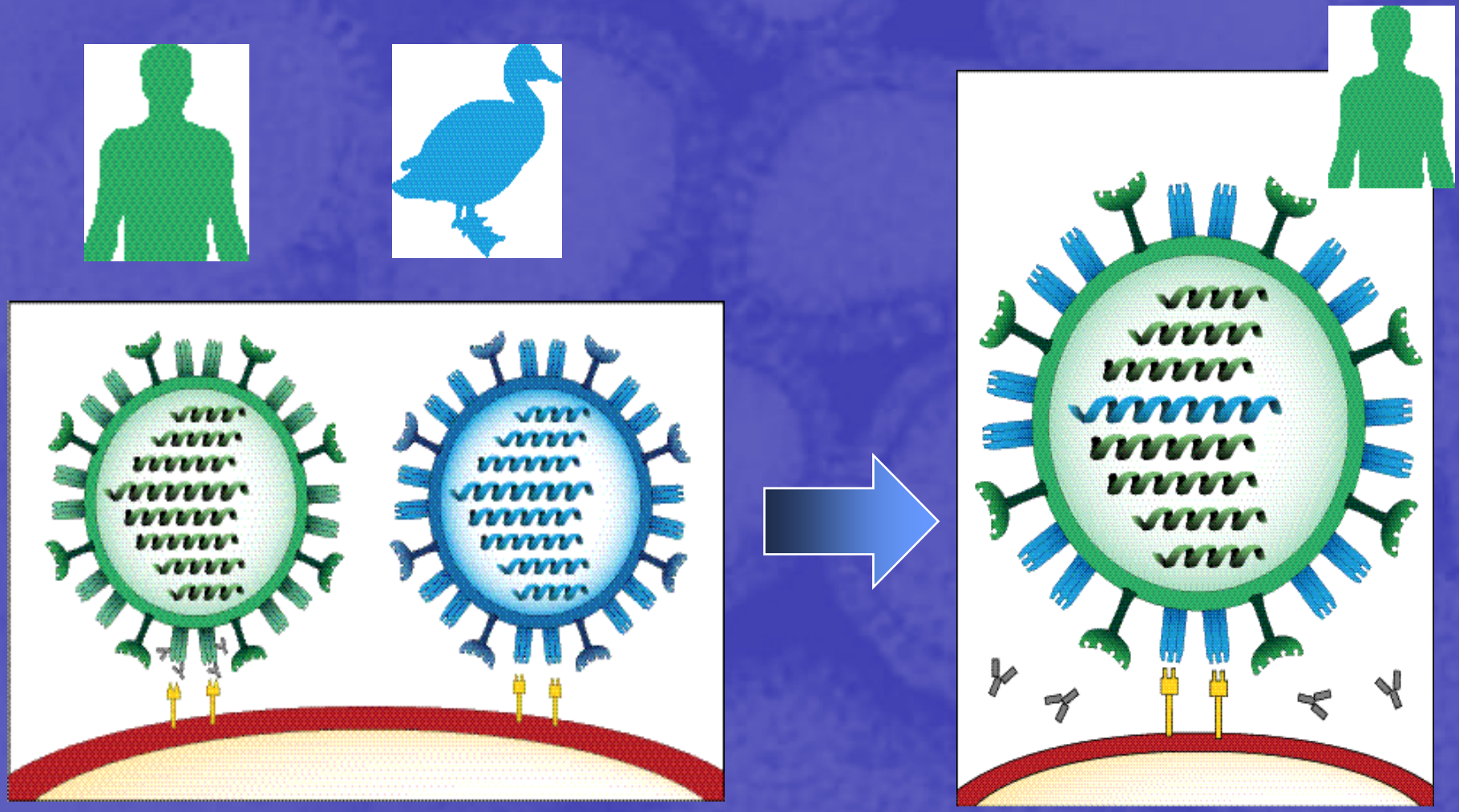


www.cdc.gov/nip/publications/pink/flu.pdf.

Influenza viruses undergo frequent minor change of antigenic determinants - Antigenic Drift



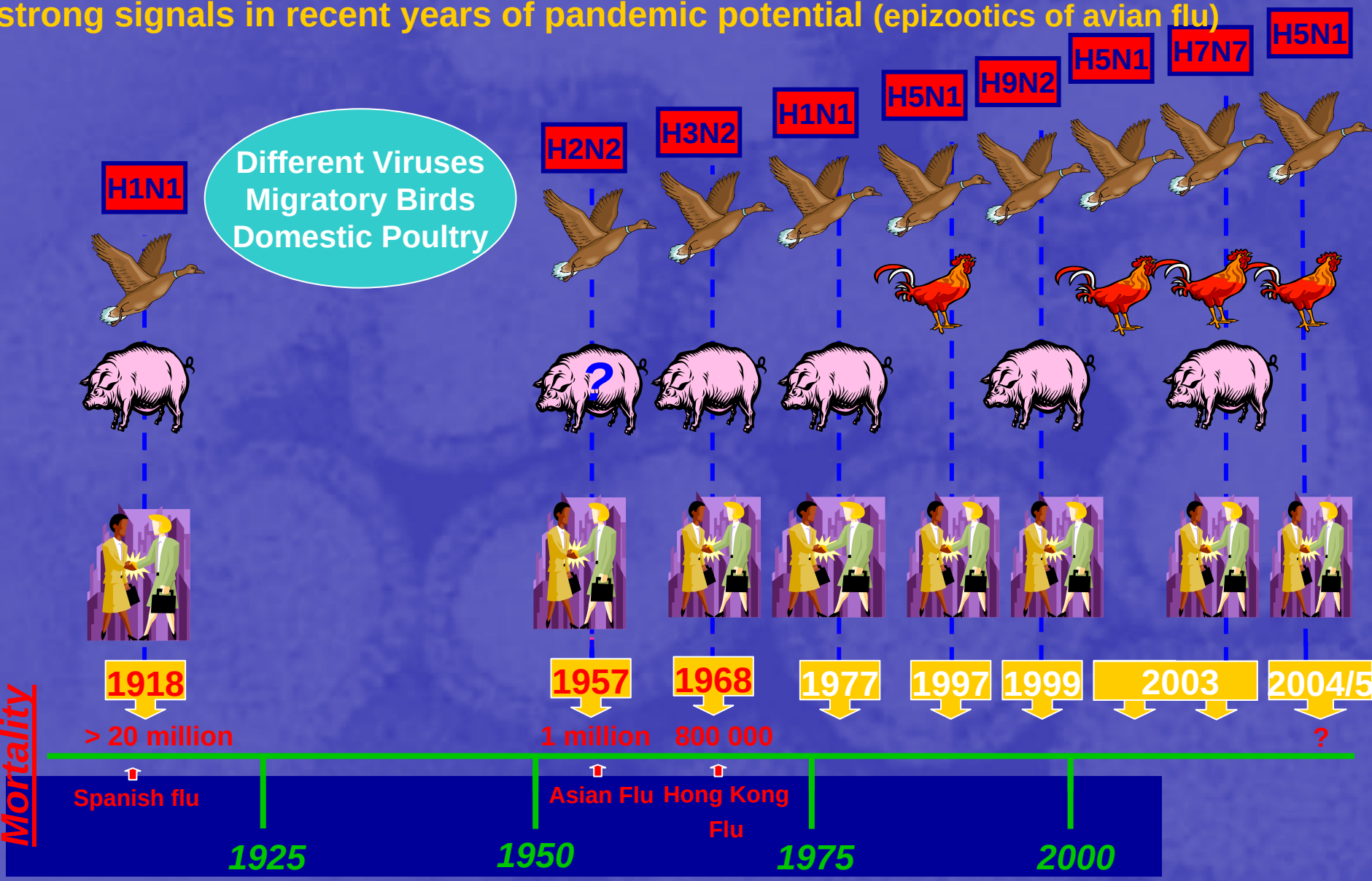
Influenza viruses undergo infrequent major change of antigenic determinants - Antigenic Shift



Influenza – "Shift"

Why the Concern?

During the past 100 years, there have been three major pandemics, and there are strong signals in recent years of pandemic potential (epizootics of avian flu)



History of the H5N1 (1)

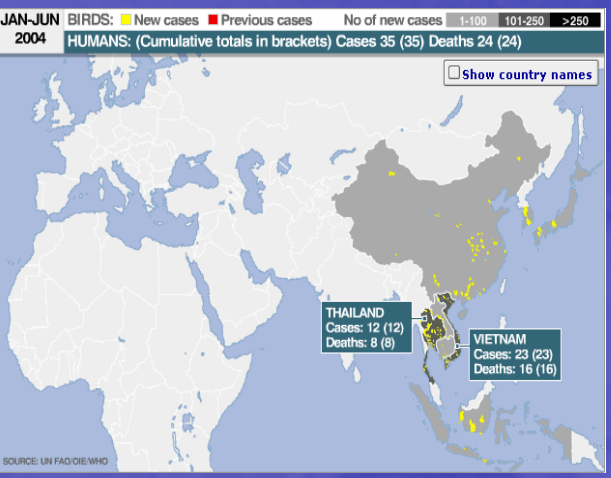
- First isolated in 1961 in South Africa
  - Present in wild birds and chickens
  - No serious illness
  - Continue to mutate
- 1997
  - Deadly from appeared in HK
  - 1.5 million chickens killed
  - 18 people infected with 6 fatalities
  - Did not surface again until 2003

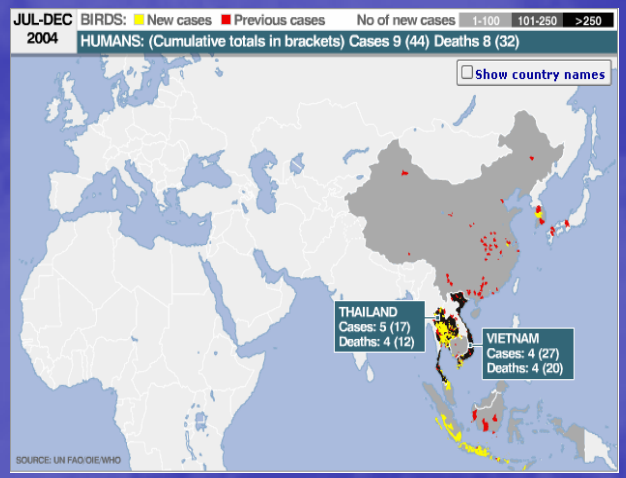
History of the current H5N1 spread

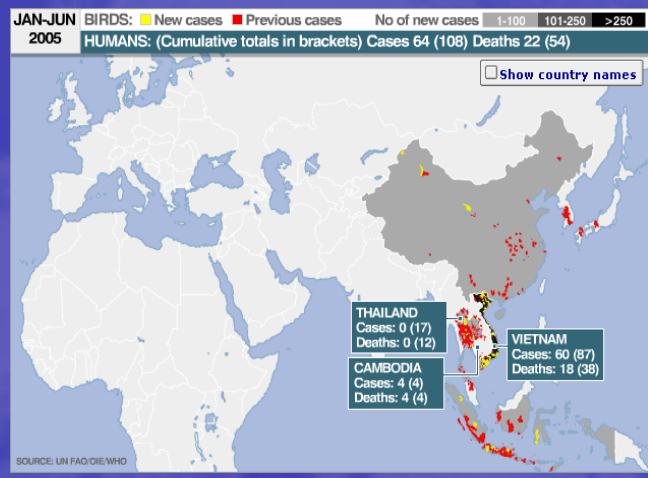
- 2003
  - Chickens infected in South Korea
  - Father and son died in HK after visiting China, daughter also died of respiratory illness in China without testing
  - Chickens infected in Vietnam
- 2004
  - Chickens infected infected in Japan
  - Chickens infected in Indonesia, Thailand and Vietnam
  - Human cases in Thailand
- 2005 - Now
  - Continued spreading to other places

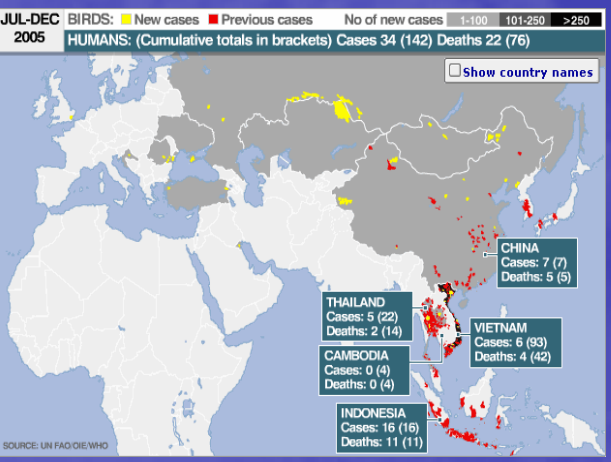
The Current Situation with the H5N1 Avian Flu

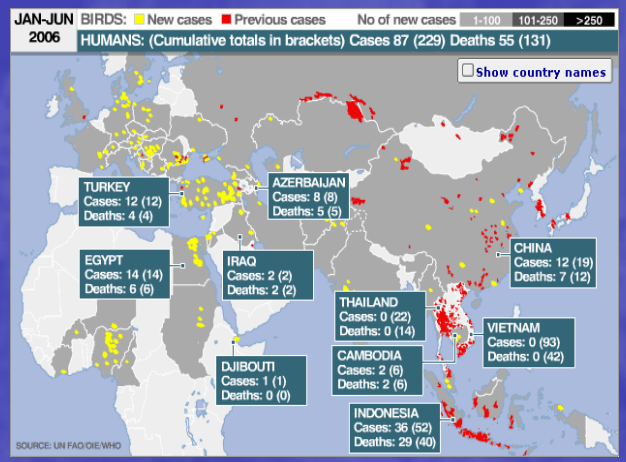
Time line of the spread of the 2003 Avian Flu Epidemic

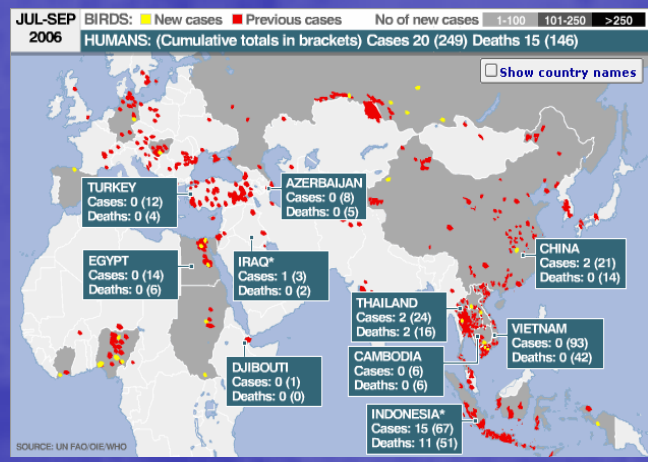












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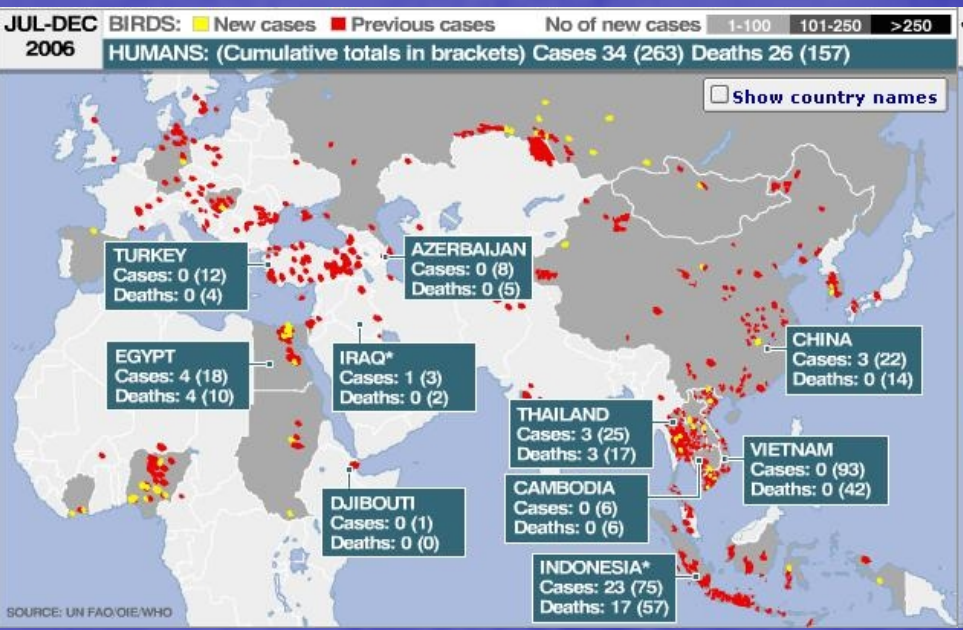
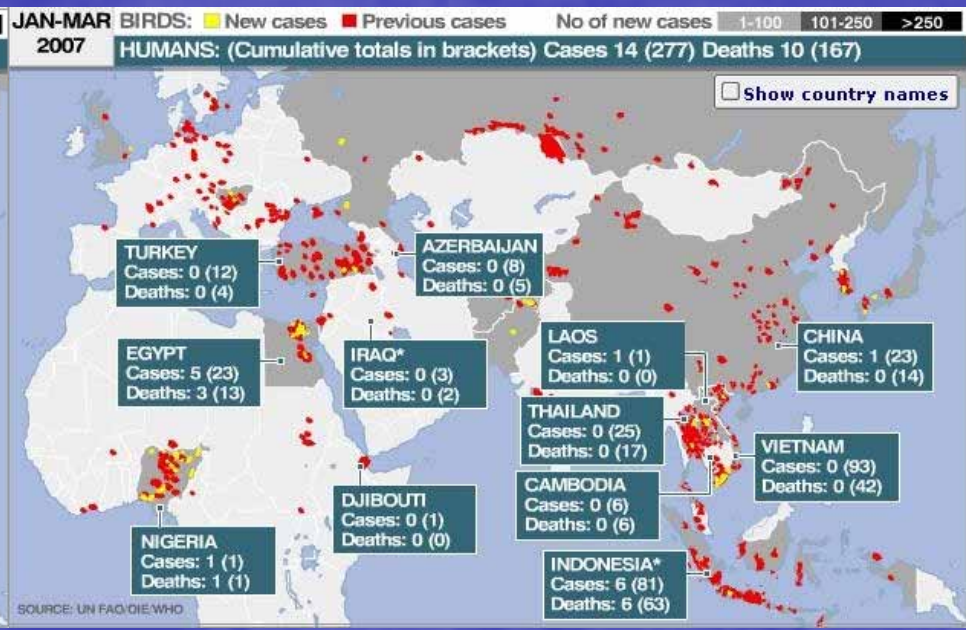
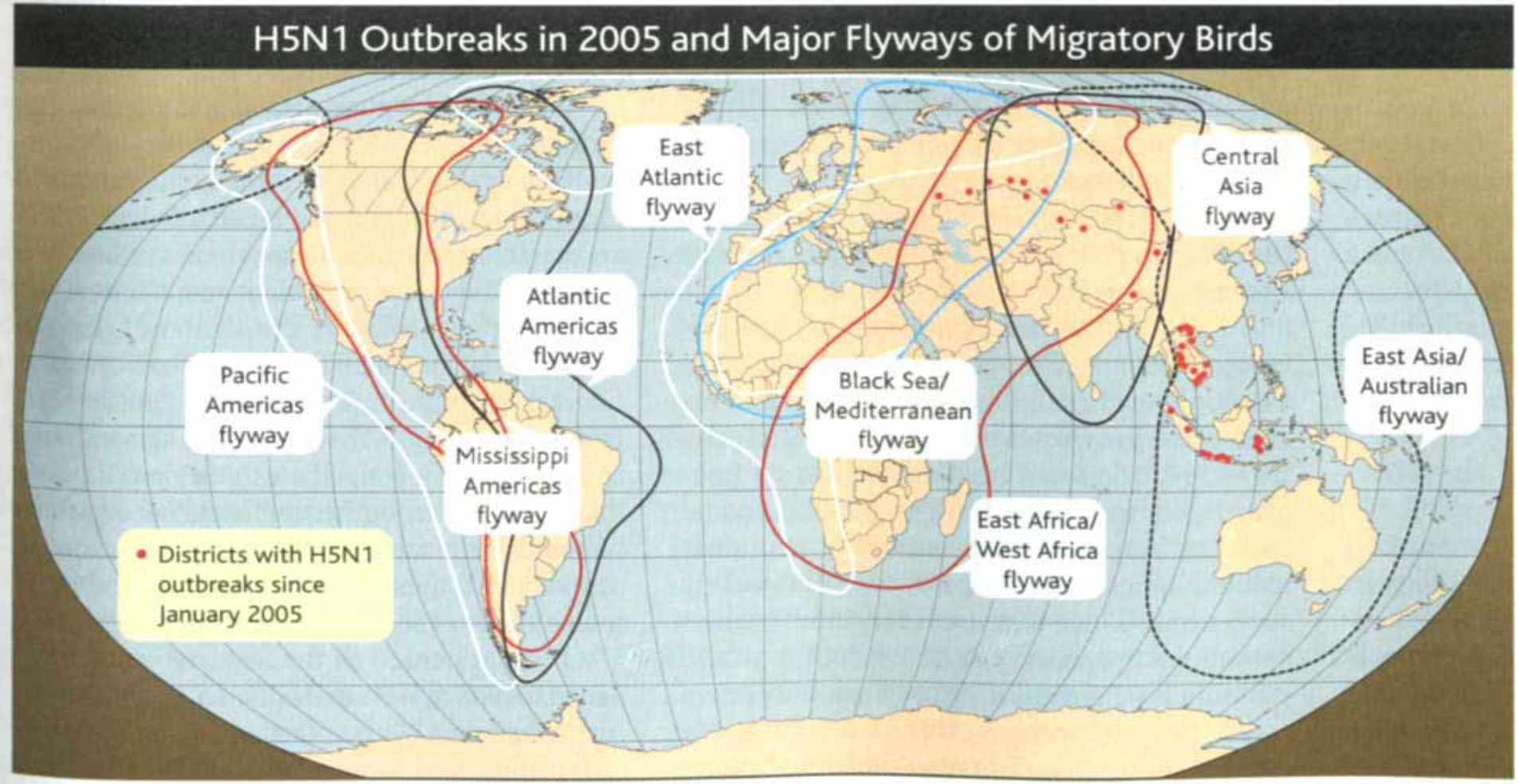






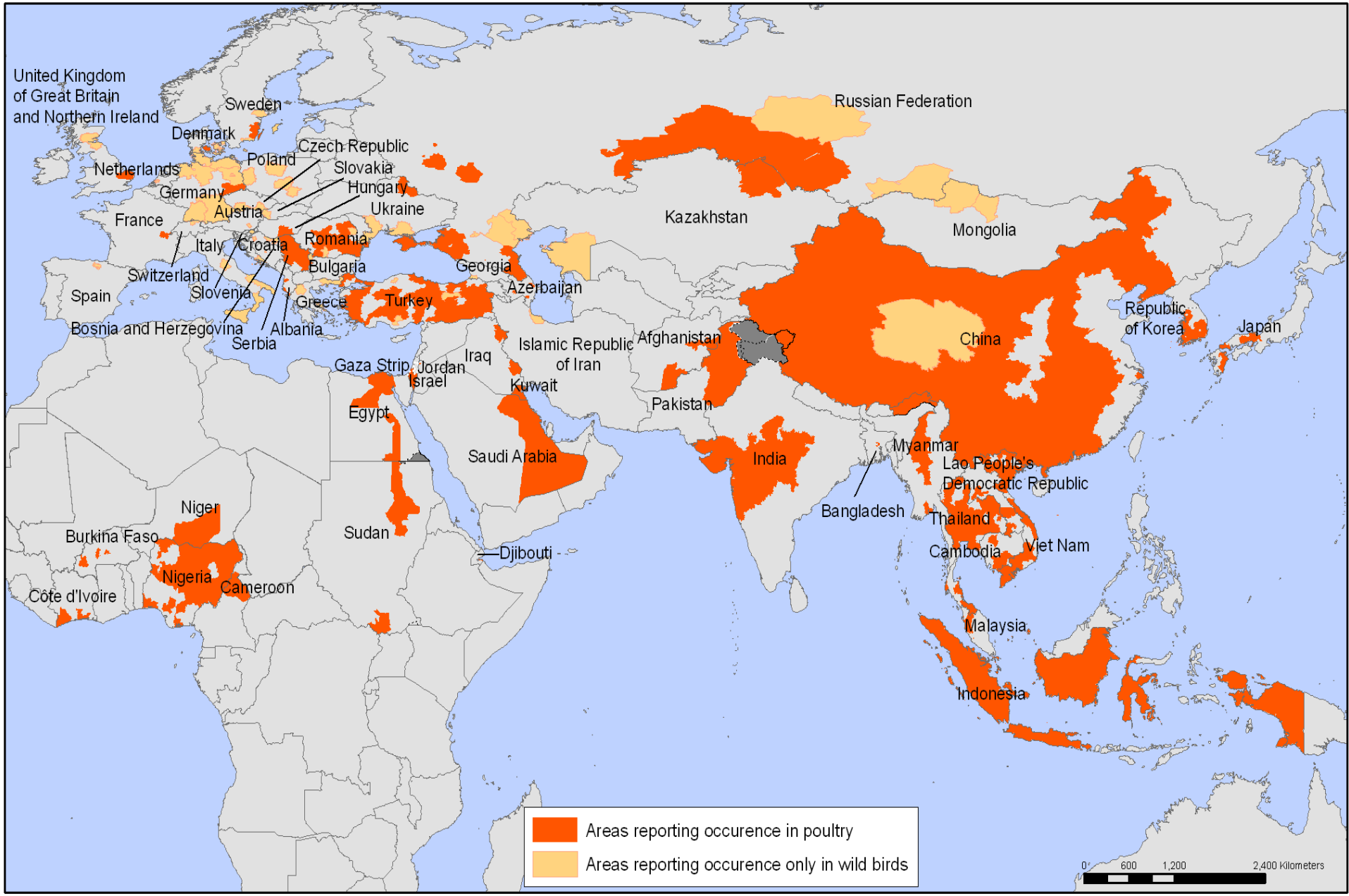
On the fly. Flyways might seem to connect the dots of H5N1 outbreaks, but the timings and locations aren't a perfect fit with known migratory patterns.





Areas reporting confirmed occurrence of H5N1 avian influenza in poultry and wild birds since 2003

Status as of 1 April 2007
Latest available update



World Health Organization

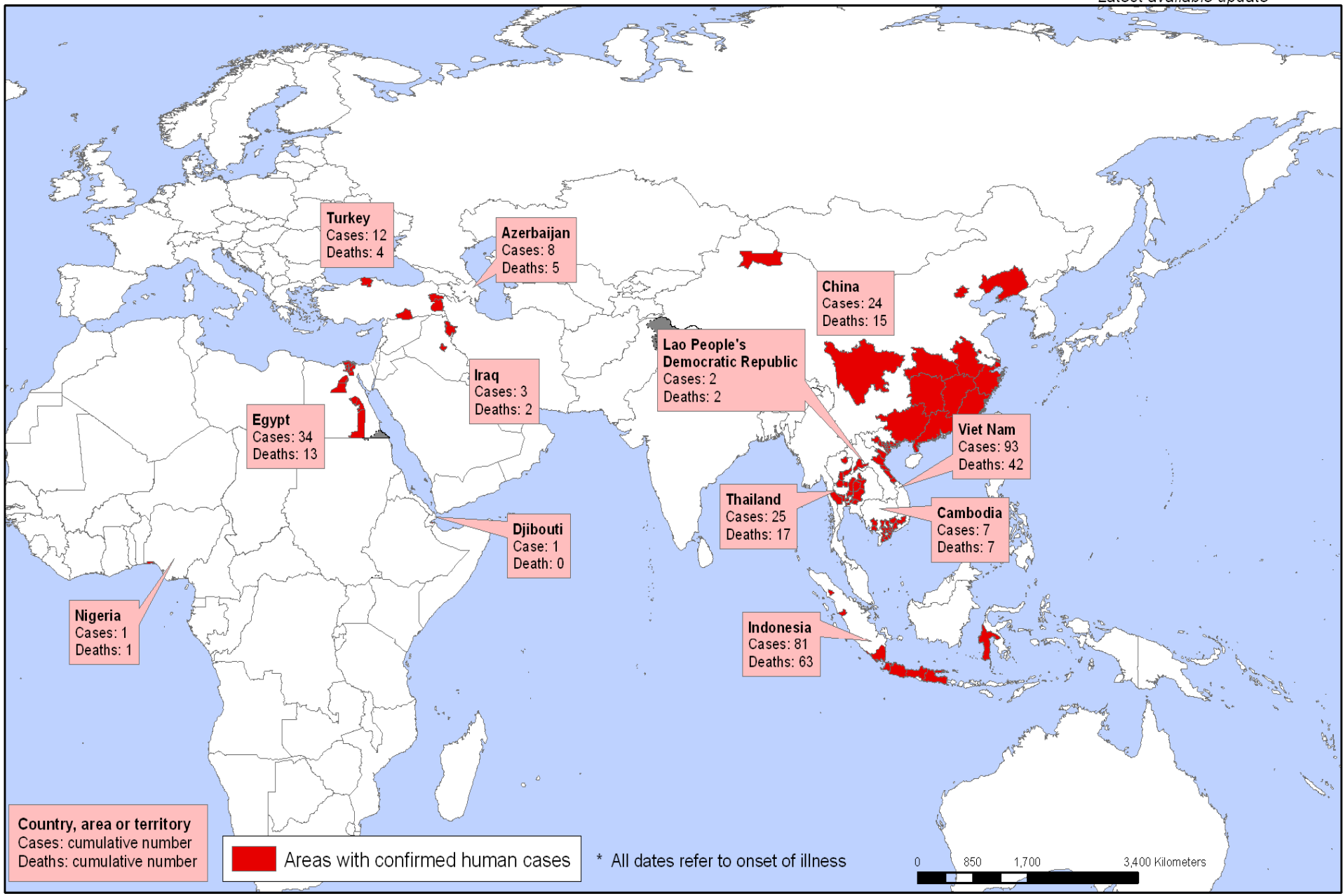
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Organisation for Animal Health (OIE) and national governments

Map Production: Public Health Mapping and GIS
Communicable Diseases (CDS) World Health Organization

Areas with confirmed human cases of H5N1 avian influenza since 2003 *

Status as of 10 April 2007
Latest available update



Data Source: WHO / Map Production: Public Health Mapping and GIS
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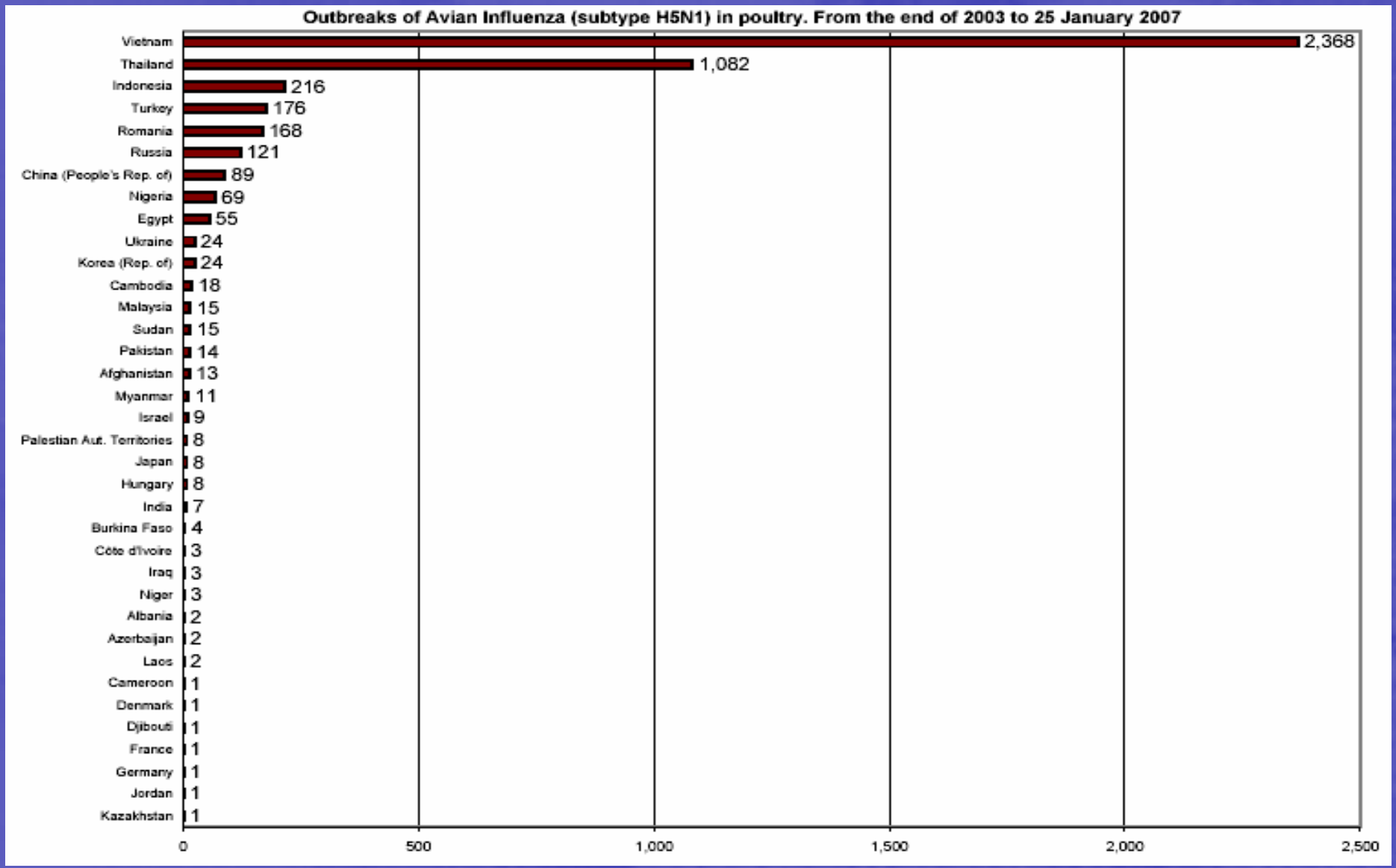
Avian Flu Outbreaks in Poultry 2003-2007



Global statistics of avian influenza
(As of 11 April 2007)

Table 1: Confirmed Human Cases of Avian Influenza A (H5N1) Reported to WHO

Country	2003		2004		2005		2006		2007		**Total**	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Azerbaijan	0	0	0	0	0	0	8	5	0	0	8	5
Cambodia	0	0	0	0	4	4	2	2	1	1	7	7
China	1	1	0	0	8	5	13	8	2	1	24	15
Djibouti	0	0	0	0	0	0	1	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	16	4	34	14
Indonesia	0	0	0	0	20	13	55	45	6	5	81	63
Iraq	0	0	0	0	0	0	3	2	0	0	3	2
Laos	0	0	0	0	0	0	0	0	2	2	2	2
Nigeria	0	0	0	0	0	0	0	0	1	1	1	1
Thailand	0	0	17	12	5	2	3	3	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	12	4
Vietnam	3	3	29	20	61	19	0	0	0	0	93	42
Total	4	4	46	32	98	43	115	79	28	14	291	172

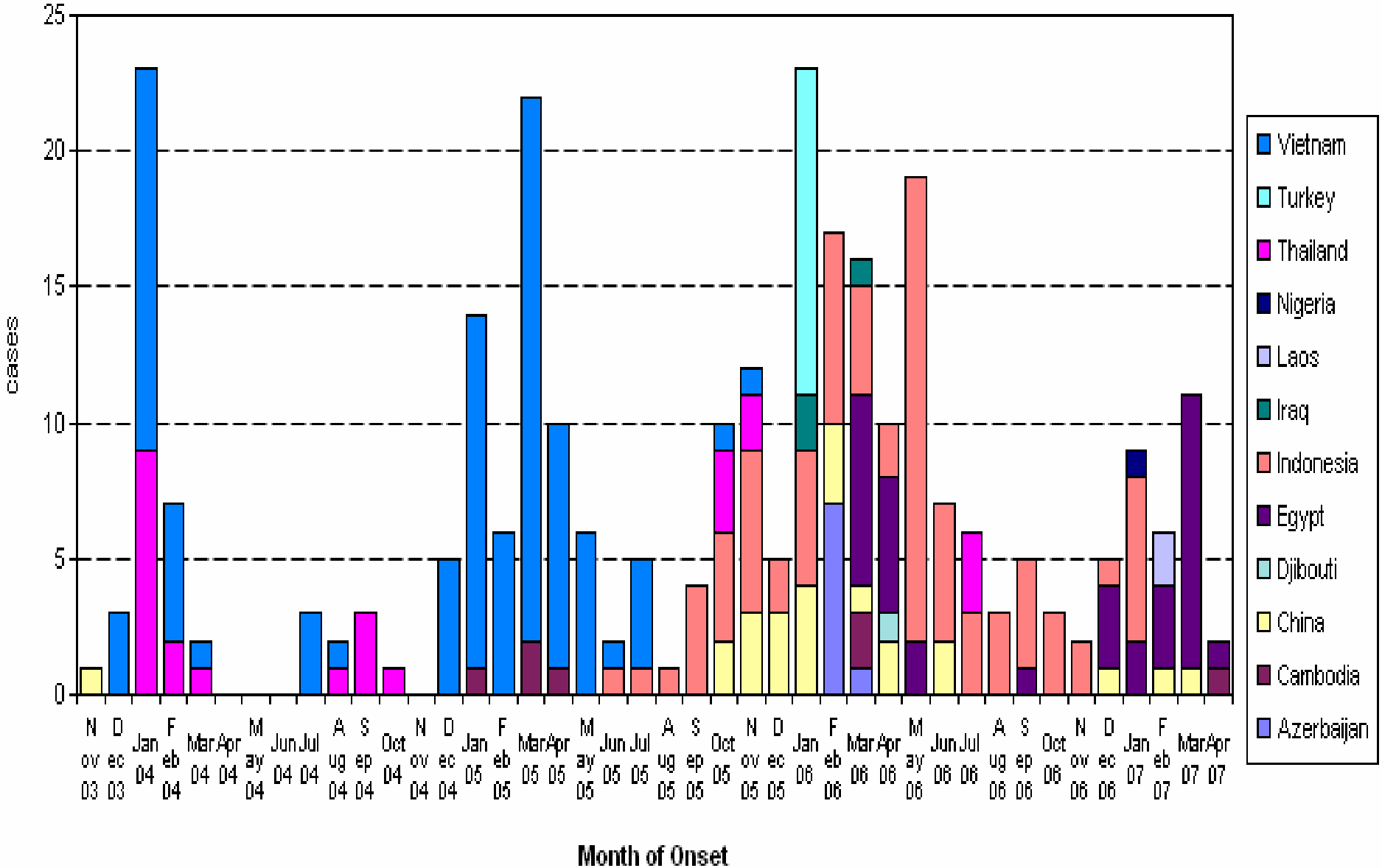
The most recently confirmed cases of human avian influenza were reported to the WHO from Cambodia and Egypt on 10 April 2007.

Table 2: Countries / areas with documented avian influenza H5 infection in birds and human in the recent 6 months

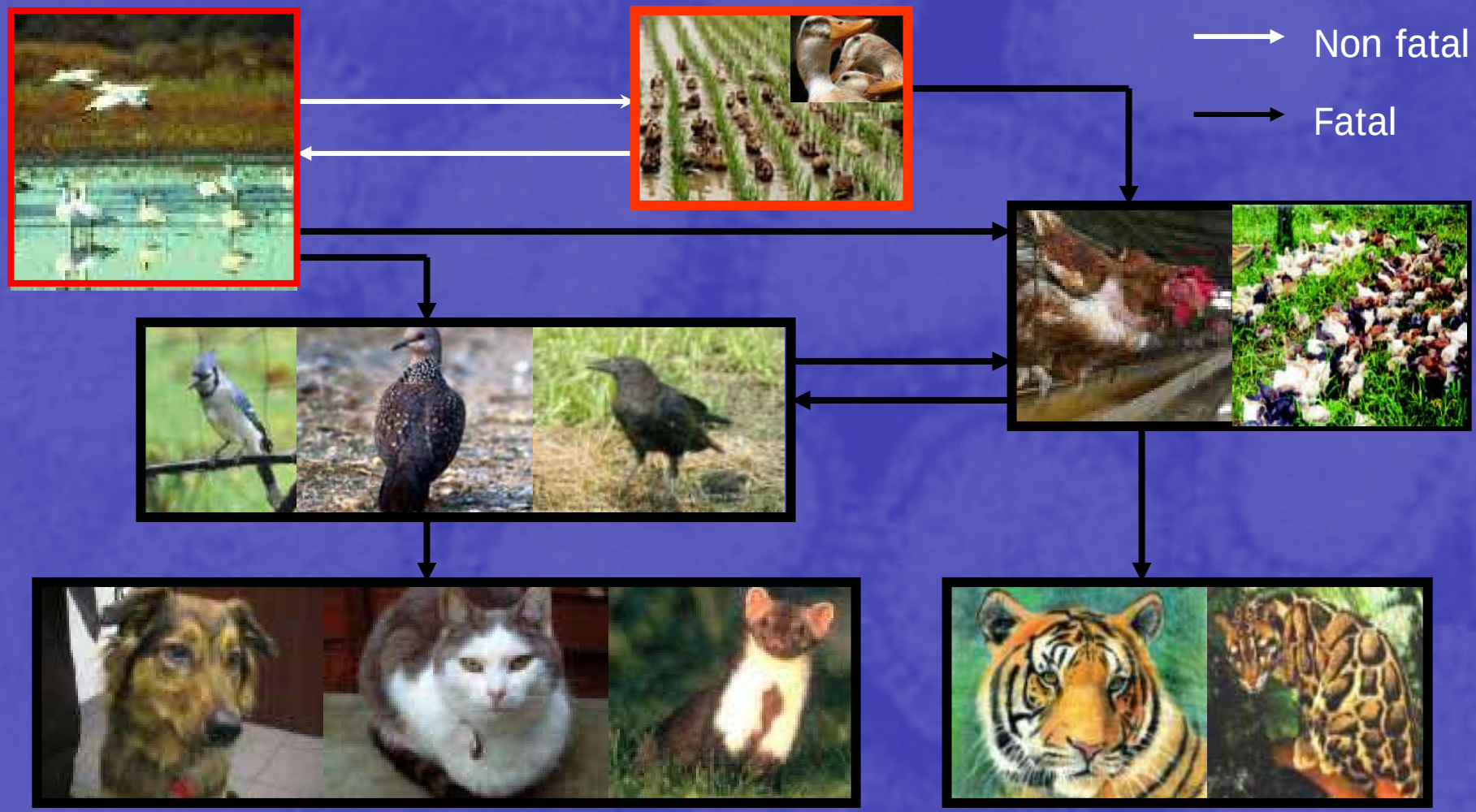
Country/ Area	Date of last report of human or animal case	Human H5	Poultry H5	Wild bird H5
Afghanistan	2007-03-14	N	Y	N
Bangladesh	2007-03-30	N	Y	N
Cambodia	2007-04-10	Y	N	N
China				
Anhui	2007-03-29	Y	N	N
Fujian	2007-03-01	Y	N	N
Hong Kong #	2007-03-09	N	N	Y
Inner Mongolia	2006-10-04	N	Y	N
Ningxia	2006-10-04	N	Y	N
Tibet	2006-03-06	N	Y	N
Egypt	2007-04-10	Y	Y	Y
Hungary	2007-02-12	N	Y	N
Indonesia	2007-01-29	Y	Y	N
Japan	2007-01-30	N	Y	N
Korea	2007-03-08	N	Y	N
Kuwait	2007-03-13	N	Y	N
Laos	2007-03-16	Y	Y	N
Myanmar	2007-04-01	N	Y	N
Nigeria	2007-02-03	Y	N	N
Pakistan	2007-04-11	N	Y	N
Russia	2007-03-19	N	Y	N
Saudi Arabia	2007-03-31	N	Y	N
Sudan	2006-10-02	N	Y	N
Thailand	2007-03-19	Y	Y	N
Turkey	2007-03-01	N	Y	N
United Kingdom	2007-02-16	N	Y	N
United States of America	2007-04-03	N	Y*	N
Vietnam	2007-04-02	Y	Y	N

(Remarks: Y: Yes; N: No)Source: WHO and OIE # Source: The Agriculture, Fisheries and Conservation Department, Hong Kong* Low pathogenic avian influenza subtype H5N2 was detected in a poultry farm in West Virginia. Last revision date: 12 April, 2007

Confirmed human cases of avian influenza A/(H5N1) by date of onset and country up to date
(Data as of 11 April 2007)



Spread of H5N1 from infected migratory water fowl to wild birds, poultry and mammals



The Latest Human Cases in China

- 17 year Anhui old boy developed symptom on March 17, hospitalized on March 20 and died on March 27

- A 37-year old Chinese man from Tunxi in Anhui Province became symptomatic on 10 December 2006 and was hospitalized on 17 December 2006. The patient was discharged on 6 January and is recovering well. He was a farmer and may have kept a number of birds in his back yard

11日，当地政府和医卫人员上门慰问痊愈出院的患者

The Latest situation in Hong Kong

- H5N1 has been tested positive from dead birds (22/1/07)

Japanese white-eye found in San Po Kong

House crow found in Sham Shui Po

White backed munia found in Mong Kok

Scaly breasted munia in Shamshuipo

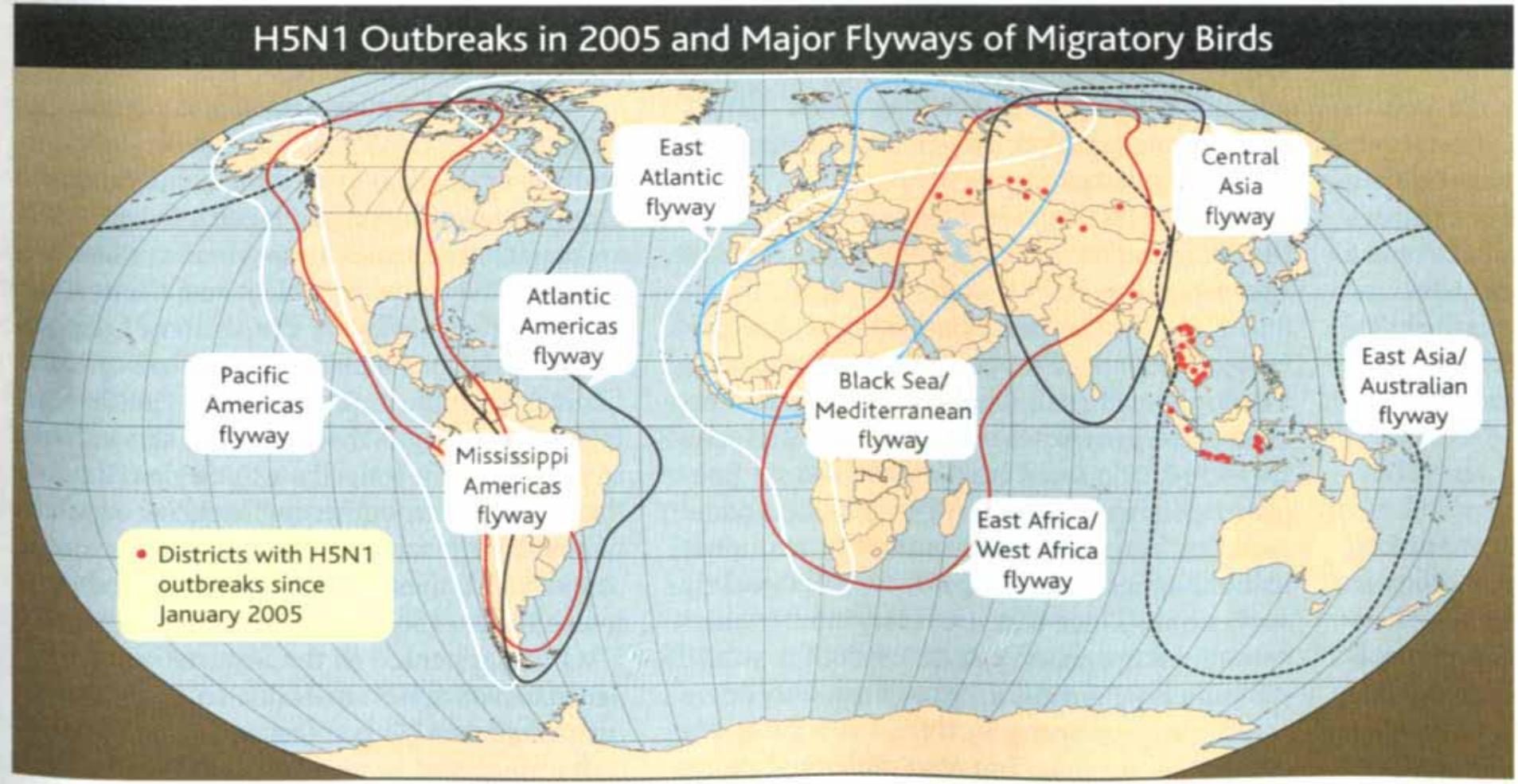
Long tail shrike in Hung Hum

peregrine falcon found in Tsuen Wan - suspected case of H5N1 – 25/1/07

No Poultry or Human H5N1 Cases Have Been Found In North or South America

Avian Flu in America

- Recent North America Outbreaks of
  - H7N3 in Canada 2004
  - H7N2 in New York 2003
  - H5N2 in Texas
  - H7N2 in Delaware, New Jersey & Maryland 2004
- No H5N1 outbreak in North or South America
  - Why?



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Criteria For A Start Of Pandemic Flu

- New virus for which the general population has no immunity against (H5N1 has never circulated in man)
- Ability for virus to replicate in humans and cause serious health effects (human cases confirm this ability)
- Ability for virus to spread efficiently from human to human (?)

Has Human to Human transmission been established?

Current situation:

- Most human cases result from contact with sick birds or poultry
- Possible sibling transmission in Vietnam case
- Possible family transmission in Hong Kong/China case
- Few highly exposed poultry workers infected (None in 1997 HK outbreak)
- No transmission to health care workers through unprotected contact with avian flu patients although antibodies developed (low transmission efficiency?)

Has Human to Human transmission been established? – The Indonesian Cluster

- in Kubu Simbelang village, Karo District, North Sumatra
- 8 members of an extended family got infected, 7 of them died
- Initial case – 37 year old female who kept chicken at home and allow them to enter her house at night
- Used chicken feces as fertilizer in her garden
- 3 of her chickens died before she became ill
- While severely symptomatic, she spent night in small room with 9 people, among them her 2 sons and a brother (who is the only survivor) were infected
- A sister and her daughter who cared for the initial case got infected
- A boy who frequently visited the house of the initial case was infected and his father who cared for him also was infected
- No hospital staff infected (some without adequate personal protective equipment

FACTORS LEADING TO CONCERN OF AN H5N1 Human INFLUENZA PANDEMIC (1)

- Avian H5N1 is widespread and endemic in Asia
- Fast spread to Russia, Middle-east, Europe and Africa
- Avian H5N1 is becoming more deadly in a growing number of bird and mammals species
- Wild birds and domestic ducks may be asymptomatically infected
- Sick birds upon recovery can continue to shed the virus for 10 days

FACTORS LEADING TO CONCERN OF AN H5N1 Human INFLUENZA PANDEMIC (2)

- The virus is able to transmit directly from wild birds to some mammals and in some circumstances to people
- Sporadic spread directly from farmed animals to humans; suspected human-to-human transmission in rare instances
- Infected human can shed virus prior to fever
- Genetic studies demonstrated ongoing evolution of H5N1

Preventing the Spread of the Avian Flu

Preventive Measures

Different levels of transmission prevention:

- Wild birds to domestic fowls
- Among domestic fowls
- Wild birds to livestock
- Wild birds to man
- Domestic fowls/livestock to man
- Man to man

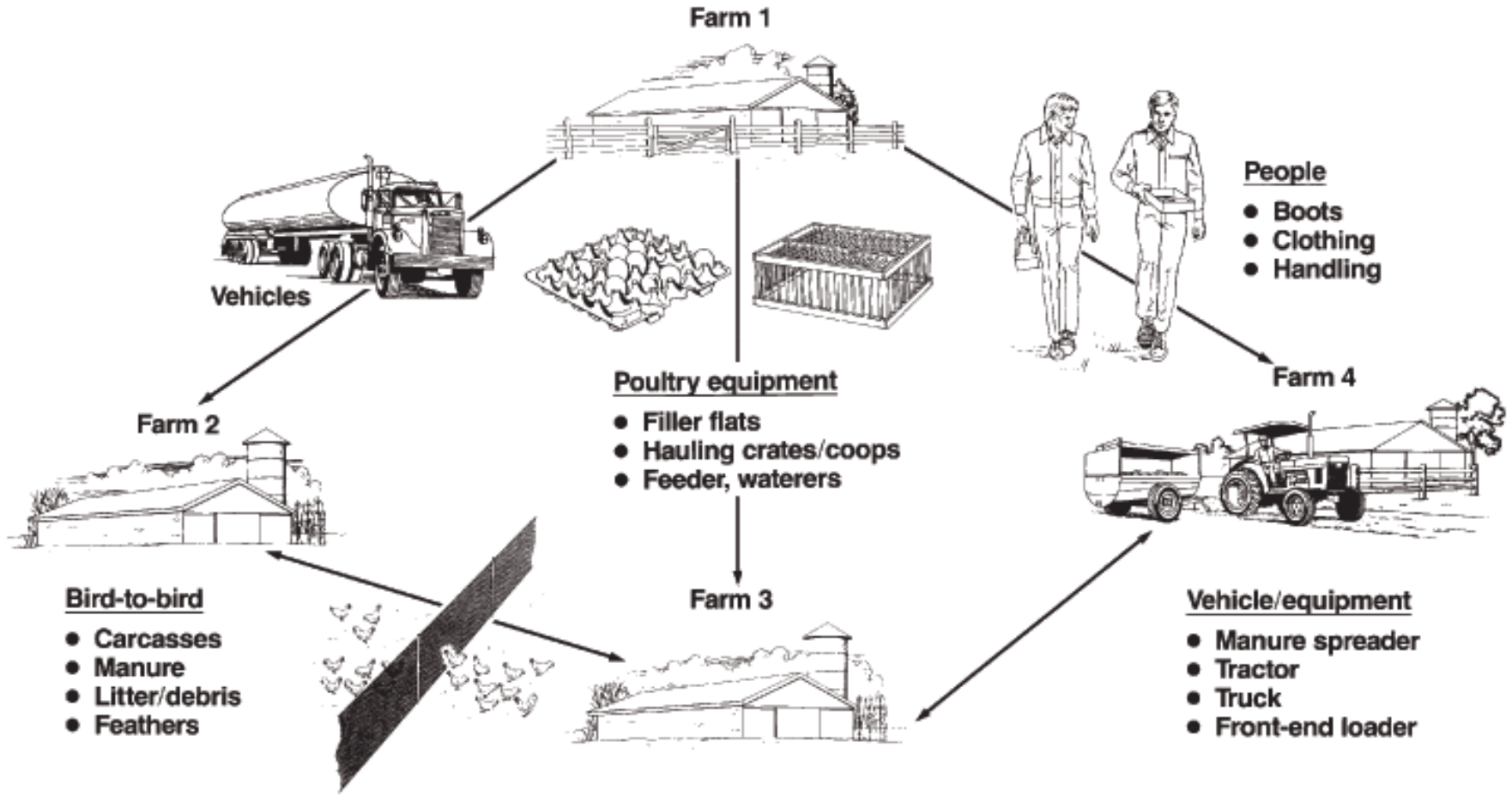
Prevention Effort

- International – WHO
  - Monitoring, coordination, investigation, laboratory test, information dissemination, guidance and support, etc
- National – CDC, CHP, Health Ministries
  - Involvement in: national policy, plans for monitoring and reporting, contact tracing, quarantine, screening of travelers, resources allocation, preparedness and drills, information dissemination, awareness promotion, etc
- Organizational – Institutions, Companies
  - Development & Implementation of policies and guidelines, awareness promotion, contingency plans, performance monitoring, etc
- Individual – Everybody
  - Learn and execute prevention measures

Approaches to preventing transmission in farmed animals

- Separate wild birds and domestic fowls
- Prevent cross contamination
- Practice Infection control measures at farms
- Vaccinate farmed animals
- Monitor and track
- Cull if necessary

How Poultry Disease Spreads



USDA United States Department of Agriculture
Animal and Plant Health Inspection Service

Disease Alert Number
APHIS 91–55–66
Issued June 2002

Difficulty in Preventing Transmission between wild birds and poultry

- Open farm operations

Approaches to preventing bird/poultry to man transmission

- Avoid contact with wild birds and bird droppings
- Use personal protective equipment in farms
- Practice good infection control procedures
- Practice good personal hygiene measures
- Practice good hygienic measure when handling poultry and poultry meat
- Do not handle/eat infected or sick poultry
- Thoroughly cook poultry meat and eggs

Approaches to preventing man to man transmission (1)

- Block aerosol transmission
  - Wear mask when sick to avoid aerosol release during coughing and sneezing
- Block contact transmission
  - Wash hands frequently after touching objects and before rubbing eyes, nose and mouth
- Block personal transmission
  - Avoid close contact with sick individuals

Approaches to preventing man to man transmission (2)

- Practice good personal hygiene measures
- Avoid crowded places
- maintain good natural ventilation
- Stay healthy
- Get vaccinated
- Seek prompt medical assistance if sick

Poultry Meat / Food Safety Issues

- Cooking (≥70°C) will inactivate the H5N1 virus
- Properly cooked poultry meat is therefore safe
- H5N1 virus in poultry meat is not killed by refrigeration or freezing
- Home slaughtering and preparation of sick or dead poultry for food is hazardous
- Good hygiene practices are essential to prevent exposure via raw poultry meat or cross contamination from poultry to other foods, food preparation surfaces or equipment

Are Eggs safe To Eat?

- Eggs can contain H5N1 virus both on the outside (shell) and the inside (whites and yolk)
- Eggs from areas with H5N1 outbreaks in poultry should not be consumed raw or partially cooked (runny yolk)
- uncooked eggs should not be used in foods that will not be cooked, baked or heat-treated in other ways
- Properly cooked eggs are safe to eat

Protection against the H5N1 Avian Flu

- vaccine and antiviral drugs

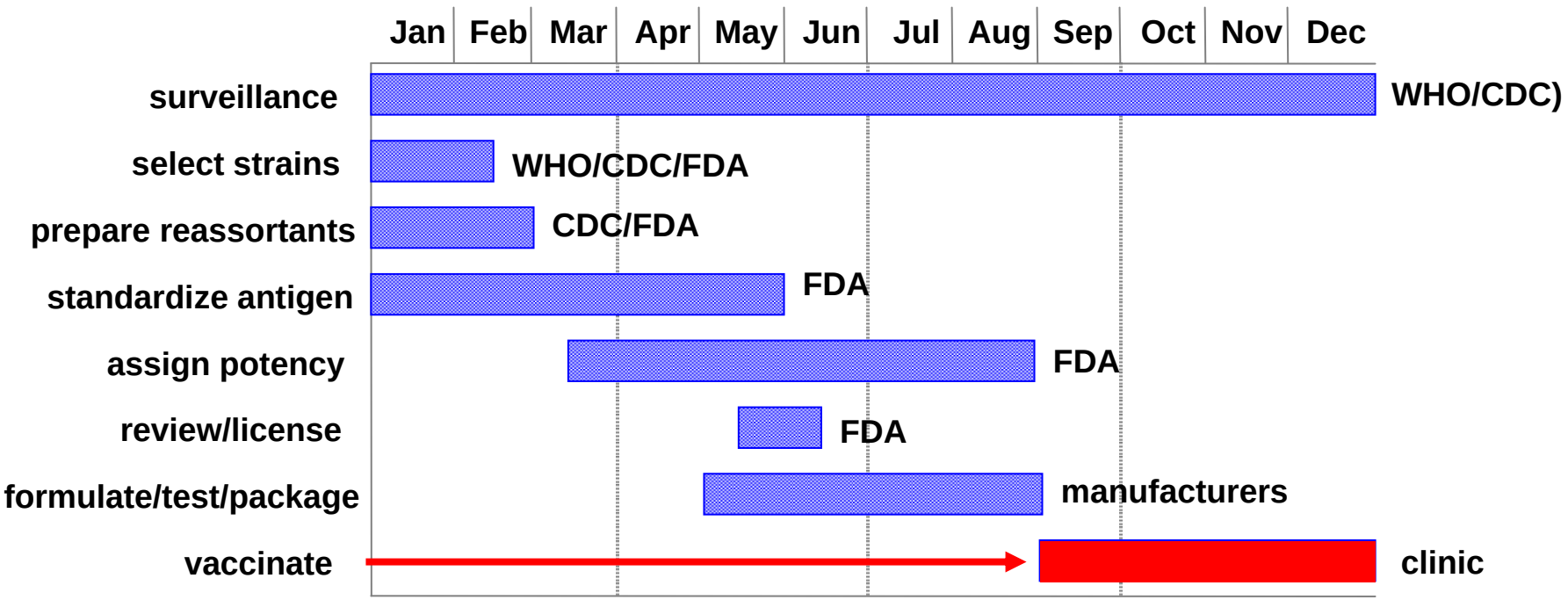
The Challenges of Making an Effective Vaccine against H5N1 (1)

- Influenza vaccines are made in eggs, but H5N1 Avian Flu virus kills embryos
- Need to create a “new” virus through ressortment of genes by genetic engineering techniques
- The H5N1 Avian Flu Virus keeps on evolving
- Different strains between Vietnam and Indonesian cases

The Challenges of Making an Effective Vaccine against H5N1 (2)

- Long lag time between identifying the right strain to vaccine availability
- Limited manufacturers
- Concurrent need for regular human flu vaccine
- Sufficient supply of eggs??

Vaccine Development



Current status of Avian Flu vaccine Development

Manufacturing the appropriate vaccine at the optimal time is a major challenge

Results of Human Avian Flu Vaccine test (2006)

- 54 percent of those who got two shots, 28 days apart, of the mega dose (12 times larger than regular flu – safer?) developed adequate protective antibody response
- Regular winter flu shots, in contrast, protect 75 percent to 90 percent of young healthy people
- Already outdated due to mutation of H5 N1?
  - Genetic change in virus strains isolated from human in 2004 & 2005 (Vietnam strain vs Indonesian strain)
- Optimistic but still ways to go

The First DNA-based Vaccine Against Avian Flu

- New approach to vaccine manufacturing
- Does not contain infectious material from the avian flu virus
- Contain only portions of the influenza virus' hemagglutinin (H) gene
- Once inside the body, the DNA instructs human cells to make proteins that act as a vaccine against the virus
- First human trial started on December 21,2006
- Study will last for a year
- Will it work?

INFLUENZA: ANTIVIRAL THERAPIES

- Amantadine: Influenza A
  - Treatment and prophylaxis
- Rimantadine: Influenza A
  - Treatment and prophylaxis
- Oseltamivir / Tamiflu*: Influenza A & B
  - Treatment and prophylaxis
- Zanamivir / Relenza: Influenza A & B
  - Treatment only

*Must begin therapy within 2 days of onset of illness

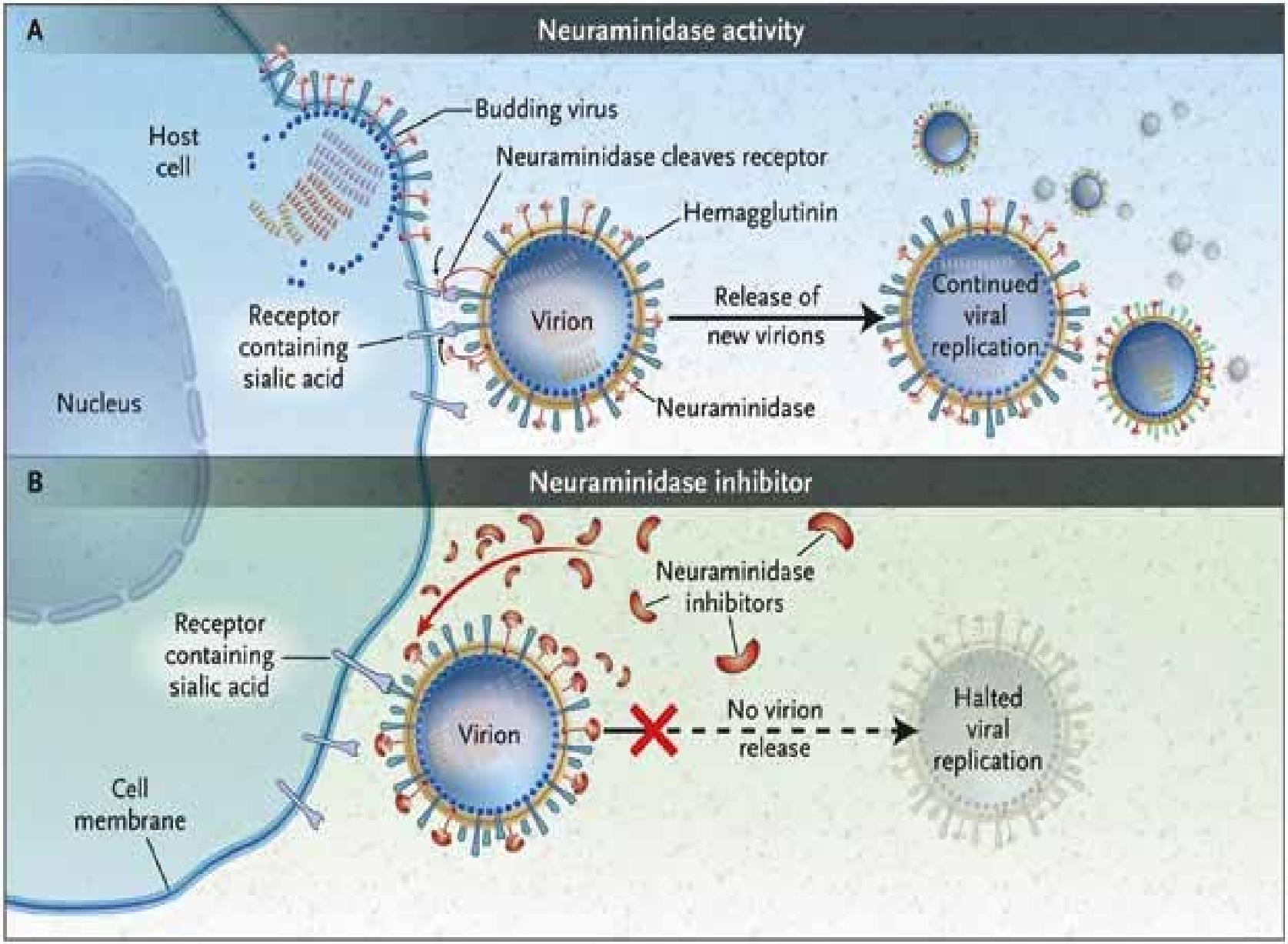
Antiviral Agents for Treatment

Antiviral	Trade Name	Influenza Spectrum	Route of Admin.	Daily Dose
Amantadine	Symmetrel®	Type A	Oral	100 mg bid
Rimantadine	Flumadine®	Type A	Oral	100 mg bid
Oseltamivir	Tamiflu®	Type A & B	Oral	75 mg bid
Zanamivir	Relenza®	Type A & B	Inhaled	10 mg bid

Antiviral Agents for Prophylaxis

Antiviral	Trade Name	Influenza Spectrum	Route of Admin.	Daily Dose
Amantadine	Symmetrel	Type A	Oral	100 mg
Rimantadine	Flumadine	Type A	Oral	100 mg
Oseltamivir	Tamiflu	Type A & B	Oral	75 mg
Zanamivir*	Relenza	Type A & B	Inhaled	10 mg

* Not FDA approved



Moscona, A. N Engl J Med 2005;353:1363-1373

INFLUENZA - ANTIVIRAL THERAPIES: TOXICITIES

- Amantadine and rimantadine
  - CNS (anxiety, insomnia, seizures, hallucinations), GI
  - CNS toxicity greater in patients on amantadine
  - Resistance develops in 10%-30% during treatment course
  - Teratogenic and embryogenic in animals
- Oseltamivir
  - GI (nausea and/or vomiting ~5-10%)
  - Neurologic effect (hallucination) report form Japan
- Zanamivir
  - Brochospasm (avoid in asthmatics)

Amantadine and Rimantadine – M2 Inhibitors

- Older generation of antiviral drugs used since the 1970's
- Advantages:
  - Inexpensive and long shelf life of >20 years
- Disadvantages:
  - Drug resistance develops quickly
  - Questionable safety in pregnant women (teratogenic?)
  - Lower dose for elders
  - Require close clinical monitoring in special patient groups (not likely available during pandemic flu)

Tamiflu and Relenza – N INHIBITORS

- New antiviral drugs
- Advantages:
  - Better safety profile
  - Less prone to develop drug resistance
- Disadvantages:
  - Cost
  - Supply
- Tamiflu has been used for treating avaian flu patients in Thailand and Vietnam with limited effective use
- Tamiflu is used frequently to treat regular influenza in Japan

Issues with Antiviral Drugs

- Toxicity
- Effective Dose
- Timeliness of Administration
- Resistance?
- Shortage of supplies
- Counterfeit
- Shelf-life
- Quantity to stock?

Tamiflu for Treatment of Influenza

- Oseltamivir (Tamiflu®) is recommended by WHO for use for both treatment and prophylaxis of influenza.
  - For treatment of influenza - Adults: 75 milligrams (mg) two times a day for five days.
  - For prevention of influenza - Adults and teenagers 13 years of age or older: 75 mg once a day for at least seven days.

Is Tamiflu Effective Against Human H5N1 Disease?

- The evidence for effectiveness is based on:
  - virological data from in vitro
  - animal models
  - limited human studies
  - extrapolation of trials results for ordinary human influenza
- Clinical trials against human H5N1 disease have not been conducted - treatment effectiveness and dosage are uncertain

Non Medical Interventions are Important Too!

- Proven effective to contain the spread of SARS in 4 months world wide
- Strategies:
  - Personal hygiene, use of mask, quarantine, contact tracing, screening of travelers, etc
- Influenza is more of a challenge since it is more infectious than SARS and has a shorter incubation period with viral release before onset of symptoms

The Hong Kong Influenza Alert System

Three Level Response System (1)

- **Alert Response Level –**
  - confirmation of highly pathogenic avian influenza (HPAI) outbreaks in poultry populations **outside** Hong Kong
  - confirmation of HPAI **in** Hong Kong in imported birds in quarantine, in wild birds, in recreational parks, in pet bird shops or in the natural environment
  - confirmation of human case(s) of avian influenza **outside** Hong Kong

Three Level Response System (2)

- Serious Response Level –
  - confirmation of HPAI outbreaks in the environment of *or* among poultry population in retail markets, wholesale markets or farms **in** Hong Kong due to a strain with known human health impact
  - confirmation of human case(s) of avian influenza **in** Hong Kong **without** evidence of efficient human-to-human transmission

Three Level Response System (3)

- Emergency Response Level
  - There is evidence confirming efficient human-to-human transmission of novel influenza occurring overseas or in Hong Kong
  - The declaration of pandemic comes from WHO. It means the influenza strain is beginning to cause several outbreaks in at least one country, and spread to other countries, with consistent disease patterns indicating serious morbidity and mortality is likely in at least one segment of the population.

The WHO Influenza Alert Scheme and The Singapore Flu Pandemic Business Continuity Guide

WHO Avian Flu Alert Scheme

Inter-pandemic phase	Low risk of human cases	1
New virus in animals, no human cases	Higher risk of human cases	2
Pandemic alert	No or very limited human-to-human transmission	3
New virus causes human cases	Evidence of increased human-to-human transmission	4
	Evidence of significant human-to-human transmission	5
Pandemic	Efficient and sustained human-to-human transmission	6

Each phase is associated with international and national public health actions. National actions during each phase are further subdivided according to the national epidemiological situation. For

NEW PHASES	OVERARCHING PUBLIC HEALTH GOALS
Interpandemic period	
Phase 1. No new influenza virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection may be present in animals. If present in animals, the risk[a] of human infection or disease is considered to be low.	Strengthen influenza pandemic preparedness at the global, regional, national and subnational levels.
Phase 2. No new influenza virus subtypes have been detected in humans. However, a circulating animal influenza virus subtype poses a substantial risk[a] of human disease.	Minimize the risk of transmission to humans; detect and report such transmission rapidly if it occurs.
Pandemic alert period	
Phase 3. Human infection(s) with a new subtype, but no human-to-human spread, or at most rare instances of spread to a close contact.[b]	Ensure rapid characterization of the new virus subtype and early detection, notification and response to additional cases.
Phase 4. Small cluster(s) with limited human-to-human transmission but spread is highly localized, suggesting that the virus is not well adapted to humans.[b]	Contain the new virus within limited foci or delay spread to gain time to implement preparedness measures, including vaccine development.
Phase 5. Larger cluster(s) but human-to-human spread still localized, suggesting that the virus is becoming increasingly better adapted to humans, but may not yet be fully transmissible (substantial pandemic risk).	Maximize efforts to contain or delay spread, to possibly avert a pandemic, and to gain time to implement pandemic response measures.
Pandemic period	
Phase 6. Pandemic: increased and sustained transmission in general population.[b]	Minimize the impact of the pandemic.

The Singapore Flu Pandemic Business Contingency Guide

- Discuss potential business impact
  - Disruption to gatherings, transportation, supplies
  - Increase in electronic communications
  - Absenteeism
- Business continuity planning
  - Sustain operations in light of changing conditions with: employees/processes/infrastructure/stakeholders/communications
- 5 Alert Levels (Green, Yellow, Orange, Red, Black) with different sets of recommended actions

Green Alert - Isolated overseas/local cases of animal to human transmission/ Low threat of human to human infection

- **Employees** – Identify staff to oversee business continuity plan, set up polices and procedures, secure materials supplies
- **Processes** – Identify critical functions, assemble plan for sustained operation, evaluate special facilities requirements
- **Infrastructure** – Assemble tele-communication requirements and plans
- **Stakeholders** – Update contact information of key stakeholders such as suppliers, customers, etc. Identify alternate sources
- **Communications** – promote flu info, develop plan for communication with stakeholders

Yellow Alert - Slight human to human transmission, small risk of importing it locally / no sustained spread

- **Employees** –Appoint flu manager, implement screening procedures, monitor development, follow vaccination program, issue PPE, restricted travel to affected areas
- **Processes** – Monitor progress and update plan on when/how to activate alternate plans
- **Infrastructure** – Activate equipment for tele-communication, increase cleaning/disinfection
- **Stakeholders** – Activate plans if necessary (suppliers and retailers)
- **Communications** – Reassure staff of effort, and provide info on anticipated plans for higher alert, inform external stakeholders of necessary info

Orange Alert – Evolves into human disease, several outbreaks spreading to other countries, cases found locally

- **Employees** – Update staff on advisories, separate team operation to minimize contact, sick staff to stay home and monitor progress, avoid crowded places, postpone travels
- **Processes** – pre-qualify alternate supplier from unaffected areas, or increase inventory levels, enable staff to remotely access stakeholders
- **Infrastructure** – Further increase cleaning/disinfection including the A/C systems
- **Stakeholders** –Implement access screening and control of stakeholders, activate alternate logistical arrangements, explore partnership with industrial counterparts for mutual aid arrangements
- **Communications** – Inform stakeholders of restrictions and requirements and of updated information

Red Alert – Wide spread infection, increase in deaths, health care systems overwhelmed, border closure imposed in some countries

- **Employees** – Non-critical staff to work from home, activate succession plan, provide counseling where needed
- **Processes** – Monitor/maintain contact with stakeholders through remote access
- **Infrastructure** – Monitor inventory levels
- **Stakeholders** – Activate mutual aid program where needed
- **Communications** – Regularly update staff and stakeholders of actions taken to instill confidence

Black Alert – High death rates reported, economic activities severely disrupted and are heading towards a standstill, panic sweeps through communities, survival is at stake

- Stop operations
- Adhere to directives from health authorities
- Wait for clearance prior to resuming business activities

Organization Preparation

Organizational Preparation (1)

- Acquire an understanding of flu and avian flu
  - Nature and difference of the two diseases
  - Influenza pandemic
  - Modes of transmission
  - Incubation period – Time (7 days) before symptoms arrive
  - Period of communicability – Release of virus (starts prior to appearance of symptom)
  - Symptoms and signs: cough, fever, sore throat, muscle ache, conjunctivitis, acute respiratory distress, vial pneumonia

Organizational Preparation (2)

- Take steps to ensure maximum protection of personnel and business:
  - Monitor latest development
  - Heighten awareness via education and training
  - Promotion of good personal hygiene practices
  - Provide good ventilation in facilities
  - Conduct frequent cleaning and disinfection

Organizational Preparation (3)

- Take steps to ensure maximum protection of personnel and business (Continued):
  - Provide hand washing/sanitizing stations
  - Provide mask where needed
  - Monitor employee health and sick leave records
  - Provide/arrange for vaccination
  - Consume only thoroughly cooked poultry and eggs
  - Relief sick workers
  - Be aware of travel advice & latest developments
  - Promote healthy lifestyle

Organizational Preparation (4)

- Know what to do when staff / family of staff develop avian flu
  - Assist health officials with:
    - Notification of cases (confirmed and suspect)
    - Assist in investigation and contact tracing
    - Provide relevant information/records
    - Closure of work place?
    - Disinfection of facility
  - Ensure sick staff / staff under home confinement not to come to work
  - Observe workplace precautionary measures

Organizational Preparation (5)

- Compile business contingency plans
  - Identify key personnel for essential functions
  - Prepare staff roster
  - Split into smaller work groups
  - Designate management deputies
  - Specify roles and responsibilities of all groups
  - Conduct drills
  - Cultivate better understanding of infection control measures
  - Stockpile personal protective equipment

Individual Preparedness

Individual Preparedness (1)

- Be prepared
  - Live a healthy life style
    - Eat balanced diet, exercise regularly, do not smoke, rest well
  - Ensure adequate supply of masks, antipyretics, thermometer, soap, tissue paper, etc
- Get Vaccinated
- Keep hands clean by frequent & proper hand washing
  - Before touching eyes mouth and nose
  - When hands are contaminated by sneeze or cough
  - After touching public installations / equipment
  - Before handling food or eating
  - After going to restroom
  - Before putting on mask and after taking one off

Individual Preparedness (2)

- Use mask properly
  - Wear when suffering respiratory illness, dispose properly
- Know how influenza presents
  - Symptoms: fever, headache, cough, runny nose, sore throat and muscle ache
  - Inform doctor of history of contact with sick birds, avian flu patients and their secretions
- Manage fever well
  - Maintain good indoor ventilation, drink plenty of water, stay home, check body temperature regularly, consult doctor promptly
- Live a hygienic life
  - No spiting, properly dispose sputum, nasal discharge and saliva, sanitary treatment of urine and feces, cover toilet when flushing, dispose waste properly...

Coughing and Sneezing release lots of Bioareosols

Droplet vs Airborne Hazard?
Most Coughs are poly-dispersed !

American Journal of Respiratory and Critical Care Medicine Vol 169. pp. 604-609, (2004), Fennelly et al

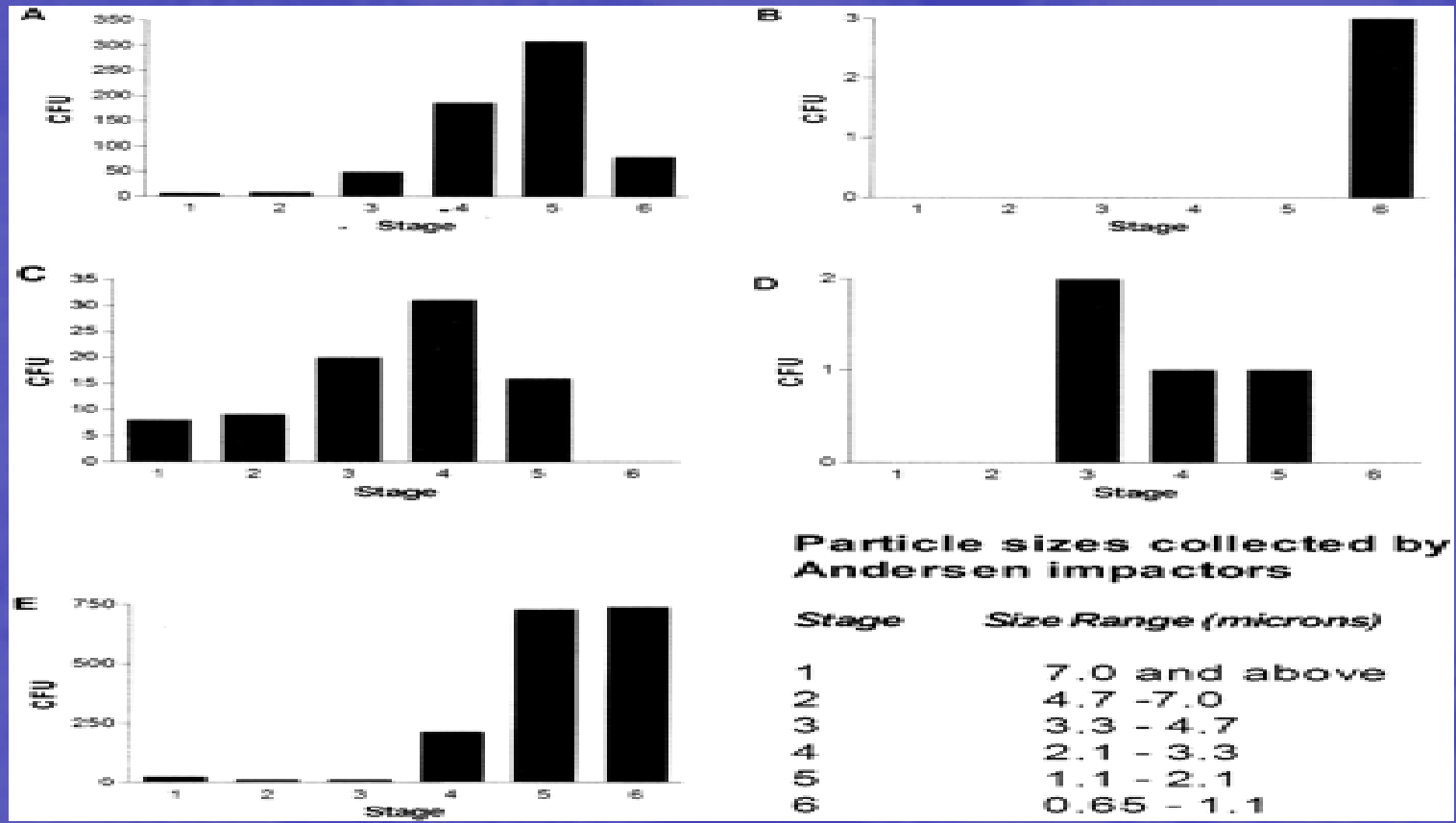


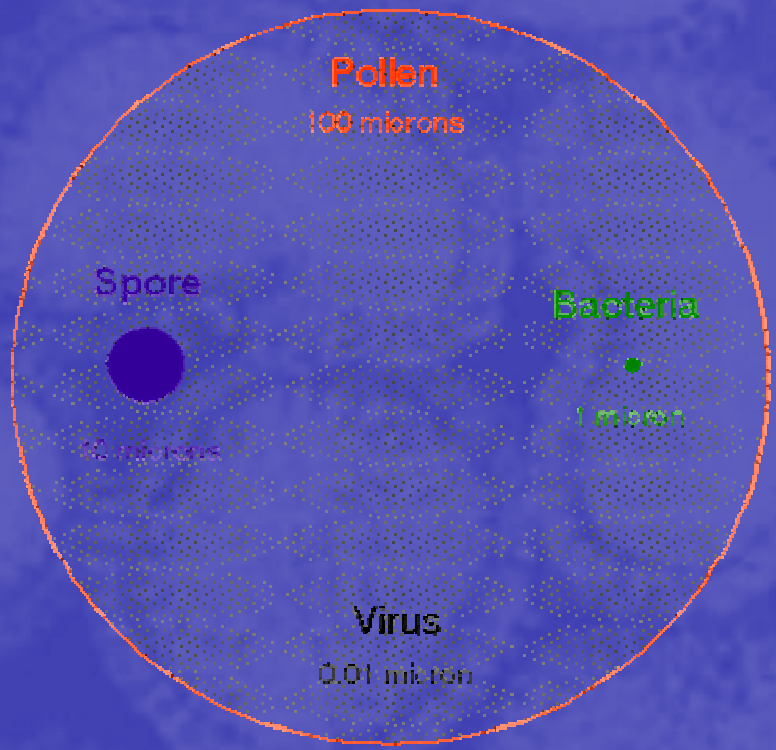
Figure 4. Particle size distributions of culturable aerosols collected by Andersen cascade impactors during the first study of each subject: (*A*) Subject 2 during sputum induction; (*B*) Subject 12 during sputum induction; (*C*) Subject 14 during voluntary coughing; and (*D*) Subject 13 during sputum induction. (*E*) Experimental aerosol of *Mycobacterium bovis* bacillus Calmette–Guérin in one study in an animal exposure system. Note that the numbers of cfu vary for each study.

Droplet vs aerosol?

- A cough can generate 100,000 particles
- Sneeze can generate 20X more than cough
- Greater pressure will generate smaller particles
- Particle behavior in air depends on many factors
- No clear delineation between droplet and aerosol
- There is evidence that influenza is spread by aerosol in addition to droplet and direct contact!

Behavior of Airborne Particle

- E.g. for 100 μm airborne particles
  - Settling velocity ~ 0.3 m/s
  - Distance traveled from a height of 1.5 meter about 0.6~ 1.5m



Respiratory Protection for Infectious Agents In Healthcare

- Engineering controls may not be adequate or feasible
- Exposure limit/ Infectious dose NOT available
- Dynamic working environment and activities

Respirator Selection Methods for Biohazardous Agents

- Expert Opinion
  - Qualitative approach – risk estimates
  - Used when important data for quantitative methods not available
  - Considers characteristics of job activities, the infectious agent, protection factors, advantages and disadvantages of using respirators
- Consult medical authority for protection levels required - CDC, WHO
- Consult manufacturer for type

Surgical Masks and “Respirators” Used for Infectious Agents

All are particulate filtration type

Surgical mask

N95 Respirator
Non-valve

N95 Respirator
Valved

Surgical mask
N95 Respirator

Typical surgical mask is NOT a respirator

Filtering Facepiece Respirator vs Surgical Mask

Performance of N95 Respirators

Expected performance 95% efficient in removing 0.3 micron particles

Actual performance reported by Balazy et al. AJIC Vol. 34 No.2

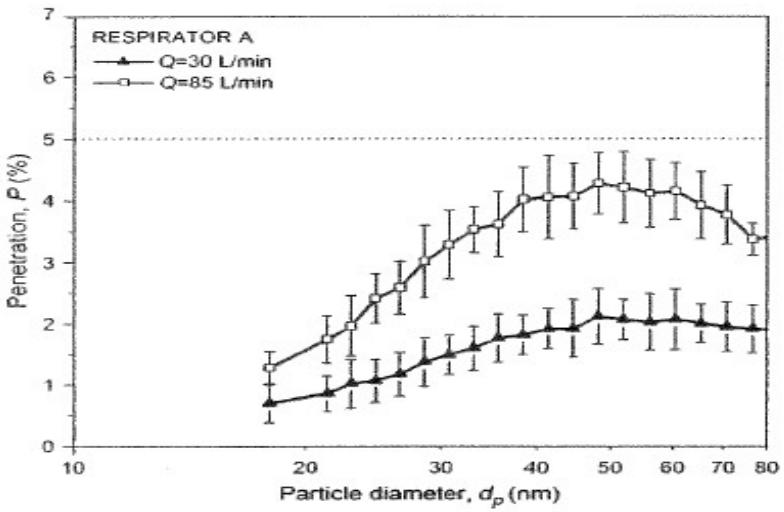


Fig 4. Effect of the inhalation flow rate on the fractional penetration of MS2 virus through respirator A (n = 5). Each point on the graphs represents the mean value of the particle penetration, and the error bars represent the standard deviations for respirators.

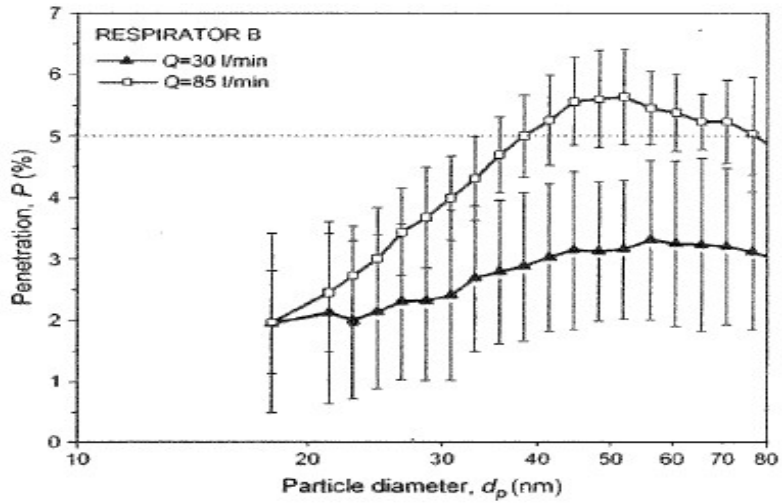


Fig 5. Effect of the inhalation flow rate on the fractional penetration of MS2 virus through respirator B (n = 5). Similar to Fig 4, the points and error bars represent the mean values and the standard deviations, respectively.

Viruses 20 to 300 nm

Bacteria 500 nm to 10 microns

Mold spores 1 to 70 microns

Fungi 2 to >200 microns

Performance of Surgical Mask

Actual performance reported by Balazy et al. AJIC Vol. 34 No.2

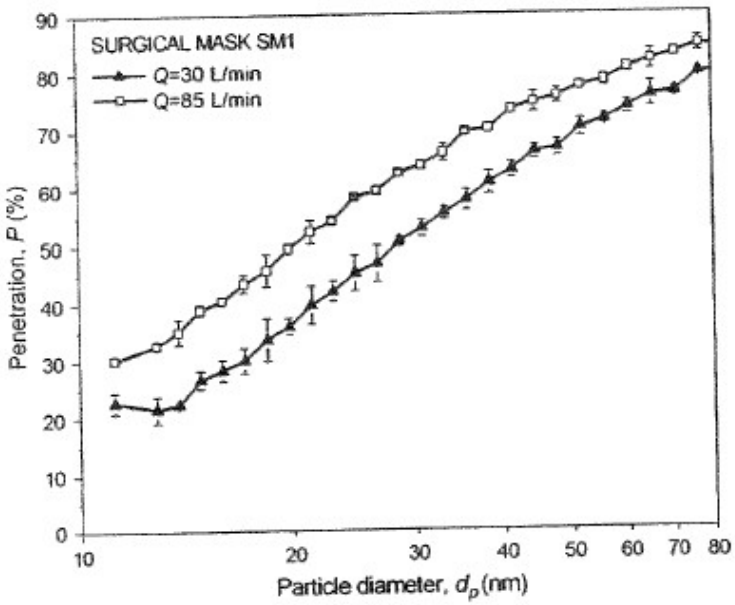


Fig 6. Effect of the inhalation flow rate on the fractional penetration of MS2 virus through the surgical mask SM1 (n = 2). Each point represents the mean penetration value, and the error bars represent the standard deviation.

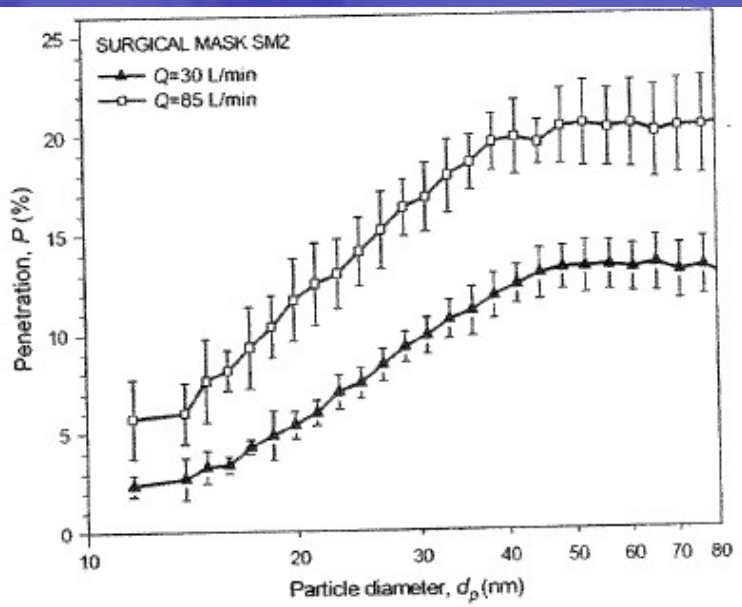


Fig 7. Effect of the inhalation flow rate on the fractional penetration of MS2 virus through the surgical mask SM2 (n = 3). Each point represents the mean penetration value, and the error bars represent the standard deviation.

Viruses 20 to 300 nm
Mold spores 1 to 70 microns

Bacteria 500 nm to 10 microns
Fungi 2 to >200 microns

Here is the picture...

- Coughing and sneezing generate particles of varying sizes including those larger and smaller than 5 microns (can we safely say influenza is spread by droplet only??)
- Surgical masks are poor filters against small particles (can we safely say that surgical masks are adequate for protection against influenza??)
- The infection dose of many respiratory pathogens are not known (is the protection factor offered by surgical mask sufficient against emerging respiratory pathogens??)

Respiratory Protection Program

- Assessment of risk
- Selection of respiratory protection device
- Medical examination
- Training of user
- Fitting of respirator
- Use and maintenance

Don’t Forget To Cover Up

Why Hand Washing is important?

http://www.microbe.org/washlan.mov

Stay Healthy and Be Safe!

Thank You

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