Avian Influenza: the moving target

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H5N1 epidemic—a disease of global relevance

- H5N1 has become endemic in poultry in several parts of the world
- It is capable of infecting a variety of birds (@50 species) and 10 species of mammals
- For every human that is infected, at least 1 million animals are infected
Challenge of the moving target

- Controlling AI is an enormous challenge for the veterinary community and local administrations
- First time in history that such a panzootic occurs, the ecology and epidemiology of AI are in constant evolution as it spreads to new ecosystems and hosts
- Significant funds and resources must be allocated and used in an organised manner – heading in the same direction
- Ongoing evaluation must feed back into adjustment strategies
“Atypical” characteristics of the H5N1 epidemic

• Involvement of waterfowl
• Spill-over to wild birds
• Billions of susceptible birds in certain affected areas
• Peculiarity of husbandry/social practices
• Infection of mammals
• Human health implications
Understanding AI epidemiology in birds

1. Birds raised for food (industrial, free-range, rural, scavenging)
2. Pet/hobby birds
3. Wild birds
H5N1: unprecedented eco/epidemiological situation

Other species

Wild bird reservoir

Industrial poultry

Rural poultry

Live bird markets

Poultry reared in the open
Fighting cocks have also been responsible for the spread of H5N1 virus
Chicken carcases placed over pond on catfish farm in Indonesia
Catfish feeding on chicken carcass
Ducks on the same catfish farm
TWO EARLY INCURSIONS INTO EUROPE (2004-2005)

TO BELGIUM AND GREAT BRITAIN
– both were contained without spread
Two mountain hawk eagles smuggled by a man travelling from Bangkok to Brussels in November 2004 were found to be infected with HPAI H5N1 virus genetically close to Thailand strains.
HPAI H5N1 in Europe

- Isolation of HPAI H5N1 from captive cage birds in quarantine in England
- Virus closest genetically to a 2005 Chinese duck isolate
Spread from East Asia - 2006
Wild birds
It is the first time in recorded history that HPAI spills over in a significant manner to the wild bird population.
Significant isolations of H5N1 from wild birds in E. Asia

- Hong Kong 2002 numerous species of wild birds - Ellis et al. 2004
- Japan 2004 - crows, Mase et al. 2005
- Mongolia 2005 - migratory waterfowl
- China 2005 - migratory waterfowl Lake Qinghai - Chen et al., 2005; Liu et al., 2005

Open debate on the carrier state for HPAI
Mute swans seem to have been responsible for spread of H5N1 in Europe in early 2006, most probably due to an unusually cold winter.

European countries HPAI H5N1 reported in swans January – April 2006

Croatia, Germany, Italy, Austria, Bosnia, Greece, Bulgaria, Slovenia, Hungary, Russia, Poland, Serbia, Sweden, UK [Whooper swan]

and Azerbaijan, Kazakhstan & Iran
At the moment it is unknown how HPAI will behave in the wild bird population

• Does it kill all the birds it infects?
• If so, what are the incubation and shedding periods?
• If not, for how long can it persist?
• Is there a true reservoir species?
The primary means of spread is through trade of infected poultry
UK and Hungarian 2007 viruses: 99.6% homology
Spanish influenza 1918-1919
20-40 million dead
Pandemic potential

• Direct infection of humans with AI
• Generation of a new pandemic virus through genetic reassortment between an avian and mammalian virus
Human pandemic viruses

• All the viruses of the 20th century have an “avian component”

• It is 28 years [or some would argue 37 years] since the last pandemic, so time is ripe for a new human pandemic

• All human pandemic viruses known to date are H1, H2 or H3 subtype
Most certainly

• The next human pandemic virus will have an avian progenitor or component
• The more AI viruses circulate in birds, the greater the risk of igniting the new pandemic
• H5N1 HPAI will be extremely difficult to eradicate from developing countries, in which it also represents a serious threat for food security
Avian Influenza - conclusions

• Is - first of all a disease of animals
• Control in the animal reservoir is a prerequisite to the management of the pandemic potential
• The comparison between strains is essential to increase knowledge on AI epidemiology and human health implications
GISAID- Global Initiative on Sharing Avian Influenza Data
www.gisaid.org

Nature Correspondence 24 Aug, 2006
Signatories:
70 leading scientists, 6 Nobel Laureates

Veterinary virologists lead by example

Open access, free database which will contain human and animal influenza virus sequences and protects intellectual property
Veterinary initiatives promoting genetic data sharing to support the global H5N1 crisis

- OIE/FAO: support and promote data sharing
- OFFLU network – collects strains and sequences and promotes deposit in open access databases
- EPIZONE: EU Network of Excellence, WP 6.2 aims at understanding AI epidemiology through the generation and analysis of sequence data