Avian Influenza/Newcastle Disease Virus Subcommittee

David L. Suarez D.V.M., Ph.D.
Southeast Poultry Research Laboratory
United States National Poultry Research Center
Athens, GA
Zoonotic Avian Influenza

• Both LPAI and HPAI can infect humans
• Recent LPAI zoonotic reports
  • H7N9 China
  • H9N2 Bangladesh
• Recent HPAI
  • H5N1 Egypt, China, Indonesia
  • H5N6 China
## Cumulative number of confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2015

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* 2003-2009 total figures. Breakdowns by year available on next table
Total number of cases includes number of deaths
WHO reports only laboratory cases
All dates refer to onset of illness

Source: WHO/GIP, data in HQ as of 4 Sept. 2015
H7N9 China

Source: FAO
H7N9 Human Cases by Month

680 Confirmed Human Cases
271 deaths
3 humans cases reported September-October 2015

Source: FAO
Poultry Surveillance H7N9

Source: FAO
HPAI Poultry Outbreaks in 2014-15

• H5N1 continues to dominate
  • China, Vietnam, Bangladesh, Indonesia, Egypt are endemic
  • Poultry outbreaks in India, West Africa, Middle East (Iran, Israel, Palestine), Bhutan, Laos, North Korea
  • Wild bird outbreaks in Russia and Kazakhstan

• H5N8 also widespread
• H5N2 in China and Taiwan
• H5N6 in China and Vietnam
• H7N3 in Mexico continues
• H7N7 in Germany
• H7N7 in Great Britain
H5N1 Outbreaks India

- Nov 2014-Jan 2015
  - 390,000
  - Poultry
- Dec 2014-Jan 2015
  - 110
  - Domestic ducks
- March 2015
  - 224,000
  - Poultry and wild birds
- Clade not reported
H5N1 HPAI West Africa

- Currently there is no publicly available sequence
- Nigeria is paying indemnity, but only small number of farms
- FAO has requested international funds to respond to outbreak
H5N8 HPAI in Europe

2014
Nov. 7 - Germany, turkeys
Nov. 17 - UK, domestic ducks
Nov. 15, 20, 30 - Netherlands, layers
Nov. 21 - Netherlands, multi. unit
Nov. 23 - Germany, wild duck
Dec. 1 - Netherlands, widgeon
Dec. 1 - Netherlands, broilers
Dec. 16 - Germany, turkeys
Dec. 16 - Italy, layers
Dec. 19 - Germany, wild duck
Dec. 21 - Germany, domestic ducks

2015
Jan. 8 - Germany, wild duck
Jan. 12 - Germany, zoo animals
Jan. 13 - Germany, gull and wild duck
Jan. 20 - Germany, mixed domestic
Feb. 25 - Hungary, domestic ducks
H5N8 South Korea
Taiwan

- H5N2 continuing with Mexican origin H5
- H5N8 outbreak similar to U.S. virus
- H5N3 outbreak with unique Asian N3 on H5N8 backbone
China

- H5N1 widespread in country despite of vaccination
- Live poultry markets and wild bird reports including black headed gulls at Qinghai Lake with high mortality > 2000
- H5N6
  - Closely related to H5N8
  - Also reported Vietnam
  - Human infections
- H5N2
  - Largest report of poultry affected by outbreak
Challenges in NDV Vaccination

- Virulent NDV outbreaks still occur despite use of vaccination
- Matched vaccines to challenge strains are recommended to reduce virus replication and reduce transmission
- New technology allow development of vaccines capable of reducing replication and transmission of challenge virus.
- Difficult to demonstrate differences in mortality under laboratory conditions with SPF birds.
Results: Viral shedding after challenge

![Graph showing viral shedding results](image)

- **Sham x PK33**: High titer (Log10 EID50/ml) at 2 Dpc and 4 Dpc.
- **LS-wt x PK33** and **rLS-PK x PK33**: Lower titer at 2 Dpc compared to Sham x PK33.
- **Sham x PK33**: Similar titer at 4 Dpc to Sham x PK33.
- **LS-wt x PK33** and **rLS-PK x PK33**: Lower titer at 4 Dpc compared to Sham x PK33.

Note: NS indicates no significant difference.
Recombinant vaccines: 
Strategy

Why F and HN genes?

Binding and fusion of the virus to the host cell.
Induce specific cell mediated immunity.
Neutralizing antibodies in vaccinated birds.
Fusion protein cleavage site determines virulence.
Experimental Strategy: Vaccinate with multiple vaccine doses to replicate field conditions

- 4-week-old White Leghorn chickens
- Vaccines:
  - LaSota $10^3$, $10^4$, $10^5$ or $10^6$
  - rLS-PK $10^3$, $10^4$, $10^5$ or $10^6$

Challenge:
- PK8 $10^{8.5}$ 7 dpv or 14 dpv
  Followed for 14 days after the challenge
A Pre-challenge PK8 HI titers 7dpv

B Pre-challenge PK8 HI titers 14dpv
Results:
Survival after challenge at 7dpv
Results:
Survival after challenge at 14 dpv

Statistical difference in survival between groups LaSota $10^3$ and rLS-PK $10^3$
Acknowledgements

• Dr. Claudio Afonso, Southeast Poultry Research Laboratory