The Emergence of HPAI in the USA

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Influenza = Orthomyxovirus

- Type A (humans, birds, other mammals)
- Type B (humans and seals)
- Type C (humans, pigs, dogs)
Secreted in birds’ feces and nasal discharges
- Virus survives for days or weeks at low temperatures
- Contaminate water/ponds
- Young birds infected and shed for several years

Humans may contract AI with close contact to infected birds
- Living in chicken houses
- Pigs and poultry in same pen
- Poultry with contact to wild birds
Wild birds may not show any clinical signs of infection
- Virus spread primarily from gastrointestinal tract
Clinical signs in infected chickens/turkeys:

- 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, hocks
- Purple discoloration of the wattles, combs, and legs
- Nasal discharge
- Coughing, sneezing
- Lack of coordination
- Diarrhea
Waterfowl Flyways

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Wild bird surveillance for highly pathogenic avian influenza H5 in North America
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Fig. 2 Poultry sales in 2012 by state in relation to major waterfowl flyways in North America. Poultry sales (layers, pullets, broilers, turkeys) as an index of density can be used to stratify wild bird surveillance sampling during the non-breeding season. This approach would target sampling in locations where the greatest risk of economic damage could occur. Sampling at high latitudes during the breeding season when populations from the various flyways (including Asian flyways) overlap can identify the potential for spread among the flyways. Poultry data from the 2012 Census of Agriculture [13].
The Chinese lake that's ground zero for the bird flu

By Rob Schmitz
March 30, 2016 | 10:36 PM
Guangdong Province, China
H5 Viruses Phylogenetic Relationships

Rapid Communication

North American Lineage

Eurasian Lineage

Nucleotide

Scale

FIG. 1. Phylogenetic relationships of the HA1 domain of the hemagglutinin gene of H5 viruses and the A/Goose/Guangdong/1/96 virus. All of the H5 subtype HA sequences available in GenBank were included. Version 3.5 of the Phylogeny Inference Package was used to estimate phylogenies from the nucleotide sequences. The tree was generated using neighbor-joining analysis determined by PHYLIP and is rooted to the A/Tern/South Africa/61 virus. Horizontal distances are proportional to the number of nucleotide differences between branch points.
USA AI Surveillance:

- Hunter harvested waterfowl
- Waterfowl die-off events
- Live bird capture (banding)
- Live bird markets - PCR
- NPIP (serology primarily, LPAI program)
  - Pre slaughter – broilers, turkeys, ducks, spent hens
  - Pre move – pullets, breeders
  - Once a year – layers
  - Antigen capture?
  - rt-PCR?
The Past: World AI outbreaks Jan 2005 to Dec 2013
History of HPAI in USA:
- 1924 – H7 east coast live bird markets
- 1983-1984 – H5N2 17 million birds depopulated
- 2004 – H5N2 Texas only one flock depopulated

History of HPAI in Canada:
- 1966 – H5N9 Ontario turkeys
- 2004 – H7N3 British Columbia
- 2007 – H7N3 Saskatchewan

History of HPAI in Mexico:
- 1994 – H7N2
- 2012 – H7N3
Figure 5. All HPAI Detections in All Birds, by Type, as of 8/31/2015 (as reported on www.aphis.usda.gov) *one or more detections may have occurred in county

[Map of the United States showing the distribution of HPAI detections in various categories such as Backyard, Commercial & Wild Bird, Backyard, Captive Wild Bird & Wild Bird, Captive Wild Bird, etc. with color coding to indicate the types of detections.]
Cumulative Infected Premises Over Time

Number of infected premises


Cumulative infected premises increase over time, with a sharp rise starting from 8-May-15.
Epi Curve of Infected Premises

Number of infected premises

Date

3/1/2015
3/15/2015
3/29/2015
4/12/2015
4/26/2015
5/10/2015
5/24/2015
6/7/2015
Total number affected birds:

- **7,759,522 turkeys**
- **40,137,700 hens**
  - **5,873,770 pullets**
  - **34,263,930 hens**

**In Iowa**

- **31,723,300 birds**
  - **1,542,300 turkeys – 34 premises**
  - **30,178,300 laying hens – 36 premises**

**In Minnesota**

- **8,996,050 birds**
  - **4,821,400 turkeys – 99 premises**
  - **4,174,500 laying hens – 5 premises**
The Present: World AI outbreaks Jan 2013 to Dec 2015
Indiana H7N8

- January 15-16, 2016
- Commercial turkey flocks
- Low Path to High Path
  - 1 HPAI
  - 9 LPAI
  - 1 risky premises (egg layers) all negative
- No symptoms in LPAI flocks
- North American H7 – wild waterfowl
  - First High Path H7 in USA
Future Considerations

- H5/H7 viruses not going to disappear (drift/shift)
- Spring waterfowl migration is currently in full swing
- Young waterfowl will carry virus for another season
- Estimated to affect the globe next 3 - 5 years
- New viruses likely to emerge
  - SE Asia?
Future Considerations

- **Vaccination?**
  - Potential use in a “worst care scenario” outbreak
  - USDA has started a stockpile of H5 vaccine
  - Current restrictions for importation from countries using AI vaccine
  - Expect trade extended, long term embargoes

**Considerations:**
- Will it match field isolate?
- Will need to identify vaccinated, infected flocks and depopulate
- Virus mutation in vaccinated birds?
Future Considerations

- Breeding considerations:
  - AI resistant bird?
  - Would shed virus like wild ducks?
  - Allow for comingling of viruses: re-assortment
  - Reservoir of virus for naive poultry flocks

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