The USA experience - strategies for the prevention and control of AI in North America after the recent outbreaks of HPAI

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Avian Influenza Virus Ecology/Epidemiology

Two sources to USA (2014-2017):
- Intercontinental spread of H5N8 Gs/GD HPAIV
- H7 LPAIV → HPAIV

Exposure → Adaptation

LPAIV (H1-16) → HPAIV (H5/H7)

Mutations:
- HA — Hemagglutinin
Influenza A virus

Spread of H5N8 to USA in 2014

- The H5N8 viruses likely moved to parts of Siberia and Beringia
- Evolved into subgroups during the breeding season
- Subsequently spread along different flyways during autumn into Europe, East Asia and North America

Reassortment events with LPAIV lead to the divergence of H5 viruses into distinct subtypes, including reassortant H5N1, H5N2 and H5N8 in North America.

Dong-Hun Lee et al., 2016. Emerging infectious diseases 22 (7), 1283.
12/8/2014 to 6/17/2015 – H5 HPAIV in wild bird, backyard poultry and commercial poultry

301 detections (4 captive wild bird; 21 backyard; 211 commercial flocks, 65 wild birds)

- 21 states affected; 15 states with wild bird cases
- ~ 50.5 million commercial birds: Layer chickens (~ 43 million) > turkeys (~ 7.5 million)
USA Control Program and Costs

  - Direct cost $1.6b; economy wide $3.3b
  - Federal taxpayer - $850m (~$200m indemnity, ~$650m response cost)
- Emergency H5 vaccine bank (500m doses)
  - Vaccines must be licensed by USDA
  - New rule: “cassette” concept for non-replicating influenza vaccines with approval via truncated licensing process
  - Requires an emergency declaration by USDA before use in the field – USA has not used vaccine in HPAI control
- Approved Vaccines (DIVA compatible):
  - rHVT-H5: recombinant herpesvirus turkey with H5 (clade 2.2) insert
  - RNP-H5: RNA particle vaccine with H5 insert (clade 2.3.4.4)
  - rgH5N1: H5N1 reverse genetics whole AIV, inactivated (clade 2.3.4.4)
10 Jan 16: meat turkeys w/↓ water consumption & pulmonary edema in dead birds within 1 of 5 barns
• 13 Jan 16: 100 dead birds (1.3%); 14 Jan, 800 dead birds (10.5%)
• 14 Jan 16: +ACIA and preliminary +H7 rRT-PCR
• 15 Jan 16: +H7N8 North American HPAIV, depopulation initiated
• 16 Jan 16: Depopulation completed; 10km zone 65 comm. premises surveillance identified H7N8 LPAIV on 9 premises; 2 dangerous contacts also depopulated
• 20 Jan 16: all depopulation completed (414,000; 12 premises)
• No further cases H7N8 LP or HPAIV identified
- Eight H7N8 viruses highly similar and supports a single introduction followed by lateral/secondary spread
- HPAIV, IVPI = 2.84, PENPKKKRKRKTR/GLF
- LPAIV, IVPI = 0.00, PENPKTR/GLF
- HA analysis suggests all LPAIV nearly identical, with HPAI distant due to insertion in HA
- Cost of H7N8 HPAI Outbreak (2016 - 1 HPAI, 9 LPAI & 2 dangerous contact premises)
  - $4.5m indemnity
  - $16.3m Federal costs

2017 HPAI Detections

- On March 4, 2017 APHIS confirmed H7N9 HPAI in a commercial broiler breeder flock in Lincoln County, Tennessee
- First commercial HPAI detection since January 2016
- The H7N9 HPAI is of North American wild bird lineage and not related to Asian H7N9 HPAI viruses
- On March 15, 2017 APHIS confirmed a second H7N9 HPAI in a commercial broiler breeder flock in Lincoln County, Tennessee
- This second HPAI detection was within the Control Area (10 km) of the First HPAI case
- APHIS worked with State and industry for quick response
- Both HPAI infected flocks were depopulated and disposal has been completed on both HPAI premises
- Virus elimination activities (C&D) completed May 13, 2017
- There have been no further detections of HPAI in the United States since March 15, 2017

Photo credit – https://www.bigdutchman.com/en/poultry
2017 HPAI and LPAI Detections

- H7N9 LPAI virus and/or antibody detections in Tennessee, Alabama, Georgia and Kentucky poultry
- Reassortment of wild bird LPAIV genes and transmission to poultry

2017 HPAI and LPAI Detections

3-4 separate introductions of H7N9 LPAIV

Highly Pathogenic Avian Influenza
A Guide To Help You Understand the Response Process

Figure 16. A Guide to Help You Understand the Response Process
United States HPAI Response: Detect
Surveillance and Diagnostics

- The challenges related to diagnostics for HPAI are greater than they may be for other diseases because the disease is so virulent.
- Diagnostic infrastructure was straining to keep up with the demand for results.
- Enhanced diagnostic laboratory preparedness
  - 56 National Animal Health Laboratory Network (NAHLN) labs reviewed and updated staffing plans, surge capacity plans, and barcoding and shipping protocols.

- Initiate depopulation based on:
  - A presumptive positive H5 or H7 virus detection (RRT-PCR): pool 11 swabs per vial and 2 vials
  - A flock that meets the AI case definition in field
  - Agreement of State and Federal officials
United States – HPAI Response: Detect
Surveillance and Diagnostics

- **Case Definition – Mortality Threshold and NALHN RRT-PCR+**
- Commercial flocks within the control area that exceed the mortality thresholds listed below are investigated and sampled as rapidly as possible for avian influenza:
  - **Commercial broilers:** mortality exceeding 3.5 birds/1,000 per day
  - **Commercial layers:** mortality exceeding 3x the normal daily mortality per day (normal=0.13 birds/1,000 per day for layers from 2 to 50 weeks, and 0.43 birds/1,000 per day for layers over 50 weeks); OR 5 percent drop in egg production for 3 consecutive days
  - **Commercial turkeys:** mortality exceeding 2 birds/1,000 per day
  - **Broiler breeders:** mortality exceeding 2 birds/1,000 per day
  - **Layer breeders:** mortality exceeding 3x the normal daily mortality per day (normal: 0.2 birds/1,000 per day up to 50 weeks, and 0.37 birds/1,000 per day after 50 weeks)
  - **Turkey breeders:** mortality exceeding 2 birds/1,000 per day; OR a decrease in egg production of 15 percent occurring over a 2-day period
  - **Small-volume high-value commercial poultry flocks and other commercial flocks not listed here:** any sudden and significant mortality event or sudden drop in egg production should be investigated.
United States HPAI Response: Quarantine

Implement Effective Quarantine and Movement Control Measures:

- The quarantine is initiated based on non-negative/presumptive positive results from the National Animal Health Laboratory Network (NAHLN) labs

- Quarantine each IPs with movement controls in the 10-km control area

- **Infected Zone (IZ):** The 3 km radius of the infected premises will be considered the infected zone

- **Buffer Zone (BZ):** The area between 3 km and 10 km of the infected premises will be considered the buffer zone

- **Control Area (CA):** 3-km infected zone + buffer zone

- **Surveillance Zone (SZ):** The zone at least 10 km wide outside the border of the Control Area, extending 20 km from IP
United States HPAI Response: Appraise/Compensate

9 CFR Part 53 - Authority to Pay Indemnity

- Federal law gives APHIS the authority to depopulate affected poultry flocks to contain or stop the spread of Foreign Animal Diseases (FAD) if they are found in U.S. poultry populations such as: Virulent Newcastle disease (vND) and Highly pathogenic avian influenza (HPAI), or any other communicable disease of poultry that, in the opinion of the Secretary of Agriculture, constitutes an emergency and threatens the U.S. poultry population.

- To encourage early reporting of disease issues, farmers are paid for depopulated animals, which helps stop the outbreak and support impacted farmers at the same time.

- When depopulation occurs, APHIS will give the producer an indemnity payment equal to the fair market value of the animal.
APHIS is authorized to pay 100 percent of eligible costs:

- Poultry or other animals infected or exposed
- Conveyances and materials
- Destruction of Eggs
- Depopulation
- Disposal
- Cleaning & Disinfection (C&D)
- Enhanced surveillance
United States – HPAI Response: Depopulate

Mass Depopulation vs. Euthanasia

Mass Depopulation

- Is a method by which large numbers of animals must be destroyed quickly and efficiently with as much consideration given to the welfare of animals as practicable, given extenuating circumstances:
  - Animal Health Emergency (AHE)
  - Catastrophic infectious disease
  - Mass intoxication
  - Natural disaster
- Goal: Depopulation in 24 hrs after diagnosis for AHE

Euthanasia

- Involves transitioning an animal to death as painlessly and stress-free as possible.
- Usually-Non-emergency
- Often for reasons other than disease control
- Typically low number of animals

In addition, the emotional and psychological impact on animal owners, caretakers, their families, and other personnel should be minimized
United States HPAI Response: Disposal

Disposal Options:

- In-house composting
- Outdoor, on-site composting
- Off-site composting
- Burial
- Landfill
- Incineration
- Rendering

Photo credit: Ms. Lori Miller – PE/APHIS

Photo credit: Dr. Melissa Mace – WI DATCP
**United States HPAI Response: Eliminate Virus**

**Virus Elimination - Cleaning and Disinfection**

- HPAI Infected Premises must be both **CLEANED** and **DISINFECTED** (C&D)
- C&D practices during an outbreak **should focus on virus elimination** in a cost-effective manner

**Step 1**

**CLEANING OPTIONS**
- Dry Cleaning:
  - Timing & method of dry cleaning must not aerosolize virus.
- and/or Wet Cleaning

**Step 2**

**DISINFECTION OPTIONS**
- Drying & Heating (100-120 °F for 7 days total)
  - At least three days must be consecutive days drying and heating at specified temperature; heating to 100-120 °F must occur for seven days total.
- and/or as needed
- Wet Disinfection with EPA Approved Antimicrobial
  - and/or as needed
- Fumigation with EPA Registered Sterilant for Porous and Non-Porous Surfaces or Alternative Science-Based Methods
  - and/or as needed

**NOTE:** A premises may require a **combination** of methods, but at least one choice must be selected from Step 1 and Step 2. The cleaning and disinfection options selected and implemented must be included as part of the approved cleaning and disinfection plan and approved by State Animal Health Officials and APHIS for reimbursement.

- For premises that cannot be cleaned and disinfected:
  - **Fallowing for 120 days or period recommended by Incident Command**
  - Heating barns/houses that have been dry cleaned is often the most efficient way to disinfect poultry houses and destroy HPAI virus
United States HPAI Response

Environmental Testing

- Environmental sampling inside the houses/barns occurs *after* the compost pile is complete and removed from inside the barns.

- Houses/barns are cleaned and disinfected.

- All environmental samples must test negative prior to restocking.
United States HPAI Response - Restocking

Premises that are approved to restock means that the premises/flocks:

- Are 21 days post completion of C&D/virus elimination,
- Finished with environmental sampling with no signs of HPAI in control area,
- Have met all requirements per the USDA Flock Plan, State Quarantine Notice/Hold Order, and USDA Cooperative Compliance Agreement, and
- Are approved by State and APHIS officials, in writing, to restock.
HPAI and Biosecurity

- We have developed a biosecurity self-assessment, and reference materials for producers

- Based on the flock size as stated in the 9 CFR 53.10 and NPIP Program Standards. The following minimum management practices and principles are designed to prevent the introduction and spread of infectious diseases:
  - Biosecurity Responsibility
  - Training
  - Line of Separation (LOS)
  - Perimeter Buffer Area (PBA)
  - Personnel
  - Wild Birds, Rodents and Insects
  - Equipment and Vehicles
  - Mortality Disposal
  - Manure and Litter Management
  - Replacement Poultry
  - Water Supplies
  - Feed and Replacement Litter
  - Reporting of Elevated Morbidity and Mortality
  - Auditing
United States HPAI Response: Conclusions

- Critical Activities and Tools for Containment, Control, and Eradication:
  - Enhanced Surveillance
  - Rapid diagnosis (Sample Collection, Surge Capacity, and Reporting of Confirmed Positive Premises)
  - Swift imposition of effective quarantine and movement controls
  - Health and Safety and PPE
  - Appraisal/Indemnity/Compensation
  - Mass depopulation and Humane euthanasia, potentially including preemptive culling
  - Effective and appropriate disposal procedures
  - Virus Elimination/Cleaning Disinfection of facilities & equipment procedures
  - Test to confirm virus is eliminated in the environment
  - Repopulation/Restocking
  - Logistics and Mobilization of Resources - National Veterinary Stock Pile
  - Epidemiological investigation and tracing
  - Biosecurity measures
  - Public Awareness, Education and Outreach Campaign/Communication
Grazie Mólto!