Essential Elements for Surveillance of Avian Influenza at the Domestic Poultry/Wild Bird Interface

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Issue: Eradication of infection from a country’s poultry

Surveillance

1. Where is the virus?
2. Using scientific principles to design sampling and select test methods to answer the question
   a. Ecology/epidemiology
   b. Host species
   c. Agricultural production systems
   d. Geographic distribution
3. Resulting information is used to develop control/eradication strategy
4. Continual assessment
LPAIV Ecology and Epidemiology

- Outdoor rearing
- Outdoor access
- Wild bird access to buildings
- Environmental exposure

LPAIV (H1-16) → Exposure → Adaptation → LPAIV (H1-13)

LPAIV surveillance does not prospectively predict which LPAIV will cause outbreaks in domestic poultry but can be used retrospectively.

The vast majority of LPAI viruses in free-living birds never enter poultry and agricultural systems.
AIV Epidemiology and Pathobiology Concepts

Outcomes:
- **Exposure:**
  - No Exposure
  - Exposure

  - No Adaptation
  - Low Dose
  - Inappr. route

  - Adaptation
  - Inadeq. immunity

  - Infection, no clinical signs
  - Mild Disease
  - Severe Disease & Death

- **Access to the virus**

- **Adaptation:** progressive viral genetic changes that result in increasing efficiencies of replication in a host species
- **Infection:** low to high infectivity
- **Pathogenicity** ability to produce lesions, disease and/or death in a host directly - associated with quantity of virus replication
- **Transmissibility** – natural host-to-host spread
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* Largest epizootic in 50 yrs

§ Vaccine used in the control strategy
H5N1 HPAI has different ecology in wild birds than LPAIV

Different risks with different agricultural production systems
### Agricultural Production in Asia

**Sectors 1 and 2 – Industrial Sector**

- Concentrated production – high populations; few farms but each with large poultry populations
- Biosecurity is usually good and access is controlled
- Best control of disease and most consistent vaccine coverage
Poultry Production Features

Sector 3 – independent ‘commercial’ but not integrated industrial

- Biosecurity is limited
- Movement controls and veterinary care variable to minimal
- Major producer system in mainland Asia
- Re-infections are common place
- Vaccine coverage inconsistent to poor
Poultry Production Features

Sector 4 – Village Poultry

- Up to 50% of Asian country’s production
- Lack of movement controls
- “Syndromic surveillance”
- Adequate vaccination coverage not achieved
- Rapid movement of birds to and from LPM
Poultry Production Features

Sectors 3 & 4 – Large populations of Domestic Ducks and Geese

- 1° Outdoor reared
- Asymptomatic infection
- Major reservoir and biomass issue
Role of Wild birds in Asia

• Recovery H5N1 from dead wild aquatic birds (sporadic and epizootic), few asymptomatic infections detected in surveys

• Periurban birds (e.g. tree and house sparrows, starlings, pigeons…) – can be mechanical and at times biovectors

• The issues for Asia are:
  • Numbers: 20-30 million migratory Anseriformes verses 20 billion poultry
  • Sector 3 & 4: a billion households with poultry; no vaccination, no movement controls, minimal surveillance
  • Find the reservoir in endemic countries?
  • Introduction verses secondary spread
Wild birds can be infected with H5N1 HPAIV
But, a virus isolation does not make a reservoir (nor the Major Risk)!

H5N1 HPAI control and eradication will require enhanced surveillance to identify the reservoirs and sites of action

Role wild bird surveillance:
1. Passive dead bird to find incursion in area leading to increased surveillance
2. Refocus on domestic ducks (significant reservoir) in area as environmental sentinels
3. LPM surveillance

Stallknecht, FAO/OIE, 2006
What are the high risk activities?
Sources for Virus

- Sector 1-3 Infected Commercial Poultry
- Wild waterfowl
- Domestic Ducks
- Clothing, shoes & equipment (Mechanical)
- Periurban birds
- Village Chickens
- Naïve Commercial Poultry
- LPM
Interface: Wild Birds/Agriculture

1. Sector 3 & 4 must be part of surveillance
2. Targeted surveillance:
   a. LPM and epidemiologic linkages of suppliers
   b. Domestic duck and geese populations
   c. Vaccinated poultry populations
   d. Enhancements when HPAI detected
3. Need some movement controls: one-way movement
4. Market chain analysis
Thank You For Your Attention!