HPAII Risk Assessment and Management

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Objectives

- to develop **qualitative** and **quantitative** risk assessment models capturing introduction and spatial and temporal spread of HPAI through different vectors and/or anthropogenic processes
- to assess, *ex-post* and *ex-ante*, the effectiveness of risk mitigation measures
Reservoirs

Spillover / Reservoir?

Dead-end hosts

GENE POOL

adapted from V. Martin, FAO-AGA
Risk Analysis Components (after OIE Animal Health Code)

- Hazard Identification
- Risk Assessment
- Risk Management
- Exposure Assessment
- Consequence Assessment
- Risk Communication
Research Questions

- potential pathways through which H5N1 HPAI virus can spread to and within poultry populations
- likelihood of entry of H5N1 HPAI virus
- likelihood of exposure of domestic poultry populations to H5N1 HPAI virus
Research Questions cont.

- likelihood of H5N1 HPAI virus becoming endemic in selected epidemiological strata and what is level of infection if this occurs
- likely impact of different control options on risk of H5N1 HPAI virus being transmitted in epidemic and endemic infection scenarios
H5N1 HPAIV Release Assessment for EU

Assessing the probability of viable virus entering EU = Release assessment

Wild migratory birds

Origin
Species
Route
Stopping places within EU

Live birds and hatching eggs legally imported

Origin, species
Legal safeguards at origin
Duration of transit
Legal safeguards at EU border
Numbers

Live birds and hatching eggs illegally imported

Avian products legally imported

Origin, species
Tissue tropism/ virus levels, processing & products
Legal safeguards at origin
Duration & conditions of transit
Legal safeguards at EU border
Numbers

Avian products illegally imported

Origin, species
Tissue tropism/ virus levels, processing & products
Legal safeguards at origin
Duration & conditions of transit
Legal safeguards at EU border
Numbers/quantity

Contaminated fomites

Origin
Type of fomite
Contact at origin
Duration & conditions of transit
Viral fragility
Any safeguards/ potential safeguards?
Numbers of fomites

Legally imported

Wild, migratory birds
Legally imported
Live birds and hatching eggs

Illegal imports

Live birds
And hatching eggs

Illegal Avian products

Illegal imports

Avian products

inside EU

EU border

from EFSA 2006
H5N1 HPAIV Exposure Assessment for EU

EU Border

Wild migratory birds

Imported live birds (legal & Illegal)

EU wild birds

Imported hatching eggs (legal & Illegal)

EU domestic birds: outside access

Imported avian products (legal & Illegal)

EU domestic birds: no outside access

Crossed EU border; inside EU

Quarantine

Release to wild

Scrub/effluent

Domestic flock

Zoo/collection

No outside access

EU Border

Contaminated fomites; e.g. packaging, tyres, shoes etc.

Hunted

Carcase scraps

Slaughter

Outside access

EU birds

Scraps/effluent

Landfill

Fly-tipping

Swill feed

Poor biosecurity

from EFSA 2006
Simulation of H5N1 HPAI Spread by Ferguson et al., Imperial College

- Neighbourhood spread
- Movement spread

by Ferguson et al., Imperial College
Temporal Pattern of HPAI Outbreaks in Viet Nam

Vaccination Campaign

Tet holiday Jan 29-31, 2006

Tet holiday Feb 9-11, 2004

Tet holiday Feb 11-13, 2005

Daily no. outbreaks

2004 2005 2006
Poultry Flows in North Viet Nam

- **Poultry Farmers**
  - 47%
  - Itinerant Village Traders (farmgate)
  - 38%
  - Local/Community Market
  - 19%
  - Wholesalers
  - 54%
  - Retailers
  - 27%
  - Other intermediaries
  - 93%
- **CONSUMERS**
  - 73%
  - 27%
  - 18% other intermediaries
  - 15% Neighbors/Villagers (farmgate)

Other intermediaries include:
- Poultry Farmers
- Itinerant Village Traders (farmgate)
- Local/Community Market
- Wholesalers
- Retailers
- Neighbors/Villagers (farmgate)
Social Network Analysis of Poultry Trade around Hanoi

From Magalhaes, Ortiz Pelaez et al: In preparation
Probability of H5N1 Presence

from Gilbert et al – under review
Potential Control Measures

- Vaccination (blanket, strategic)
- ‘Bio-security’
- Compartmentalization, zoning
- Enhanced disease detection and response
  - Cull (radius?)
  - Compensation, ‘assistance’
- ‘Sanitization’ of markets and marketing
H5N1 HPAIV Farm Transmission Model for Viet Nam

Potential source of H5N1 HPAIV

Infected Sector 3 poultry holding

Other Sector 3 poultry holdings

Live bird market

Infected Sector 4 poultry holding

Other Sector 4 poultry holdings

Magalhaes et al. 2006
Example Simulation Output: Impact of Vaccination in Sector 4

Farm/da

Incidence rate_D3
Incidence rate_C3
Incidence rate_S4

Magalhaes et al. 2006
Envisaged Project Outputs

- risk pathway diagrams specific to local circumstances and epidemiological strata developed in consultation with stakeholders
- qualitative or quantitative risk assessment models
- robust (mathematical) models of dynamics of H5N1 HPAI virus infection specific to study countries
- estimates of the effectiveness of different control interventions under field conditions
Local Risk Assessment Teams

- national partners responsible for informing decision makers to work in close collaboration with members of project teams
- risk assessment models to be developed by local epidemiologists or local mathematical modellers
- multi-disciplinary teams to assure that risk assessment is linked to risk management options being considered
Required Skill Sets

- Avian influenza epidemiology
- Animal disease management
- Poultry production
- Expert opinion elicitation/participatory epidemiology
- Risk assessment
- Mathematical disease modelling
- Economists
Summary

- structured, multi-disciplinary approach
  - qualitative and/or quantitative
- science-based and transparent
  - documentation of evidence
  - engagement with stakeholders
- express and communicate risk as well as uncertainty surrounding the estimate!!!