Controlling Avian Flu and Protecting People’s Livelihoods

DFID-Funded Collaborative HPAI Research Project: Risk Management Options

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International Meeting on Pro-Poor HPAI Risk Reduction
Phuket, 26 October 2010
Disease Control Measures

Risk Reduction

Reducing Exposure
- Bio-security
  - Conceptual
  - Structural
  - Operational

Reducing Susceptibility
- Vaccination
  - Targeted
    - Spatially
  - Temporally
  - Prod system
  - Blanket

Risk Coping

Early Detection

Surveillance
- Farm
- LBM
- Abattoir
- Wet Market

Traceability

Culling
- IP
- Contacts
- ‘Ring’
Poultry Density China, 2005

GLW, 2007

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Poultry Density India, 2005

GLW, 2007
SE-Asia Chicken & Duck Density

Chicken distribution map

Duck distribution map

REFERENCE:
Cambodia - DAHP 2003 Census (AVSF 2004), year 2002
Lao - Data elaborated from National Statistical Centre, State Planning Committee, 2000, year 1999
Myanmar - School of Veterinary Science, University of Queensland, Australia, year 2007
Thailand - Census 2004, Department of Livestock Development

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Thailand - Census 2004, Department of Livestock Development
Viet Nam: Outbreaks & Control Measures

- Compensation 10-15% market value increasing to 50% June 05
- First round vaccination campaign Oct-Dec 2005
- Twice yearly follow-up campaigns
- Sero-survey estimated 55% overall protection
- During 2007 only infected flocks culled with ring vaccination
Pre- & Post-Vaccination Comparison: Reproductive Numbers

Wave 2004-05, pre-vaccination

Wave 2005, post-vaccination

Walker et al., 2009.
Effect of Vaccination (1)

- Significant reduction in infectivity (daily spread) following vaccination
- Relative infectivity after vaccination comparable to 45% effective coverage
- Agrees with estimate from serology (55% coverage well within C.I.s)
- But need to know how long communes were infectious
Effect of Vaccination (2)

- **Increase in infectious period after vaccination**
- May indicate ‘silent spread’ of infection in vaccinated flocks
  - Infection spreads amongst vaccinated but harder to detect due to delay/reduction in clinical signs.
- **Shift in species distribution - unprotected ducks?**

Walker et al., 2009.
Effect of Vaccination (3)

- Reduction in infectivity offset by increased opportunity to spread
- Produced slower but more persistent wave post-vaccination
- RRD once again area of high risk
- Emphasizes need for more rapid detection and reporting
## Impact of Improved Detection, 2005 Wave

<table>
<thead>
<tr>
<th>Max. nr. of days to detection</th>
<th>Outbreaks averted (%)</th>
<th>Reduction in duration of wave (%)</th>
<th>Prob. of ≤ 10 outbreaks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>12</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>49</td>
<td>50</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>84</td>
<td>73</td>
<td>53</td>
</tr>
<tr>
<td>04-05 rate of detection</td>
<td>67</td>
<td>56</td>
<td>20</td>
</tr>
</tbody>
</table>

*Walker et al., 2009*
<table>
<thead>
<tr>
<th>System</th>
<th>Vaccinations required</th>
<th>Min. Vaccination costs per prod. cycle (USD cents)</th>
<th>Max. Value at risk of loss (USD)</th>
<th>Min. Break even outbreak risk per prod. cycle (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grant parent chicken hen</td>
<td>4</td>
<td>16</td>
<td>182</td>
<td>0.1</td>
</tr>
<tr>
<td>Layer chicken hen</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Broiler chicken (white)</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Broiler chicken (crossbred)</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Chicken Flock: Mixed/Backyard</td>
<td>up to 4</td>
<td>72</td>
<td>33</td>
<td>3</td>
</tr>
</tbody>
</table>
## Flock Type / Size & HPAI Risk, Viet Nam

<table>
<thead>
<tr>
<th>Flock Type / Size &amp; Size</th>
<th>Risk per 1,000 Flocks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2004/05</td>
</tr>
<tr>
<td>Backyard</td>
<td>0.013</td>
</tr>
<tr>
<td>Small commercial</td>
<td>0.633</td>
</tr>
<tr>
<td>Medium commercial</td>
<td>21.359</td>
</tr>
<tr>
<td>Large commercial</td>
<td>90.000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.126</strong></td>
</tr>
</tbody>
</table>
Private Financial Incentives

- For (risk neutral) farmers the financial incentives to use vaccination are too low to reach high coverage levels.
- Even free of charge vaccination may not be accepted by all flock owners (e.g. hens in lay).
- Higher vaccination incentives and subsequent coverage are only likely to be observed when the perceived private risk increases due to reports/news of surrounding outbreaks.
- Vaccination costs for 1,000 industrial broiler flock owner vary between 325 and 651 USD per year.
  - Simple improvements such as purchase and use of cleaning and disinfection equipment may cost less and have an equal risk reduction effect.
Poultry Trade & Live-bird Markets

Wholesale market

Poultry movement from farm to wholesale market

Poultry movement from wholesale to retail markets

Regional market

Farm

Cluster

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Fournie et al., 2009
The potential for the virus to circulate silently within the LBM depends on the time a bird remains in the market system.
Virus Amplification within LBM

Introduction of a cohort

Time spent by the cohort in the market

Prevalence

Time (in days)

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Poultry Trade & Live-bird Markets

Controlling Avian Flu and Protecting People’s Livelihoods | Mekong Region

Fournie et al., 2009
Comparison of Interventions in Markets vs. Farms

Main sources of infection: markets

- Detection & stamping out, vaccination

Main sources of infection: other farms

In Farms:
- Rest days, closure

In Markets:

Fournie et al., 2009
Compared Impact of Interventions on Flock Reproduction Number $r$

**Main sources of infection: markets**

- Rest days
- Rest days + early detection
- Rest days + early detection, vacc 50%

**Main sources of infection: other farms**

- Rest days
- Rest days + early detection

Fournie et al., 2009
## Targeting Control Measures

<table>
<thead>
<tr>
<th>Scenario*</th>
<th>Probability of extinction at day 48 (%)</th>
<th>Prop. cases averted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1: Backyard flock ‘biosecurity’ up</td>
<td>22</td>
<td>77</td>
</tr>
<tr>
<td>B2: Comm. flock ‘biosecurity’ up</td>
<td>8</td>
<td>60</td>
</tr>
<tr>
<td>B3: B1 &amp; B2</td>
<td>43</td>
<td>92</td>
</tr>
<tr>
<td>V1: Backyard flock vaccination</td>
<td>21</td>
<td>71</td>
</tr>
<tr>
<td>V2: Commercial flock vaccination</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>V3: V1 &amp; V2</td>
<td>31</td>
<td>99</td>
</tr>
</tbody>
</table>

*Population structure of 1,000 backyard & 250 commercial flocks

*Magelhaes et al., in prep.*
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Industrial replica of integrated smallholder farming (pigs, poultry, fish)
Conclusions

• Don’t expect the magic recipe and quick victory!!

• Adapt ‘traditional’ approaches to prevailing circumstances, including:
  – disease zoning, compartments, within countries, accreditation schemes, etc

• Pilot new approaches building on advances in:
  – Diagnostics (quick and cheap)
  – Information technologies (SMS, RFIDs, etc.)
  – Market developments

• H5N1 is not the ONLY risky virus!!!
Shortridge et al., 2000. Interspecies transmission of influenza viruses: H5N1 virus and a Hong Kong SAR perspective, Veterinary Microbiology, 74, 141-147

‘Who cares about H5N1, our jobs are in jeopardy'