Can you keep HPAI from entering your operation?

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- Insufficient evidence to support any particular modes of virus spread
- Contaminated from infected migrating waterfowl
- Biosecurity breaches
- Unusually high wind speeds
- Spread from farm to farm, but not from barn to barn within farms
Avian Influenza H7N7
Holland

Transmission index:
<1 km: 0.016

It appeared that most of the transmission of the infection took place within about 5 km (modelization based on the Denmark AI epidemic).

Gert Jan Boender a,*, Ronald Meester c, Edo Gies b, Mart C.M. De Jong
Preventive Veterinary Medicine; Volume 82, Issues 1-2, 15 November 2007, Pages 90-101
Case-control studies

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Risk factor</th>
<th>Risk level</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella</em></td>
<td><strong>High farm density</strong></td>
<td>OR 2.2</td>
<td>Snow et al., 2012; Great Britain</td>
</tr>
<tr>
<td><em>Newcastle</em></td>
<td></td>
<td>OR 4.2</td>
<td>East et al., 2006; Australia</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td></td>
<td>OR 6.3</td>
<td>Vandekerchove et al., 2004; Belgium</td>
</tr>
</tbody>
</table>

Less than 1 km (0.6 mile) between farms

- 2 x more chances → *Salmonella*
- 4 x more chances → *Newcastle*
- 6 x more chances → *E. Coli*

⇒ eggs, equipment, people, vehicles, wildlife
## Case-Control Studies

<table>
<thead>
<tr>
<th>Disease</th>
<th>Risk Factor</th>
<th>Risk</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avian Influenza</td>
<td>Visitors</td>
<td>OR 8.3</td>
<td>Fasina et al., 2011; Nigeria</td>
</tr>
<tr>
<td></td>
<td>Clothing, boots, hands</td>
<td>OR 7.0</td>
<td>Nishiguchi et al., 2007; Japan</td>
</tr>
<tr>
<td></td>
<td>Sharing equipment</td>
<td>OR 29.4</td>
<td>Nishiguchi et al., 2007; Japan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Racicot, 2013</td>
</tr>
</tbody>
</table>

- Fasina et al., 2011; Nigeria
- Nishiguchi et al., 2007; Japan
- Racicot, 2013
### Biosecurity Measures reported applied “usually or always”

<table>
<thead>
<tr>
<th>Biosecurity Measures</th>
<th>Parking outside</th>
<th>Washing tires before entering farm</th>
<th>Plastic boots or shoe covers</th>
<th>Footbath</th>
<th>Hairnets</th>
<th>Shower and change clothes</th>
<th>Use coveralls</th>
<th>Wash hands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>%</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>MG status</strong></td>
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<tr>
<td>Pos.</td>
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<td></td>
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</tr>
<tr>
<td><strong>Coveralls</strong></td>
<td><strong>YES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required for visitors</td>
<td><strong>12</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>NO</strong></td>
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<td><strong>22</strong></td>
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</tr>
<tr>
<td><strong>65% versus 12%</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fisher Exact Test</td>
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<td></td>
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<tr>
<td>p = 0.0008</td>
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</tbody>
</table>

Adapted from Dorea et al., 2010
7 X more chances of introducing the virus on farms using rendering
Darkling beetles


- No transmission studies....
- Coronavirus transmissible 1 hour
- In Ohio: travel 2-3 km (1-2 miles)!

Wes Watson, 2013
[wwatson@ncsu.edu]
HPAI H5N1: isolated from 30% of flies captured in a 2.3 km radius from an infected farm.
Control Access Zone

House

Poultry barn

Shed

Control access points

Dead bird disposal

Restricted Access Zone
Three zone entrance

Outside Zone
- Remove coat and sign logbook
- Contaminated area
- Remove shoes

Flock Zone
- Put on coveralls, hairnet
- Clean area
- Put on barn specific boots

Transition area
- Hand washing

Inside farm
3-zone entrance

OUTSIDE DOOR

Red zone 8'-8"

Yellow zone 4'

Yellow zone 4'

DOOR TO POULTRY FLOCK

Log book

Sink & water

BENCH

BENCH
The type of disinfectant was irrelevant if manure was not removed from the surface of boots… contaminated boot baths increased boot contamination during cleaning…
Control group
• Hidden camera in entrance
• Non functional camera elsewhere in the barn
• No intervention

Audit group
• Hidden camera in entrance
• Non functional camera elsewhere in the barn
• 3 audits in 6 months
• Poster

Visible camera group
• Visible camera in entrance for 6 months
• Poster advising that monitoring is done

SHORT TERM
1517 visits
Monitoring 24 h/day for each farm during 2 weeks

6 months

MEDIUM TERM
1231 visits
Monitoring 24 h/day for each farm during 2 weeks

Identification of people filmed and evaluation of personality profiles
Relationship between personality traits and compliance
Errors made

- 44 different biosecurity errors
- Average of 4 errors per visit
- Maximum number of errors in one visit: 14
- 26 visits (2.9% of visits) with no error by 11 different employees

Pie chart showing percentages:
- Respecting zones: 61%
- Boots: 14%
- Washing hands: 7%
- Coveralls: 7%
- Logbook: 11%
## Top 5 errors

<table>
<thead>
<tr>
<th>Error</th>
<th>% of visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not washing hands at entry</td>
<td>79.3</td>
</tr>
<tr>
<td>Zones ignored</td>
<td>67.4</td>
</tr>
<tr>
<td>Not wearing farm boots</td>
<td>56.3</td>
</tr>
<tr>
<td>Not wearing coveralls</td>
<td>43.3</td>
</tr>
<tr>
<td>Doors kept opened</td>
<td>14.4</td>
</tr>
</tbody>
</table>
Visit compliance depending on the group and the follow-up period

Compliance = \frac{\text{Applied biosecurity measures}}{\text{Required biosecurity measures}} \times 100

Graph showing visit compliance for different periods and groups:
- Short term:
  - Camera: 59.5%
  -Audit: 39.2%
  -Control: 34.7%
- Medium term:
  - Camera: 46.9%
  -Audit: 37.1%
  -Control: 25.7%
Boot compliance according to the study group and the observation period

Boot compliance (%)

Short term | Medium term
---|---
93.6 | 68.7
73.6 | 58.7
52.5 | 46.1

camera
audit
control
Lack of knowledge on biosecurity (Lotz, 1997; Barcelo & Marco, 1998; Amass & Clarke, 1999; Sanderson et al., 2000; O'Bryen & Lee, 2003)

Economic constraints (Vaillancourt & Carver, 1998; Barclay, 2004)

Lack of training, communication, incentives

Lack of time

Difficulty to apply suggested measures

Absence of biosecurity program audits

Lack of coherence of available information (Jardine & Hurdey, 1997; Moore & al., 2008)

Beliefs, attitudes, perceptions, education, experience, personality traits (Delabbio & al. 2003 et 2005)
Personality traits

A fairly steady, reliable, and enduring interior characteristic which is inferred from a trend of actions, outlooks, feelings, and habits within the person. Personality traits can be useful in summarizing, making predictions, and explaining someone.

http://psychologydictionary.org/personality-trait/

But behavior can be substantially modified with the assistance of adaptation processes.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion</td>
<td>Dominance</td>
</tr>
<tr>
<td></td>
<td>Persuasion</td>
</tr>
<tr>
<td></td>
<td>Impulsive</td>
</tr>
<tr>
<td></td>
<td>Direct approach</td>
</tr>
<tr>
<td></td>
<td>Emotionalism</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>Empathy</td>
</tr>
<tr>
<td></td>
<td>Altruism</td>
</tr>
<tr>
<td></td>
<td>Sociability</td>
</tr>
<tr>
<td></td>
<td>Team-oriented</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>Results-oriented</td>
</tr>
<tr>
<td></td>
<td>Work-oriented</td>
</tr>
<tr>
<td></td>
<td>Responsibility</td>
</tr>
<tr>
<td></td>
<td>Organization</td>
</tr>
<tr>
<td></td>
<td>Cognitive approach</td>
</tr>
<tr>
<td></td>
<td>Complexity</td>
</tr>
<tr>
<td>Emotional stability</td>
<td>Peace mind</td>
</tr>
<tr>
<td></td>
<td>Self-confidence</td>
</tr>
<tr>
<td></td>
<td>Independence of mind</td>
</tr>
<tr>
<td></td>
<td>Stress tolerance</td>
</tr>
<tr>
<td></td>
<td>Action-oriented</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>Initiative</td>
</tr>
<tr>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td></td>
<td>Creativity</td>
</tr>
<tr>
<td></td>
<td>Open-mindedness</td>
</tr>
<tr>
<td></td>
<td>Perseverance</td>
</tr>
</tbody>
</table>
**Personality traits**

- **Boot compliance**
  - Responsibility: OR = 1.3 (1.1-1.5)
  - Is responsible and conscientious towards the work he undertakes. Does not compromise or bend the rules as far as his principles and promises are concerned.

- **Visit compliance**
  - Action-oriented: OR = 1.2 (1.0-1.4)
  - Reacts quickly to constraints in his environment. Becomes energetic when faced with tasks to accomplish and challenges to overcome.

  - Complexity: IRR = 1.048 (1.002-1.097)
  - Values a logical and rational approach as well as the use of complex strategies.

- Selection of employees when hiring
- Evaluation of current employees and job assignment
- Proper incentives; **training**!
Mycoplasma: “Location of farm is the factor most associated with reinfection… the second factor is size of neighboring farm”.

RFW Goodwin, 1985
You cannot biosecure a region by only biosecuring each farm
Business → Farm 1 → Farm 2 → Farm 3

Accounting ≠ biology

Nature → One Big Fat Juicy Site
(including viruses, bacteria, protozoa)
Use of geographic information systems (GIS) for:

- disease surveillance
- outbreak control
  - routing of live haul trucks
  - creation of quarantine, vaccination, and surveillance zones
- emergency management
Quarantine notice
1. The grower involved and his/her employees
2. President
3. Vice-presidents (mainly the VP in charge of production)
4. Production manager
5. All veterinarians within the company
6. All service people
7. Feedmill manager
8. Feed truck drivers/handle through dispatcher
9. Utilities company that may have field workers in the area (electric; gas; phone)
10. Live haul manager and personnel, including loading/chasing personnel, if separate
11. Vaccination crew
12. Artificial insemination crew
13. Dead bird disposal company
14. Individuals responsible for used litter removal
15. Individuals responsible for new litter delivery
16. Hatchery manager and poult delivery personnel
17. Maintenance crews (electricians; plumbers; construction crews that may work on this farm)
18. Pest control crew, if such a crew exists within the company
19. Growers under contract with the company and others depending on disease and species affected
20. Processing plant
21. Person in charge of live-haul equipment sanitation
22. Breeder managers
23. Motor fleet manager – fleet maintenance
24. Nutritionists
25. Local or state poultry organization and/or health group.
26. State Veterinarian

Goldsboro Milling Co. with permission
Zoom in for detail of visitors

Red = high risk
Yellow = medium risk
Green = low risk
Click on any event to see detail
## Transaction Records Grouped By Equipment Persons

Export to CSV

<table>
<thead>
<tr>
<th>Farm ID of Transaction</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;02406</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 - Poultry Farm</td>
<td>6 Mar, 2014 - 08:01</td>
<td>6 Mar, 2014 - 08:46</td>
<td>45</td>
</tr>
<tr>
<td>87 - Swine Farm</td>
<td>14 Mar, 2014 - 08:28</td>
<td>14 Mar, 2014 - 09:36</td>
<td>67</td>
</tr>
<tr>
<td>32 - Swine Farm</td>
<td>14 Mar, 2014 - 14:01</td>
<td>14 Mar, 2014 - 16:32</td>
<td>151</td>
</tr>
<tr>
<td>32 - Swine Farm</td>
<td>17 Mar, 2014 - 12:31</td>
<td>17 Mar, 2014 - 14:43</td>
<td>131</td>
</tr>
<tr>
<td>&lt;2daff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 - Swine Farm</td>
<td>12 Mar, 2014 - 10:56</td>
<td>12 Mar, 2014 - 11:04</td>
<td>8</td>
</tr>
<tr>
<td>&lt;4690f</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67 - Swine Farm</td>
<td>8 Mar, 2014 - 06:54</td>
<td>8 Mar, 2014 - 07:50</td>
<td>56</td>
</tr>
<tr>
<td>51 - Poultry Farm</td>
<td>11 Mar, 2014 - 06:22</td>
<td>11 Mar, 2014 - 06:26</td>
<td>3</td>
</tr>
</tbody>
</table>
Mapped, ‘de-identified’ reports

Syndromic reporting

Blue polygons denote a disease report exists in that region. Click on region to see detail.
- Individual farm measures
- Variable traffic flow
- Minimal communication

- Integrated farm measures
- Managed traffic flow
- Established communication
- Compliance assessment