Risk of a Poultry Flock Becoming Infected with HPAI-virus due to Garbage Management

Emily Walz, Eric Linskens, Jamie Umber, Marie Culhane, David Halvorson, Francesca Contadini, Carol Cardona
Secure Poultry Supply Plans

SES
SECURE EGG SUPPLY

STS
SECURE TURKEY SUPPLY

SBS
SECURE BROILER SUPPLY
Goals of the Secure Food Supply Projects

- Avoid interruptions in animal and animal product movement from premises with no evidence of FAD infection
  - [Interruptions of movement can have unintended consequences]
- Provide a continuous supply of [safe and] wholesome food to consumers; and
- Maintain **business continuity** for producers, transporters, and food processors through response planning

Interesting finding - 2015 HPAI outbreak

- 2015 case-control study (Garber et al, 2016)
- Infected layer flocks in Nebraska and Iowa
- “Garbage trucks coming near barns”
  - OR= 14.7 (p<0.001)
- Frequency of garbage truck visits not reported
Other studies

- Risk factors for repeated presence of LPAI H5 and H7 viruses in live bird markets (Garber et al, 2007)
  - Disposed of dead birds and offal in the trash - OR: 2.4 (95% CI, 1.8-3.4)
- Risk factors associated with H5N1 in backyard poultry in Egypt (Sheta et al, 2014)
  - Disposing mortality and poultry feces in garbage piles outside was highly correlated in the regression model (F=15.7; p <0.0001)

- No previous work on commercial poultry farms in US
HPAI survival studies

- HPAI virus in chicken and turkey secretions, feces, feathers:
  - $10^3$ to $10^7$ EID$_{50}$ per gram or per milliliter
  - Assuming a low infectious dose of $10^2$ viral particles, 1.5 ounces carcass fluid contains enough viral particles to infect thousands of birds
- Virus persistence is generally longer at cooler temperatures and in more humid conditions
- Virus survival on materials that may be disposed of in the garbage
  - Poultry carcasses, feathers, egg shells, egg trays, wood, steel, glass, and PPE: days to weeks at ambient environmental conditions

**HPAI-virus present in the garbage + Ability to survive environmental conditions = Sufficient to infect a bird exposed to that material**
Hypothesized risk pathway(s)

<table>
<thead>
<tr>
<th>Potential sources of HPAI-virus contamination at landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
</tr>
<tr>
<td>Processing plant offal</td>
</tr>
<tr>
<td>Eggs from layer premises</td>
</tr>
<tr>
<td>Infected, undetected premises</td>
</tr>
<tr>
<td>Infected, detected premises</td>
</tr>
</tbody>
</table>

- HPAI virus cross-contamination at landfill to garbage management truck
- HPAI virus introduced to an uninfected premises via contaminated garbage management truck or driver
- HPAI virus tracked into barn
Gathering more details...

- Online survey (Qualtrics software), administered June-August 2016
- Convenience sample of veterinarians and other managers in the poultry industry
- Option to decline to answer any question within the survey

Results:

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Number surveys completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>15</td>
</tr>
<tr>
<td>Broiler</td>
<td>8</td>
</tr>
<tr>
<td>Layer</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
</tr>
</tbody>
</table>
## Results - Garbage Contents

<table>
<thead>
<tr>
<th>Item</th>
<th>Broiler Sector (n=8 respondents)</th>
<th>Turkey Sector (n=15 respondents)</th>
<th>Layer Sector (n=39 respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dead wildlife/wild birds</td>
<td>Yes (1/8)</td>
<td>Yes (5/15)</td>
<td>Yes (1/39)</td>
</tr>
<tr>
<td>Rodents</td>
<td>Yes (3/8)</td>
<td>Yes (5/15)</td>
<td>Yes (10/39)</td>
</tr>
<tr>
<td>Mortality or poultry carcasses</td>
<td>No (0/8)</td>
<td>Yes (1/15)</td>
<td>Yes (9/39)</td>
</tr>
<tr>
<td>Eggs or egg products&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Yes (1/8)</td>
<td>Yes (1/15)</td>
<td>Yes (8/39)</td>
</tr>
<tr>
<td>Manure</td>
<td>No (0/8)</td>
<td>No (0/15)</td>
<td>Yes (1/39)</td>
</tr>
<tr>
<td>Spilled feed</td>
<td>Yes (2/8)</td>
<td>Yes (8/15)</td>
<td>Yes (7/39)</td>
</tr>
<tr>
<td>Disposable chick transport boxes&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Yes (4/8)</td>
<td>Yes (4/15)</td>
<td>Yes (24/39)</td>
</tr>
<tr>
<td>Used needles/syringes/diagnostic supplies that have contacted birds&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Yes (1/8)</td>
<td>Yes (5/15)</td>
<td>Yes (14/39)</td>
</tr>
<tr>
<td>PPE (boot covers, gloves, coveralls, etc.)</td>
<td>Yes (8/8)</td>
<td>Yes (14/15)</td>
<td>Yes (36/39)</td>
</tr>
<tr>
<td>Feathers</td>
<td>No (0/8)</td>
<td>Yes (2/15)</td>
<td>Yes (4/39)</td>
</tr>
<tr>
<td>Offal</td>
<td>No (0/8)</td>
<td>No (0/15)</td>
<td>No (0/39)</td>
</tr>
<tr>
<td>Equipment or supplies from inside barns&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (22/39)</td>
</tr>
<tr>
<td>Household garbage from farm manager or any other residence&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>Yes</td>
<td>Yes (20/39)</td>
</tr>
<tr>
<td>Trash associated with waterfowl hunting&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>No (0/39)</td>
</tr>
<tr>
<td>Garbage from processing operation&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>Yes (23/39)</td>
</tr>
<tr>
<td>Lunch room and restroom garbage&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>Yes (37/39)</td>
</tr>
</tbody>
</table>
## Results - Garbage truck routing

### How is garbage transported to landfill?

<table>
<thead>
<tr>
<th>Method</th>
<th>Layer Sector</th>
<th>Broiler Sector</th>
<th>Turkey Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract garbage hauling company picks up</td>
<td>97%</td>
<td>86%</td>
<td>73%</td>
</tr>
<tr>
<td>Grower/employee transports garbage to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>landfill</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Does the garbage truck collect waste from multiple poultry premises before depositing the load at a landfill?

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Layer Sector</th>
<th>Broiler Sector</th>
<th>Turkey Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>43%</td>
<td>61%</td>
<td>57%</td>
</tr>
<tr>
<td>No</td>
<td>53%</td>
<td>33%</td>
<td>47%</td>
</tr>
<tr>
<td>Not sure/Unknown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable - no garbage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>truck used</td>
<td>3%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

---

College of Veterinary Medicine
University of Minnesota

UMN Secure Food System Team
Food system solutions through risked based science
Results - Trash pickup location

Where is the dumpster or trash collection point located on the premises?

Layer Sector: Where is the dumpster or trash collection point located on the premises? (Check all that apply)?

- Container at the entrance to farm: 57%
- Container on the perimeter of farm: 47%
- Container located near rendering pickup location: 7%

- Container located near barns inside Perimeter Buffer Area (PBA): 15%
- Container on farm but outside PBA: 59%
- Container located at entrance/perimeter of farm: 31%
- Container present at each house: 5%

College of Veterinary Medicine
University of Minnesota

UMN Secure Food System Team
Food system solutions through risked based science
Results - Trash pickup location

Where is the dumpster or trash collection point located on the premises?

- Container at or entrance to barn: 57%
- Container located near barns: 47%
- Container located near barns inside perimeter buffer area (PBA): 43%
- Shared container utilized by multiple premises: 47%
- Container on farm but outside PBA: 15%
- Other: 3%

Layer Sector: Where is the dumpster or trash collection point located on the premises? (Check all that apply)?

- Container located near barns inside perimeter buffer area (PBA): 59%
- Container on farm but outside PBA: 59%
- Container located near barns: 31%
- Shared container utilized by multiple premises: 15%
- Other: 3%

On average, how close is the dumpster/trash collection point to the nearest poultry barn?

- Directly adjacent to barn: 11%
- Less than 100 ft: 14%
- 100-150 ft: 22%
- 151-250 ft: 29%
- 250 ft: 33%
- More than 250 ft: 21%
Conclusions

- Potentially HPAI-contaminated or infectious material is in the garbage on poultry premises
  - i.e., dead wildlife, poultry carcasses, egg shells, and materials that have contacted poultry
- Garbage contractors used by some turkey and broiler premises may visit multiple poultry premises on one route before depositing a load at the landfill
  - HPAI virus-contaminated garbage from an infected (but undetected) premises may be present on the truck when it arrives at the next poultry farm
- Overwhelming majority of respondents indicated that they hire a contractor for some or all of their garbage transport needs
- Distance from nearest barn may be key in prevention (dumpster and garbage truck must be considered)
Limitations

• Exploratory survey:
  • Convenience sampling method
  • Small sample size

• Proportion of industry engaging in risk activity unknown
  • Highlights potential differences between sectors that may operate in the same geographic area
  • Absence of an affirmative response to a high risk activity does not definitively indicate it is not occurring

• Illustrates the variations in industry practice - What might my neighbor be doing?
Impacts

• Preliminary survey identified items in garbage that may contain infectious virus, some which may carry high titers of virus

• Secure Poultry Supply Proactive Risk Assessments for movement of poultry and poultry products:
  • Broiler sector working group, Turkey Sector Working Group opt to suspend garbage collection during Pre-Movement Isolation Period before moving birds to slaughter
  • Support to keep asking about garbage in future epi questionnaires
References


Acknowledgements

• SBS Broiler sector working group
• STS Turkey sector working group
• SES Egg sector working group
  • United Egg Producers

• Funded by a Cooperative Agreement between USDA APHIS VS-NPIC and the University of Minnesota, Department of Veterinary and Biomedical Sciences