Avian Flu - Update

Dr. Sheila E. Purdum
Extension Poultry Specialist
Professor, Animal Science, UNL
Pandemics of influenza

Recorded human pandemic influenza
(early sub-types inferred)

H2N2 → H1N1 → H3N8 → H1N1 → H3N2 → H1N1

1889 Russian influenza H2N2
1900 Old Hong Kong influenza H3N8
1918 Spanish influenza H1N1
1957 Asian influenza H2N2
1968 Hong Kong influenza H3N2
2009 Novel influenza H1N1

Recorded new avian influenzas

H9† 1999
H5 1997 2003
H7 1980 1996 2002

† The H9 virus is not conclusively documented as having caused a pandemic.
THE NEXT PANDEMIC?
Although the H5N1 virus, known as the avian flu virus, does not usually infect humans, new mutated forms of this virus could represent a realistic risk of a flu pandemic, experts say.

Shorebirds
Are natural carriers of the avian flu virus in the wild.

Natural viral cycle

Domestic birds
Intermediate hosts and easily infected by the virus through contact with nasal or fecal material. Contact with other domestic animals favors the spread of the disease.

Mammals
Intermediate hosts. Hogs can also be infected by human flu virus, which increases the risk of mutated human compatible viruses.

Pandemic cycle

Waterfowl
Infected by shared water sources.

Humans
Rarely infected by unaltered strains of the avian flu virus. Experts think that mutated viruses could spread from human to human.

MAJOR FLU PANDEMICS
Number of deaths in the USA:

<table>
<thead>
<tr>
<th>Year</th>
<th>Virus</th>
<th>Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish Flu (1918)</td>
<td>1918</td>
<td>500,000</td>
</tr>
<tr>
<td>Asian Flu (1957)</td>
<td>1957</td>
<td>70,000</td>
</tr>
<tr>
<td>Honk Kong Flu (1968)</td>
<td>1968</td>
<td>34,000</td>
</tr>
</tbody>
</table>

Global killer: The [A(H1N1)] strain of the flu virus, commonly known as the "Spanish Influenza" killed more than 50 million people worldwide.

Sources: Centers for Disease Control, World Health Organization
Flu virus - multiple species
HPAI H5N2

• “Largest loss of livestock due to a Foreign Animal Disease in the History of the United States”
• Not the first introduction of Bird Flu in the U.S.
How do AI viruses mutate?

The eight genes of the H7N9 virus are closely related to avian influenza viruses found in domestic ducks, wild birds and domestic poultry in Asia. The virus likely emerged from “reassortment,” a process in which two or more influenza viruses co-infect a single host and exchange genes. This can result in the creation of a new influenza virus. Experts think multiple reassortment events led to the creation of the H7N9 virus. These events may have occurred in habitats shared by wild and domestic birds and/or in live bird/poultry markets, where different species of birds are bought and sold for food. As the above diagram shows, the H7N9 virus likely obtained its HA (hemagglutinin) gene from domestic ducks, its NA (neuraminidase) gene from wild birds, and its six remaining genes from multiple related H9N2 influenza viruses in domestic poultry.
Movement of H5 clade 2.3.4.4
How is AI moving in the U.S.?

- Eurasian H5 clade 2.3.4.4 is now present in North American flyways
- H5N8 appears well adapted to certain waterfowl species; no definitive means to predict how long it will remain in our flyways
- Asian and European studies have detected the H5 2.3.4.4 viruses in wild birds across Eurasian flyways and winter resting grounds
3 Major U.S. Poultry Sectors

• Broiler – largest – production of broiler meat for consumption, (not eggs), geographically predominant in the U.S. Southeastern states
• Turkeys – Minnesota is the largest state
• Commercial Egg Production, largest egg producing state is Iowa (prior to 2015 break)
• Egg production chickens are genetically quite different from meat production chickens
High Pathogenicity Avian Influenza (HPAI)

- Over 40 million laying hens, constituting 11% of the U.S. layer flock
  - 30% decreased supply of egg products
    - (hardest hit sector in U.S. Midwest region)
    - Resulting in Changes in Restaurant Recipes and Use
- Over 7.5 million turkeys (< 5% total market lost)
### Description of the problem

#### Number of birds affected (until June 17th, 2015)

<table>
<thead>
<tr>
<th>Specie</th>
<th>Sites</th>
<th>Sites %</th>
<th>Birds affected</th>
<th>Birds %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg Layers</td>
<td>32</td>
<td>14%</td>
<td>34,358,140</td>
<td>71%</td>
</tr>
<tr>
<td>Pullets</td>
<td>14</td>
<td>6%</td>
<td>5,873,700</td>
<td>12%</td>
</tr>
<tr>
<td>Turkeys</td>
<td>153</td>
<td>69%</td>
<td>7,759,520</td>
<td>16%</td>
</tr>
<tr>
<td>Mixed &amp; Backyard</td>
<td>24</td>
<td>11%</td>
<td>99,933</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>223</td>
<td></td>
<td><strong>48,091,293</strong></td>
<td></td>
</tr>
</tbody>
</table>

Layer sites affected represented only 14% of the outbreak, but they represented 71% of the affected birds because of the large size of the premises affected.

Source: USDA APHIS
Link to USDA/APHIS Website

Note only 1 outbreak early 2016 – turkey farm in Indiana, but contained
Figure 4. All HPAI Detections in Poultry and Captive Wild Birds, as of 8/27/2015 (as reported on www.aphis.usda.gov) *one or more detections may have occurred in county
Different Serotypes of HPAI

- H5N8, found in Pacific flyway 2015, waterfowl very well adapted to this serotype
- H5N1 and H5N2, found in Mississippi and Missouri River Flyways
- H5N2 primary serotype in Midwest Breaks, very high mortality in poultry flocks (>90%)
- Virus mutates rapidly
Point Source vs. Lateral Spread

- Minnesota Turkeys – Point Source contaminations by wild waterfowl sources
- Iowa Layers – much lateral spread by human and vehicle vectors
Avian Influenza is Easy to Kill but highly Contagious

- High temperatures kill this virus - > 95 for 48 hours
- Simple strong disinfectants kill the virus – Chlorox solution
- Exposure to UV light
- So why did so many birds get this virus during Spring 2015?
Risk to Humans

- USDA indicates that the Risk to Human Health remains low with this particular strain of HPAI, it is different from the Asian strains
  - Does not get into eggs, and eggs are held until lab results are reported and then destroyed
  - All hens/turkeys are destroyed, no slaughter allowed of positive AI birds
Movement of Poultry Products

• In order to move product in and out of control zones, within and outside of the state in which the plant is located, permits are needed. Companies work directly with their state and APHIS.

• Example – Smart Chicken had several farms in Control Zones but none of their flocks broke with AI
Highest Risk Factors for Poultry Farmers

- Located in a Infected Zone
- High density of Corn Fields
- Open water/lakes frequented by waterfowl
Biosecurity vs. Biocontainment

- Biosecurity is protecting your farm, keeping all possible vectors of HPAI OUT!

- Biocontainment occurs once you have HPAI in your facility, keeping it in and from spreading to your neighbors
Vaccination

- Vaccine has been developed and tested for various serotypes including H5N2
- Has not been released by USDA due to several factors
  - Efficacy for a highly mutating Virus
  - Not a cure-all
  - Politics
Losers and Winners in the Egg Market

- Egg Processors with huge losses – Rembrandt (Iowa), Michael Foods (Nebraska), Sioux County Eggs, (Iowa), Sparboe (IA and MN)
  - 30% loss in liquid egg production caused a change in import law and imports of liquid eggs from Europe to U.S.
- Winner – Cal-Maine is the largest egg producer in US and had no flocks affects by AI, net income rose from $27.7 million to $143 million in 2015
Export Markets

- Politics Complicate the Situation
- Many bans on U.S. Poultry including broiler meat while breaks are primarily eggs and turkey
- Some countries accept compartmentalization/regionalization for bans
- Any + tests for AI antibodies, including those from vaccine will trigger export bans
U.S. Per Capita Egg Consumption by Year (1913-2016)

Source: USDA ERS
Projected year 2015 production is 6% lower than in 2014 (similar to years 2011–2012).

Sources: USDA NASS Chickens and Eggs and Urner Barry Midwest Prices
Impact on the shell and liquid egg prices

Prices Source is Urner Barry: Midwest LG White Eggs Delivered to the Store Door and Liquid Whole Unpasteurized Standard
Production of all eggs (including hatching)

AI outbreak effect on supply is expected to continue well into the year 2016

Source: Agricultural Markets and Policy, August 2015
Egg Prices and Consumption

Warehouse price is: NY grade A large egg

Source: Agricultural Markets and Policy, August 2015
Urner Barry market reporter says projected recovery in hen numbers combined with lost exports may increase US egg supply enough to bring down egg prices.
US Egg Farm Price Received

Source: USDA

Apr 11 2016, 3:56PM EDT. Powered by YCHARTS
Preliminary numbers – 1st year
(value of eggs not produced)

• Associated economic loss is very large, some early estimates are that almost 7.5 billion eggs (5.5 billion in IA) are not going to be produced, which value represent almost 750 million dollars at 1st processing (priced as liquid whole unpasteurized for breaking industry and delivered to the store door for shell egg industry).

• This estimate will really depend on the speed of the repopulation (the faster the speed the lower the value of eggs not produced)
Cost to the USDA

According to Dr. John Clifford, chief veterinary officer for APHIS:

• the H5N2 outbreak had killed more animals and cost more than any prior animal disease event in U.S. history

• this outbreak will cost the USDA probably somewhere in the neighborhood of $550 million

• USDA have paid, or are in the process of paying, $190 million in indemnity
Summary

- Tremendous losses to the egg and turkey industries and egg supply
- Likely to happen again
- Not harmful to human health at this time
- Biosecurity is paramount to limit spread of the disease in the poultry industry
- Poultry products are safe