The Impact of Broilers Raised Without Antibiotics on Sustainability

Dr. Matthew Salois, MA, PhD
Global Scientific Affairs & Policy
**Trending Headlines**

- **Reuters**
  - Pilgrim's Pride to near antibiotics goal early with chicken deal: CEO

- **Time**
  - You Asked: Which Foods Are Treated With Antibiotics?

- **Fortune**
  - Thousands Sign Petition for 16 Major Restaurants to Reduce Antibiotic Levels in Food

- **Reuters**
  - Burger King, Tim Hortons to curb antibiotics used in chicken
Three Analyses of Raising Chickens in the U.S.

**Environmental Impact Analysis**
Analyzed impact of removing or constraining antibiotic use on environmental resources utilization and efficiency.

**Animal Health Impact Analysis**
Analyzed the risk and severity of occurrence of 3 very serious and painful diseases – ammonia burns in the cornea, footpad lesions and airsacculitis.

**Economic & Market Impact Analysis**
Analyzed the economic and market impact of raising broilers without antibiotics and how producer prices and premiums are affected.
Environmental Analysis
Data Sources

- Expert Consensus Data (Consensus Model)
  - Interviews with technical experts

- Proprietary Industry Data (Industry Model)
  - AgriStats, 2012 data or recent, 3-year averages

Four Key Parameters to Assess Environmental and Economic Impact

- Mortality (%)
- Grow-Out Time (Days)
- Bird Density (Sqft/Bird)
- Cycle Downtime (Days)
Data on four key production parameters are used to estimate barn-level output between RWA and ABI.

Estimated house level are then used to estimate market level based on four macroeconomic inputs.

The number of additional broilers needed to close the gap is then estimated along with additional resources utilized and cost impact.

*Raised Without Antibiotics (RWA) - Bird does not receive any antibiotics or anticoccidials in their diet; also known as ABF (Antibiotic Free)

ABI (Antibiotic Inclusive) - Bird receives an antibiotic or anticoccidial at least once, also known as Conventional
### Mortality (%)

<table>
<thead>
<tr>
<th>Diet Class</th>
<th>Consensus Model&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Industry Model&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWA</td>
<td>5.80%</td>
<td>4.25%</td>
</tr>
<tr>
<td>ABI</td>
<td>3.80%</td>
<td>3.43%</td>
</tr>
<tr>
<td>Diff (Δ)</td>
<td>+2.00%</td>
<td>+0.82%</td>
</tr>
<tr>
<td>% Diff</td>
<td>52.63%</td>
<td>23.81%</td>
</tr>
</tbody>
</table>

<sup>a</sup> Consensus Model is based on data from USDA, EMI, Ross/Aviagen, Cobb/Vantress, and Expert Consensus.

<sup>b</sup> Industry Model is based on data from USDA, EMI, Ross/Aviagen, Cobb/Vantress, and Agri Stats.
## Grow-Out Time (Days)

<table>
<thead>
<tr>
<th>Diet Class</th>
<th>Consensus Model(^a)</th>
<th>Industry Model(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RWA</td>
<td>ABI</td>
</tr>
<tr>
<td>Grow-Out Time (Days)</td>
<td>49.00</td>
<td>47.00</td>
</tr>
</tbody>
</table>

\(^a\) Consensus Model is based on data from USDA, EMI, Ross/Aviagen, Cobb/Vantress, and Expert Consensus.

\(^b\) Industry Model is based on data from USDA, EMI, Ross/Aviagen, Cobb/Vantress, and Agri Stats.
## Bird Density (Sqft/Bird)

<table>
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<th>Industry Model(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RWA</td>
<td>ABI</td>
</tr>
<tr>
<td>Bird Density (Sqft/Bird)</td>
<td>0.94</td>
<td>0.84</td>
</tr>
</tbody>
</table>

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\(^b\) Industry Model is based on data from USDA, EMI, Ross/Aviagen, Cobb/Vantress, and Agri Stats.
## Cycle Downtime (Days)

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<th>Industry Model&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWA</td>
<td>18.00</td>
<td>18.89</td>
</tr>
<tr>
<td>ABI</td>
<td>14.00</td>
<td>16.57</td>
</tr>
<tr>
<td>Diff (Δ)</td>
<td>+4.00</td>
<td>+2.32</td>
</tr>
<tr>
<td>% Diff</td>
<td>28.57%</td>
<td>21.32%</td>
</tr>
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<sup>b</sup> Industry Model is based on data from USDA, EMI, Ross/Aviagen, Cobb/Vantress, and Agri Stats.
Impact of RWA on the U.S. Market

RWA

- Mortality: ~24-52%
- Grow-out Time: ~3-4%
- Bird Density: ~5-12%
- Cycle Downtime: ~21-29%

More Birds Needed to Meet Demand

683 and 883 million

*1 bird = 10 million
Environmental Impact

5.4 to 7.2 million more tons of feed per year
(Roughly equal to rail cars filled with grain that span 655 to 873 miles)
Environmental Impact

3.9 to 5.2 thousand more square miles of land to grow the feed

(About twice the size of Los Angeles)
Environmental Impact

1.9 to 3.0 billion more gallons of water consumed by the birds
(About the water consumed annually by 3,400-5,400 families of four in the U.S.)
Environmental Impact

4.6 to 6.1 million more tons of manure
(Approximately equal to the amount of sewage produced by the people in Texas annually)
Economic Impact

More than $2.9 to $3.8 billion in additional investment

(Aproximately equal to the 2015 GDP of Belize)

(Aproximately equal to the 2016 profit of MasterCard)
CONCLUSIONS & IMPLICATIONS

• Commercially raising broilers under a 100% antibiotic-free program is possible:
  – The restriction of antibiotics, however, reduces the overall efficiency of broiler production.

• To maintain the same supply of meat under RWA conditions requires adding more birds:
  – This results in additional costs and resources utilized, leading to more land, feed, and water consumed and more manure produced.

• Results are sensitive to the data and the performance parameters that influence economic costs and total output:
  – Mortality Rate
  – Cycle Downtime
  – Days Grow-out
  – Bird Density

• Policy implications suggest that a ban on antibiotic use would come with negative consequences.
  – Emphasis on consumer and producer choice and responsible antibiotic use.
Animal Health Analysis
Data

2014 bird-level data from Elanco’s Health Tracking System

- Propriety global data management system with information on over 50 different indicators of bird health since 1993
- Data is collected via posting sessions (post-mortem examinations) conducted by a veterinarian from a sub-sample of birds representing individual flocks in production
- Also collects information on the animal health products used during production to define antibiotics use program
Methodology

Assess 3 serious and painful conditions:

- Ammonia burns in the cornea
- Footpad Lesions
- Airsacculitis

Regression model to estimate association:

- Ordered logit for burned feet & airsacculitis severity
- Controls for age, date of placement
- Estimates of predicted probabilities and relative risk
Ammonia Burns in the Cornea

- Painful ulcerations
- “Gravel in the eye”
- Burns caused by high levels of ammonia in the litter
- Directly impacts bird performance and respiratory health
Footpad Lesions

- Caused by ammonia in wet litter
- Can introduce *bacteria* into footpads and cause lameness
- Birds *refuse to move/walk* and therefore stop eating
- Direct economic impact to the marketability of paws
Airsacculitis

- Presence of *suds and exudate* on the air sacs
- Birds feel like they’re *running a never-ending race*
- May indicate *respiratory virus* or secondary *bacterial infection*
- Directly impacts bird performance, mortality morbidity and processing
### Ammonia Burns

#### Predicted Probabilities and Range

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Predicted Probability (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised Without Antibiotics (RWA)</td>
<td>0.020 (0.005)</td>
</tr>
<tr>
<td>Animal Only (ANO)</td>
<td>0.007 (0.001)</td>
</tr>
<tr>
<td>Conventional (CNV)</td>
<td>0.006 (0.001)</td>
</tr>
</tbody>
</table>

#### Comparison

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Relative Risk Ratio (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWA vs. CNV</td>
<td>3.441 (1.998, 5.924)</td>
</tr>
<tr>
<td>RWA vs. ANO</td>
<td>2.677 (1.568, 4.570)</td>
</tr>
<tr>
<td>ANO vs. CNV</td>
<td>1.286 (0.860, 1.920)</td>
</tr>
</tbody>
</table>
### Burned Feet

#### Predicted Probabilities and Range

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Predicted Probability (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised Without Antibiotics (RWA)</td>
<td>0.468 (0.025)</td>
</tr>
<tr>
<td>Animal Only (ANO)</td>
<td>0.471 (0.007)</td>
</tr>
<tr>
<td>Conventional (CNV)</td>
<td>0.397 (0.007)</td>
</tr>
</tbody>
</table>

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<th>Relative Risk Ratio (95% C.I.)</th>
</tr>
</thead>
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<tr>
<td>RWA vs. CNV</td>
<td>1.110 (1.005, 1.225)</td>
</tr>
<tr>
<td>RWA vs. ANO</td>
<td>0.964 (0.875, 1.063)</td>
</tr>
<tr>
<td>ANO vs. CNV</td>
<td>1.151 (1.102, 1.201)</td>
</tr>
</tbody>
</table>
### Airsacculitis

#### Predicted Probabilities and Range

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<th>Program Type</th>
<th>Predicted Probability (standard error)</th>
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</thead>
<tbody>
<tr>
<td>Raised Without Antibiotics (RWA)</td>
<td>0.199 (0.020)</td>
</tr>
<tr>
<td>Animal Only (ANO)</td>
<td>0.114 (0.004)</td>
</tr>
<tr>
<td>Conventional (CNV)</td>
<td>0.139 (0.005)</td>
</tr>
</tbody>
</table>

#### Comparison

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Relative Risk Ratio (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWA vs. CNV</td>
<td>1.389 (1.132, 1.704)</td>
</tr>
<tr>
<td>RWA vs. ANO</td>
<td>1.688 (1.375, 2.073)</td>
</tr>
<tr>
<td>ANO vs. CNV</td>
<td>0.823 (0.748, 0.905)</td>
</tr>
</tbody>
</table>
Health Impacts from RWA Summary

- Broilers raised without antibiotics have a greater risk for corneal burns, burned feet & airsacculitis than conventionally raised broilers
- In some cases, animal-only programs had a reduced risk of disease states occurring compared to RWA
- Policies aimed at the elimination of antibiotic use may have negative consequences for animal health & welfare
- Responsible antibiotic use along with good housing and management, should be considered for good animal welfare outcomes
U.S. Broiler Production Data

- Agri Stats ® / Express Markets Inc. (EMI)
  - Industry benchmark data, reports and analyses
  - Production and Price Data cover >95% of broiler operations in the USA
  - Compare economic trends between broilers raised conventionally and raised without antibiotics (RWA)
Conventional vs. RWA Average Price

Cents per pound

2013 2014 2015 2016

RWA Price  EMI Price  Linear (RWA Price)  Linear (EMI Price)
Production Impacts of RWA

- Lower flock density in barn equates less pounds of food produced per barn
  - 5% - 15% Reduction in Density
- Longer time span between flocks (disease control measures)
  - 20% Increase in downtime
- Longer grow-out period
  - 4% increase
- Requires more feed to produce a pound of meat
  - 6% increase
- Higher mortality rates
  - 20% - 50% higher
- Potential for more birds treated with shared class medically important drugs
  - 0% - 15%
BROILER SLAUGHTER WEIGHTS BREAKOUT

USDA 2006
- 4.25 lbs & down 29%
- 7.76 lbs + 6%
- 6.26 - 7.75 lbs 17%
- 4.26 - 6.25 lbs 48%

USDA 2016
- 4.25 lbs & down 26%
- 7.76 lbs & up 23%
- 6.26 - 7.75 lbs 20%
- 4.26 - 6.25 lbs 31%
Volume RWA Produced vs. Sold RWA

- Volume Sold RWA
- Volume Produced RWA
Percent of RWA Production Sold as RWA

- 2013: 15%
- 2014: 20%
- 2015: 25%
- 2016: 30%
Boneless/Skinless Breast Unsized RWA vs. Conventional

Premium for RWA breast meat declining over time
Relationship between RWA premium and volume produced

- RWA premiums fall as supply increases

Equation: \( y = -10.6 \ln(x) + 214.9 \)

\( R^2 = 0.2143 \)
Elasticity Regression Estimates for Boneless/Skinless Breast Meat

<table>
<thead>
<tr>
<th>Regression Statistics</th>
<th></th>
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<tbody>
<tr>
<td>Multiple R</td>
<td>0.7856</td>
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<tr>
<td>R Square</td>
<td>0.6172</td>
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<tr>
<td>Adjusted R Square</td>
<td>0.5976</td>
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<tr>
<td>Standard Error</td>
<td>0.2561</td>
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<tr>
<td>Observations</td>
<td>42</td>
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<table>
<thead>
<tr>
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<td>Regression</td>
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<tr>
<td>Residual</td>
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</tr>
<tr>
<td>Total</td>
<td>41</td>
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</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>34.5125</td>
<td>2.0477</td>
<td>16.8544</td>
</tr>
<tr>
<td>ln(RWA price)</td>
<td>-2.6880</td>
<td>0.5256</td>
<td>-5.1138</td>
</tr>
<tr>
<td>ln(CNV price)</td>
<td>-0.3231</td>
<td>0.3387</td>
<td>-0.9539</td>
</tr>
</tbody>
</table>
The Bottom Line
100% RWA Impacts OneHealth

One Health Impact

More birds require more housing, feed, and water, using more natural resources to produce the same amount of chicken.

More birds needed to produce same amount of meat leading to increased costs for the farmer and for consumers.

Higher mortality, increased occurrence and severity of eye and foot lesions and airsacculitis without ability to treat and prevent disease.
We Need Choice and Innovation

Sustaining Choice

Consumer Choice: The ability of an individual to choose foods that align with their diet, values and budget.

Farmer Choice: The ability of a farmer to choose a production system that makes the most sense for his/her operation, factoring animal health, the environment and economic viability.

Innovative solutions, management approaches and more are keys to sustaining Choice and protecting One Health.