INNOVATION IN AVIAN DISEASE CONTROL STRATEGIES AND VACCINE ADMINISTRATION

BARCELONA–SPAIN

APRIL 26TH 27TH 28TH 2016
Emerging and re-emerging poultry diseases

GUILLERMO ZAVALA
Avian Health International, LLC
Emerging and Reemerging Diseases

Guillemo Zavala
DVM, MAM, MS, PhD, Dipl. ACPV
Avian Health International, LLC
avianhealth@gmail.com
gzavala@uga.edu
Emerging and Reemerging Viral Diseases

Emerging and Reemerging Bacteria and Mycoplasma-Induced Diseases

Emerging and Reemerging Gastrointestinal Diseases

Emerging and Reemerging Immuno-suppressive and Oncogenic Diseases

Emerging Diseases Associated With Management, and Infrastructure

Emerging and Reemerging Metabolic, Nutritional and Toxic Diseases
Viral Diseases

- Avian influenza
- Newcastle Disease
- Infectious Bronchitis
- Infectious Laryngotracheitis
- Reovirus infection
- Enteric Viruses
Avian Influenza

- Major threat to industry worldwide
- Largest infection rates and losses ever in 2013-2015
- Permanent concern about pandemic influenza
- Need for restructuring international trade policies
H7N3 - Impact on Production and Livability
H7N3-Vaccinated Commercial Egg Layer Flock
Areas with confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2013*

*All dates refer to onset of illness
Data as of 24 January 2014
Source: WHO/GIP
<table>
<thead>
<tr>
<th>Year</th>
<th>Subtype</th>
<th>N</th>
<th>Country (OIE WAHID)</th>
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<tbody>
<tr>
<td>2010</td>
<td>H5N1</td>
<td>17</td>
<td>Bangladesh, Bhutan, Bulgaria, Cambodia, China, Hong Kong, India, Israel, Japan, Korea N., Laos, Mongolia, Myanmar, Nepal, Rumania, Russia, Vietnam</td>
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<tr>
<td>2010</td>
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<tr>
<td>2013</td>
<td>H7N2</td>
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<td>Mexico</td>
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<td>2013</td>
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<td>H5N8</td>
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<tr>
<td>2014</td>
<td>H7N3</td>
<td>1</td>
<td>Mexico</td>
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<td>2015</td>
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<td>Canada, China, Taiwan, France, USA</td>
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<td>Mexico</td>
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<td>1</td>
<td>France</td>
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<tr>
<td>2016</td>
<td>H7N8</td>
<td>1</td>
<td>USA</td>
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</tbody>
</table>

H5 = 122/133 (91.7%)  
H7 = 11/133 (8.3%)
H5 in North America 2014-2015

CHINA/SE ASIA H5 HPAI in Geese (2014)
KOREAN PENINSULA Ducks (2014)
JAPAN Broiler Breeders (2014)
RUSSIA Siberian Tundra Swans (Fall 2014)
E.U. (Germany, Netherlands, U.K.) (2014)
CANADA Fraser Valley, BC (Late 2014)
UNITED STATES Pacific States (Dec 2014)
U.S. MISSISSIPPI Flyway (March 2015)

U.S. Poultry Industry as of June 16th 2015 = 221 premises (~50 million birds)
Bird Migration in the Americas
Avian Influenza in America
Role of Wild Birds

- Introductions are by wild birds
- Spread is by humans
- North American viruses confined to North America
- The Amazon basin acts as a buffer
- More AIVs in breeding grounds (North)
Eurasian H5 Viruses in North America

H5N8 + HXN2 → Genetic Mix H5N2

Modified from: USDA/ARS/SEPRL Stakeholder Meeting 3/20/2015.
Total Losses

- 232 affected premises → 211 commercial farms
- 50 million birds depopulated
- 670 USDA personnel: Numerous contractors and subcontractors
- 21 states (15 with commercial poultry)
- USDA expenses = $850,000,000 (besides industry losses)
- Export losses = >$4.5 Billion; Combined export value losses = 25.8% vs. 2014
Economic Impact on Trade

Percent Change in Exports (2015 vs 2014)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Percent Change in Exports (2015 vs 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broilers</td>
<td>-50</td>
</tr>
<tr>
<td>Turkeys</td>
<td>-40</td>
</tr>
<tr>
<td>Table Eggs</td>
<td>-30</td>
</tr>
<tr>
<td>Egg products</td>
<td>-20</td>
</tr>
<tr>
<td>Chicken paws</td>
<td>-10</td>
</tr>
<tr>
<td>Duck</td>
<td>0</td>
</tr>
<tr>
<td>Spent Fowl</td>
<td>10</td>
</tr>
</tbody>
</table>

Percent Loss or Gain in 2015 vs 2014

Commodity

2014
A Culture of Biosecurity

Corporate

Live Production

Breeders

Feed mill

Hatchery

Broiler production

Live Haul

Residue:
- Hatchery
- Production
- Processing
- Litter and mortality

Processing Plant

Transport

Commercialization

Breeders

Chicks

Broilers

Live Haul

Broilers
Newcastle Disease - Status

- Frequent outbreaks in enzootic areas
- Novel genotypes and sub-genotypes
- Wide use of recombinant vaccines
- Wide use of “hyper-concentrated” killed vaccines
- Drifting away from conventional vaccination programs
- Chronic biosecurity failures
Newcastle: Frequent Outbreaks
Production

Mortality

Broken Eggs
Infectious Bronchitis
Phylogeny of the Complete IBV S1 Gene

Phylogeny courtesy of:
M.J. Jackwood
University of Georgia
June, 2015
Live Infectious Bronchitis Vaccine Use (GA)

NE Georgia IBV Vaccine Use (%)

MASS
CONN
ARK
DE072
GA98
HOLL
GA08
GA13

Source: GPLN
Condemnations in The U.S.A.

Environment + Bacteria

Condemnations in The U.S.A.
Nephropathogenic IBV
Epidemiology of ILT

No. of VLT Cases

Seasonality

- Spring
- Summer
- Fall
- Winter
Role of Broiler Processing Age in ILTEpidemiology

Days

N = 566 Cases
Confirmed by V.I., PCR or Histopathology
Mean Dx Age = 42.4
Mean DTP = 4.0
Runting-Stunting Syndrome

162.0 grams

952.0 grams
White Chick Syndrome

1Smyth E. et al., WVPC Nantes, France (2013).
2Smyth E. et al., Avian Pathol. 6:467-474 (2010).
Reovirus Frequency in Broilers

Reovirus (Clinical) Cases Per Year

Source: GPLN
Reovirus Infection
Two molecular genetic groups:

- **Group 1 (MG1)**
  - <50% similar to vaccine strains
    (S1133, 2408, 2177, 1733)

- **Group 2 (MG2)**
  - 80% similar to vaccine strains
  - <50% similar to Group 1
Neurotropic Reovirus
Bacterial Diseases

- Infectious coryza
- Colisepticemia, salpingitis, peritonitis
- Gallibacterium anatis
- Clostridial diseases
- Fowl typhoid
- Paratyphoid
- Vertebral osteoarthritis
Avibacterium

E. coli

Gallibacterium

Mort/Day%
Focal Duodenal Necrosis (FDN)
Intestinal Dilatation Syndrome (IDS)

- Segmental enteropathy of brown layers and breeders reared on the floor, with severe dilatation of the midgut, chronic intestinal inflammation, severe emaciation, marked behavioral changes and permanent loss of egg production.
IDS – Gross Lesions
Brown Layers SG Mort/Day%
Paratyphoid Infection

Avian Mycoplasma Infection

MG - Age at Detection (Weeks)

Cases
2010-2014 (n = 18)

MS – Age at Detection (Weeks)

Cases
2010-2014 (n = 199)
Parasitic Diseases

- Parasitic diseases
  - Internal parasites
    - Nematode and cestode infestation
    - Histomoniasis
  - External parasites
    - Mites
    - Lice
Coccidiosis (E. tenella)

Heterakis

Ascaridia

Histomonas
Hemorrhagic Hepatosis Syndrome

- Layers 16-60 weeks of age
- Salmonella-vaccinated chickens
- All strains are susceptible
Immunosuppressive Disease

- Stress
- MDV
- IBDV
- CIAV
- REV
- Mycotoxins
vvIBDV
vvIBDV G 09
vvIBDV G 11
Molecular Epidemiology of FAdV (2010-2014)

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
<th>Count</th>
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<tbody>
<tr>
<td>FAdV-1</td>
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<tr>
<td>FAdV-2</td>
<td>20.4%</td>
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<tr>
<td>FAdV-4</td>
<td>25.8%</td>
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<tr>
<td>FAdV-7</td>
<td>1,1%</td>
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<tr>
<td>FAdV-8</td>
<td>4,3%</td>
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<td>FAdV-8a</td>
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<td>FAdV-10</td>
<td>2,2%</td>
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<tr>
<td>FAdV-11</td>
<td>1,1%</td>
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</tbody>
</table>

n = 93
Immunosuppressive/Oncogenic Diseases

- Infectious Bursal Disease
- Chicken Infectious Anemia
- Marek’s Disease
- Reticuloendotheliosis
- Avian Leukosis/Sarcoma Complex
- Lymphoproliferative Disease of Turkeys
Neoplastic Diseases

- Melanoma
- Marek's
- Lymphoid Leukosis
- Hemangioma
- Myelocytoma
- Sarcoma
Diseases or Conditions Related to Management and Infrastructure

- Respiratory complex
- Enteric complex
Rolling vaccine reactions

MG MS

ORT

E. coli

Field IBV

IBV Vaccine

Airsacculitis
Mortality
Condemnations

Management
Ventilation
Litter Quality

Immunosuppression

Secondary
Bacteria
Infection
Starter Feed
Grower Feed
Minimal Ventilation
Tunnel Ventilation
Brood (0-12 Days)
Growth → Finish → Withdrawal

Bursal Lymphocytic Depletion Scores

Maternal Antibodies
Lymphocytic Depletion (IBD)
Coccidial Multiplication

Vaccinations

ELISA

NDV
IBV
IBDV
REO
Thank you

Guillermo Zavala
DVM, MAM, MS, PhD, Dipl. ACPV
Avian Health International, LLC
avianhealth@gmail.com
gzavala@uga.edu