REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY AND OTHER AVIAN SPECIES

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Vice Chair: Sarah Mason, NC

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The Committee met on October 20, 2014 from 1:00 to 5:50 PM and October 21, 2014 from 1:00 to 5:15 PM at the Sheraton Hotel in Kansas City, Missouri. There were 46 Committee members and 50 guests in attendance, for a total of 96 participants. Chair Dale Lauer presided assisted by Sarah Mason, Vice Chair. The Chair welcomed the Committee, summarized the 2013 meeting, and reported on the responses to the 2013 Resolution:

Resolution 17 and 18 (Combined with the Committee on Salmonella) Subject Matter: OBJECTION TO SALMONELLA LINKED TO HUMAN ILLNESSES BEING DECLARED ADULTERANTS: The United States Animal Health Association (USAHA) urges the United States Department of Agriculture (USDA) to refrain from declaring any serotype of Salmonella an adulterant of raw poultry meat products, intact or ground, because this action is scientifically unwarranted and unlikely to result in measurable reductions in the national salmonellosis burden.

Response – USDA's Food Safety and Inspection Service (FSIS) evaluated the petition from the Center for Science in the Public Interest (CSPI) requesting that antibiotic-resistant Salmonella be declared as adulterants. FSIS posted the CSPI letter as a related document to the CSPI petition on the FSIS website and in the administrative record. The USDA denied the CSPI petition (August 2014).

Presentations & Reports—Session 1

Annual Broiler Industry Report was presented by Dr. David Shapiro, Perdue Foods, LLC, Salisbury, MD. A summary of the report is included in these proceedings.

Annual Table Egg Industry Report was presented by Dr. Eric Gingerich, Diamond V, Zionsville, IN. A summary of the report is included in these proceedings.

Annual Turkey Industry Report was presented by Dr. Steven Clark, Pfizer Animal Health Global Poultry, West Jefferson, NC. A summary of the report is included in these proceedings.

Upland Gamebird Industry Report was presented by Mr. Bill MacFarlane, MacFarlane Pheasants, Janesville, WI. A summary of the report is included in these proceedings.

Annual Report for Backyard and Small Commercial Flocks Dr. Julie Helm, Livestock Poultry Health, Clemson University, Columbia, SC. A summary of the report is included in these proceedings.

Avian Influenza and Newcastle Disease Subcommittee Report was presented by Dr. David Suarez, USDA-ARS, Athens, GA. The report was approved by the Committee and a summary is included in these proceedings.

Southeast Poultry Research Lab Research (SEPRL) Update was presented by Dr. David Suarez and Dr. Darrel Kapczynski, USDA-ARS, Athens, GA. A summary of the report is included in these proceedings.

The U.S. Poultry & Egg Association Research Report was presented by Dr. Gregorio Rosales, Aviagen, Inc., Huntsville, AL in lieu of Dr. John Glisson. A summary of the report is included in these proceedings.

Update on the Proposal for a US National List of Reportable Animal Diseases (NLRAD) and on the National Animal Health Reporting System (NAHRS) was presented by Dr. Stan Bruntz, USDA APHIS VS Science, Technology and Analysis Services (STAS), Fort Collins, CO. A summary of the presentation is included in these proceedings.

National Animal Health Monitoring System/Layers 2013 Report was presented by Dr. Lindsey Garber, USDA-APHIS-VS-CEAH-NAHMS, Fort Collins, CO. A summary of the report is included in these proceedings.

Avian Disease and Oncology Lab (ADOL) Research Update was presented by Dr. John Dunn, USDA Agricultural Research Service, East Lansing, MI. A summary of the report is included in these proceedings.

Industry Concerns with AI Response Plans was presented by Dr. David Shapiro, Perdue Foods, LLC, Salisbury, MD. A summary of the report is included in these proceedings.

California H5N8 LPAI Incident Report was presented by Dr. Sarah Mize, California Department of Food and Agriculture, Ontario, CA. A summary of the report is included in these proceedings.

The Monday session adjourned at 5:50 PM. The committee reconvened at 1:00 PM on Tuesday, October 23, 2014.

Presentations & Reports—Session 2

Off Site Carcass Disposal Challenges in FAD Outbreaks was presented by Dr. Jimmy Tickel, North Carolina Department of Agriculture & Consumer Services Emergency Programs Division, Raleigh, NC. A summary of the report is included in these proceedings.

Minnesota NAI Tabletop Exercise report was presented by Dr. Shauna Voss, Minnesota Board of Animal Health, Willmar, MN. A summary of the report is included in these proceedings.

Secure Poultry Supply Plan report was presented by Dr. Tim Goldsmith, University of Minnesota, Center for Animal Health and Food Safety, St. Paul, MN. A summary of the report is included in these proceedings.

A World Organization for Animal Health (OIE) update on poultry activities was presented by Dr. Michael David, Director of Sanitary International Standards, National Center for Import and Export, USDA-APHIS-VS, Riverdale, MD. A summary of the report is included in these proceedings.

Annual Status report for the National Poultry Improvement Plan (NPIP) was presented by Dr. Denise Brinson, USDA-APHIS-VS, National Poultry Improvement Plan (NPIP), Conyers, GA. A summary of the report is included in these proceedings.

Annual Status Report for Avian Influenza and Newcastle Disease (NDV) Diagnostics was presented by Dr. Mia Kim Torchetti, National Veterinary Services Laboratory (NVSL), Ames, IA. A summary of the report is included in these proceedings.

Annual NVSL Bacteriology Diagnostic Report was presented by Ms. Brenda Morningstar-Shaw, NVSL, Ames, Iowa. A summary of the report is included in these proceedings.

Live Bird Market System Update Report was presented by Dr. Elena Behnke, USDA-APHIS-VS, National Poultry Improvement Plan (NPIP), Conyers, GA, in lieu of Dr. Fidel Hegngi. A summary of the report is included in these proceedings.

Reovirus Infection, Diagnostics and Prevention in Turkeys update was presented by Dr. Ben Wileman, Ag Forte, Willmar, MN. A summary of the report is included in these proceedings.

Evaluation of Pre-movement Active Surveillance Options for Broilers was presented by Dr. Sasidhar Malladi, University of Minnesota and the USDA: APHIS Center for Epidemiology and Animal Health (CEAH). A summary of the report is included in these proceedings.

The Chicken Gut Microbiome was presented by Dr. Hosni Hassan, Prestage Department of Poultry Science, NCSU, Raleigh NC. A summary of the report is included in these proceedings.

Committee on Salmonella Report was presented by Dr. Doug Waltman, Georgia Poultry Laboratory Network, Oakwood GA**.** A summary of the report is included in these proceedings.

Committee Business:

Committee Resolutions: No Resolutions were proposed.

Committee Recommendations: No Recommendations were proposed

Committee Old Business: The Chair reported that a previous 2012 Resolution sent to the Department of Homeland Security concerning funding of avian influenza vaccine production received no response. The Chair will follow up on the Resolution to determine the outcome.

Committee New Business:
1) The Chair reported that the previous Chair (Dr. David Swayne) of the Subcommittee on AIV / NDV will be stepping down. Dr. David Suarez has offered and is willing to take over the AIV / NDV Subcommittee Chair position. The Chair will follow-up with Dr. Suarez and confirm this change.
2) Dr. Bruce Stewart-Brown will be stepping down as the poultry commodity representative to the Committee on the National List of Reportable Animal Diseases (NLRAD). The Chair asked TDP members to consider assuming this open position on the committee. After discussion it was suggested the Chair consult the current leadership of the Veterinarians in Broiler Production for possible candidates for this position. The Chair asked TDP committee members to consider other possible candidate. December 1, 2014 was set as the deadline for filling the position.
3) OIE request for comments on proposed changes to the Terrestrial Code will be published soon (November-December, 2014). The Chair will forward the request for comments to TDP committee members when received.
4) The Chair urged TDP members to review 2015-2020 USAHA Strategic Plan.
5) The Chair announced that a meeting survey will be sent to TDP members for comments on the 2014 meeting.

There being no additional business, a motion was made by Mr. Paul Brennan and seconded by Dr. Heather Hirst to adjourn the meeting. The meeting was adjourned at 5:15 PM October 21, 2014.

Broiler Industry Report
David Shapiro, DVM, Perdue Foods LLC, Salisbury, MD

Broiler Production: Production thus far in 2014 is about 2.5% lower by broiler head but about 1.5% higher in dressed pounds (due to higher average slaughter weight) than the same period in 2013 and is projected to be close to the same as last year. Average broiler weight has increased slightly. Average feed cost is lower than last year.
Mortality: First week mortality over the first half of 2014 is slightly higher than the same period in 2013. A relative shortage of hatching eggs may be contributing (increased usage of hatching eggs from very young and very old breeder flocks). Chick quality was also identified by broiler veterinarians as a current key issue. This same trend was reported last year.
Total mortality during the first half of 2014 was 0.48% higher than the same period in 2013. This was reflected in most weight classes but was more pronounced in the heavier broiler classes. This same trend was also reported last year.
Condemnations: Whole Body Farm Condemnations + Parts Condemnations increase from 0.538% in the first half of 2013 to 0.568% in the first half of 2014. Septic toxemia accounted for the increase with IP, airsacculitis and leukosis all decreasing.
Key Broiler Health Issues: Coccidiosis was again listed as the highest ranking disease by broiler veterinarians. This reflects not only the actual frequency of diagnosis or treatment of coccidiosis but also to the cost and challenge of maintaining effective anticoccidial programs. *Eimeria* Maxima was the coccidial species most often mentioned by broiler veterinarians. Necrotic Enteritis also ranked high as a disease issue and would be often associated with inadequate control of *E.* Maxima.
Novel strains of **reoviruses** continue to cause tenosynovitis in many broiler operations. Both this year and last, it was ranked second.
Infectious Bronchitis continues to be a challenge, whether due to new strains or failure to of vaccination programs to protect completely against existing strains.
Other diseases ranked in the top rankings of the most recent survey of the Association of Veterinarians in Broiler Production (AVBP) members were ILT (an increasing problem regionally), chick quality/early mortality, IP, Gangrenous Dermatitis, Necrotic Enteritis, *E.* Coli airsacculitis, Femoral Head Necrosis, Kinky-Back, Foot Pad Dermatitis, and Gumboro disease.
Generally, the diseases of concern have not changed from last year.
Key Non-Disease Broiler Issues: *Salmonella* (as a food safety concern) was ranked highest in the non-disease issue category. **Salmonellosis** also ranked highly (65^{th} percentile) in the disease ranking, leaving no doubt as to the importance of this genus to modern broiler production.
As significant change from last year was the high ranking of **Antibiotic-Free (ABF) issues** compared to last year. This is undoubtedly related to recent public announcements regarding increased production and demand for ABF poultry by both customers and broiler production companies.

Like last year, the loss or **lack of effective drugs** was ranked highly a key issue. Also, similar to last year, **increased regulation by the USDA and FDA** were ranked highly as serious concerns. Increased monitoring of *Salmonella spp.* and C*ampylobacter spp.* in the processing plant and the future implementation of FDA guidelines for drug use are the most likely causes.
Other non-disease issues ranked in the top ten percentile of the most recent AVBP members included Poultry Welfare, Biosecurity, Campylobacter, Paw Quality, and accuracy of FSIS condemnation dispositions.
Increasing and more stringent poultry welfare audits occupy more of a broiler veterinarian's time than previously.
Paw Quality was not listed as a major concern in previous years, but was ranked highly this year. Many companies report increasing challenges maintained paw quality (minimizing foot pad dermatitis).

US Table Egg Industry Update, October 2013 to October 2014
Eric Gingerich, DVM, Diamond V, Zionsville, IN

Overall health of the national table egg layer flock continues to be very good. There are no major clinical disease problems occurring at this time. This is due to the several resources and practices available to the industry:

- Continued availability of high quality vaccines
- Flock supervision from professional, well-trained flock service technicians
- Readily available veterinary technical assistance from primary breeder, vaccine company, diagnostic laboratory, feed additive suppliers, and consulting veterinarians
- High quality nutrition provided by professional nutritionists
- Housing of a majority of layers in environmentally controlled facilities in cages without exposure to litter
- Use of sound biosecurity practices.
- Continual surveillance for foreign animal diseases or potentially highly pathogenic agents such as Newcastle and avian influenza by our state and federal laboratory system

A poll of the Association of Veterinarians in Egg Production (AVEP) was conducted within the last month. The members were asked to rate a list of common diseases of caged and cage-free pullets (23 and 24 conditions listed respectively) and caged and cage-free layers (32 and 34 conditions listed respectively) as to their prevalence and their importance in their area of service on a scale of 0 to 3 with 0 = not seen, 1 = seen but not common, 2 = commonly seen, and 3 = seen in a majority of flocks. For the importance question, they were asked to give a value of each disease to a company in their area of service on a scale of 0 to 3 with 0 = not important issue for flock health or economics to 3 = very important issue for flock health and economics. 16 members of the total membership of 100 answered the survey.

To follow are the results of prevalence and importance of chick issues:

	Caged Pullets		**Cage-Free Pullets**	
	Prevalence	**Importance**	**Prevalence**	**Importance**
Yolk Infections	1.19 (1.32)*	1.13 (1.26)	1.14 (1.47)	1.14 (1.50)
Starveouts	1.25 (1.14)	0.93 (1.05)	1.14 (1.21)	1.08 (1.19)

* 2013 survey results are in parenthesis

Yolk infections and starveouts are associated with hatch egg quality, hatchery sanitation, and hatchery management of incubation, sanitation, chick processing, holding, and delivery. Compared to last year's survey, these problems appear to be subsiding.

The survey revealed the following top 5 diseases of concern occurring in US for growing pullets excluding chick yolk infections and starveouts:

Top 5 Caged Pullet Diseases		**Top 5 Cage-Free Pullet Diseases**	
Prevalence	**Importance**	**Prevalence**	**Importance**
1 – Coccidiosis (1.50)	1 – Coccidiosis (2.00)	1 – Coccidiosis (1.86)	1 – Coccidiosis (2.00)
2 – Necrotic enteritis (1.00), E. coli (1.00)	2 – Infectious bursal disease (1.47)	2 – Piling (1.36)	2 – Marek's (1.77)
	3 – Infectious laryngotracheitis (1.40)	3 – Ascarids (1.21)	3 – Piling (1.38)
4 – Infectious Laryngotracheitis (0.88)	4 – Marek's (1.27)	4 – Necrotic enteritis (1.00)	4 – Infectious Laryngotracheitis (1.38)

5 – Post SE bacterin hepatitis (0.81)	5 - Post SE bacterin hepatitis (1.20)	5 – Infectious bursal disease (0.93)	5 – Necrotic enteritis (1.31)

Coccidiosis and secondary necrotic enteritis remains the major disease concern in pullets. It is an increasing problem in caged pullets as well with vaccine usage as an intervention on the rise.
Marek's Disease in cagefree pullets is due to early exposure to Marek's virus laden dust from the prior flock in the house that is not removed by the cleaning and disinfection program between flocks. Marek's vaccine requires 5 to 7 days to provide full immunity.
SE bacterin induced hepatitis syndrome can result in up to 7 percent mortality starting 2 weeks after the administration of SE bacterin. It is has a genetic susceptibility base as it has not been seen in one strain of birds. The cause of this problem continues to be unknown at this time.
Infectious bursal disease (IBD) is its subclinical form may lead to immunosuppression after the maternal antibody has subsided. The use of the recombinant HVT-vectored IBD vaccine has greatly aided those sites with problems.
Infectious laryngotracheitis is causing losses of pullet flocks in enzootic areas.

To follow are the top 5 diseases for caged and cage-free layers from the survey:

Top 5 Caged Layer Diseases		**Top 5 Cage-Free Layer Diseases**	
Prevalence	**Importance**	**Prevalence**	**Importance**
1 – E. coli (1.69)	1 – E. coli (2.07)	1 – Cannibalism (2.00)	1 – Cannibalism (2.00)
2 – Focal Duodenal Necrosis (FDN) (1.63) 2 – *Mycoplasma* Gallisepticum (1.63)	2 – Calcium depletion (1.93) 2 - FDN	2 – E. coli (1.75)	2 – Cocci (1.87) 2 – E. coli
4 – Calcium depletion (1.56) 4 – Cannibalism 4 - Mites	4 – MG (1.80) 4 – ILT	3 – Mites (1.56)	4 – FDN (1.80)
		4 – Coccidiosis (1.38) 4 - MG	5 – Infectious bronchitis (1.47)

Cannibalism continues to be seen in cagefree flocks especially in high light intensity situations. In these cases, the 10-day or younger rule for beak trimming results in longer beaks than desired compared to a beak trim at 4 to 8 weeks and may result in an increase in incidence and severity of cannibalism. As this is a major problem for cage-free flocks that are gaining market share, genetics companies are placing more emphasis on reducing this trait. The increasing use of large colony cages may also increase the level of cannibalism.
Colibacillosis continues as the #1 disease problem in caged flocks and is a problem mainly of young flocks with mortality rates of 0.5 to 4% per week starting shortly after housing can occur. It is felt that this condition is most often secondary to upper respiratory challenges with MG, *Mycoplasma* Synoviae (MS), ammonia, infectious bronchitis (IB), etc. in early lay. It also may be a primary problem if water lines are contaminated with *E. coli*. The overall prevalence of early colibacillosis was about the same as last year, 1.62. A post-molt colibacillosis syndrome is also seen in some flocks due to declining immune system function, an ascending infection of the reproductive tract, upper respiratory infections, etc. The live E. coli vaccine, introduced in mid to late 2006, has been increasingly used successfully as both a preventative and as a treatment in the face of an outbreak in most areas.
Calcium depletion continues to maintain high importance in caged flocks and is normally associated with low intake of calcium, phosphorus, and/or vitamin D3 especially early in production with low feed intakes. This condition will be an ongoing issue with increasingly higher egg production rates accompanied with lower feed consumption through improvements in management and genetics.
Focal duodenal necrosis (FDN), felt to be due to *Clostridium* Colinum, is an under-diagnosed problem and has come up to #2 in importance from #5 last year. It is felt to be a widespread subclinical disease with lesions in the duodenum, and results in losses of egg weight gain and/or egg production depending on the severity of the infection. The antibiotics chlortetracycline or bacitracin are used successfully for treatment and/or prevention. Fermentation metabolite, probiotic, prebiotic, and botanical products are being evaluated for their usefulness in prevention of FDN.
Coccidiosis was tied for #2 in importance for cagefree layers indicating problems with developing immunity during growing.

***Mycoplasma* Gallisepticum (MG)** continues as an issue in multi-aged facilities and is successfully controlled in most cases through vaccination. Each complex must customize its vaccination program to control the strain on the farm. Ts-11 and 6/85 live vaccines are used for controlling mild strains of MG while F-strain live vaccine is being used to control more pathogenic strains or where the Ts-11 or 6/85 vaccines are no longer effective. The live pox-vectored recombinant MG vaccine is being used in a variety of situations and appears to be useful in low challenge situations. Vaccine failures with all vaccines are somewhat common and the unit must resort to medication programs using tylosin or tetracycline antibiotics before alterations in the immunity program are made. Most all operators are now applying the F-strain vaccine by eyedrop rather than spray in an effort to increase its efficacy.

Infectious bronchitis (IB) has a low prevalence in flocks but crept into the picture due to its importance where found in cagefree flocks. Variant strains of IB are usually the problem. Incorporating all of the available vaccine strains into the pullet program, making sure the pullet live and killed vaccines are administered properly, preventing the entry of variant strains using good biosecurity especially concerning egg pickup and egg handling materials, and/or utilizing a live booster program in lay are utilized in response to these problems.

Infectious laryngotracheitis made the top 5 for caged layers this year indicating the ongoing struggle to contain the vaccine viruses from causing disease in our flocks. Some of the reason for ILT problems is the switch to recombinant vaccines with low efficacy compared to the chick embryo origin (CEO) vaccines.

An external parasite, the **Northern Fowl Mite**, has risen to prominence in cage layers in past years' surveys. The difficulty in treating this condition, in cages and in cage-free flocks, has likely led to this increase. Spray treatment of caged layers is difficult due to the configuration of equipment. Elemental sulfur in dust baths is being used very successfully in cage-free flocks. Feeding of elemental sulfur will aid in reducing numbers of mites on birds as well. Decontamination of pullet moving trucks and equipment may also be lacking especially if the equipment was used previously for mite-infested spent fowl movement.

Diseases under control and of low incidence are as follows: fowl cholera (cagefree), fowl coryza, and urolithiasis/gout. These diseases tend to be localized to a region or a farm. Fowl cholera in cagefree flocks due to introduction from wild or domesticated animals is occurring on some farms with outdoor access. Fowl coryza is a regional disease (Maine, California, Florida, and south Texas) and is controlled well by the use of commercial bacterin. Gout is almost exclusively due to feeding of excess calcium to birds not yet sexually mature or feeding inadequate phosphorus to birds at any stage of life.

Diseases that are very rarely a problem for table egg layers are pox, Newcastle, infectious bursal disease, chick anemia virus, erysipelas, and fowl cholera. The area where the very virulent IBD outbreaks (vvIBD) seen in northern California in Dec08 and May09 have not shown a recurrence of the disease in layers but apparently may still be present in broiler flocks in central CA. An outbreak on a commercial pullet farm in Washington state in Feb14 showed high mortality in the pullets and has luckily not spread.

An emerging disease that has several veterinary investigators concerned is the role of **Spirochetes** in causing egg production losses. A couple sites have seen production issues similar to that seen in Europe and elsewhere in regard to slow onset of production and very poor peaks in production with a prolonged recovery associated with the isolation of *Brachyspira* Pilosicoli and *B.* Intermedia from cecae of flock members. Unfortunately, the US egg producer does not have the antibiotic tools to fight this disease, lincomycin or tiamulin, as do the Europeans.

The AVEP survey also asked about other issues and diseases of concern on a scale of 0 to 3 with 0 = no concern, 1 = some concern, 2 = moderately concerned, and 3 = very high concern. The opinions of the 20 respondents is as follows:

Issue	Average 2012	2013	2014
Avian Influenza (AI)	1.55	2.00	2.19
Lack of Effective Treatments	2.15	2.43	2.56
SE and FDA Egg Safety Rule	2.55	2.29	2.31
S. Heidelberg and Egg Safety Rule	2.45	1.90	2.13
Welfare in General	2.33	2.15	2.31
Beak Trimming	1.70	1.50	1.88
Disposal of male chicks	1.40	1.25	2.00
On-Farm Euthanasia	1.95	1.80	1.88
Molting of Layers	1.60	1.35	1.31
Banning of Cages	2.60	2.35	2.69
Adoption of Enriched Cages	N/A	2.11	2.44
Supply of Useful Vaccines	1.20	1.05	1.56
Number of Responses	20	17	16

Concern for **avian influenza** appears to be increasing likely due to ongoing threat of highly pathogenic (HP) AI, H7N3, in Mexico. The situation in Mexico is being controlled by vaccination without culling of flocks that may be infected with the virus so the threat of virus coming from positive flocks there.

AI active and passive surveillance programs are continue across the US in response to the threat of HPAI H5N1 from Asia or HPAI H7N3 from Mexico. As there is great concern in the layer industry in regard to the amount of time before egg movement can take place once quarantine is placed on a premise in a control zone, the industry and USDA have developed the Secure Egg Supply (SES) Plan that would allow movement of product within 48 hours after quarantine. This is done by assuring that a farm 1) has good biosecurity practices by being pre-approved, and 2) is negative for AI by a) testing five dead birds per house by AI real time PCR, and b) reporting daily mortality and egg production to the authorities. Discussion and research as to the best ways of bird euthanasia and disposal from large cage layer houses and complexes continues.

The threat of H5 or H7 low pathogenic AI (LPAI) for layer flocks on the East coast is much reduced due to the efforts by NY and NJ Departments of Agriculture and USDA to reduce the positivity of the live bird markets from 60% positive markets in 2004 to near 0 since. No significant AI isolations have been made in layer flocks in the US in the last year. A majority of egg operations are complying with the National Poultry Improvement Plan (NPIP) low pathogenic AI (LPAI) program for commercial layers.

The **lack of effective treatments** for diseases such as colibacillosis, necrotic enteritis, ascarids, *Capillaria spp*., fowl cholera, etc. is a very high concern and a welfare issue for the diseases that can cause much suffering due to illness. The list of antibiotics that can be used in egg layers is quite short – bacitracin, tylosin, and chlortetracycline. The lack of an anti-parasitic product for used in controlling ascarids during lay, or other nematodes, is especially troublesome as these conditions are becoming increasingly common in cage-free production. Amprolium continues to be available to prevent and treat coccidiosis. Hygromycin is also now approved for use in egg layers in production for roundworms, *Capillaria spp*., and cecal worms. Also, there is an increase in usage of non-antibiotic, preventative feed and water additives containing probiotics, prebiotics, and fermentation metabolites.

Concern for ***Salmonella*** **Enteritidis** (SE) and its consequences continues due to the ongoing possibility of human outbreaks as occurred with the egg recall of 2010 involving two Iowa operations in August 2010. The Egg Safety Rule was implemented on July 9, 2010 for flocks over 50,000 layers. Flocks of between 3,000 and 50,000 joined the program on July 9, 2012. Inspections by FDA are ongoing. The prevalence of SE is at an all time low based on certain states monitoring results. A moderate degree of concern for adding other serotypes to the plan is apparent.

The FDA Egg Safety Program entails obtaining chicks from NPIP SE Clean breeders, rodent and fly monitoring and control programs, biosecurity, cleaning and disinfection of premises, training of persons involved, testing of manure samples at 14-16 weeks, 40 to 45 weeks, and 6 weeks after molt. If any of the manure tests are positive for SE, egg testing must take place. The producer funds all testing and compliance efforts. Laboratories have managed to gear up to handle the increased testing load this requires. Producers with a manure positive swab test are holding eggs from the market until after the test results of eggs are obtained. The use of DNA based tests are now being used that minimize the time of testing from the formerly required 10 days for culture to as low as 27 hours with the new tests. There is no provision in the program for compensating a producer who has an egg-positive flock and does not have a pasteurization or hard-cooking plant that will take their eggs. Producers are greatly ramping up measures to reduce risk of SE infection by increased use of vaccines, intestinal health feed additives, rodent and fly control measures, and biosecurity practices as was intended by the plan.

The possible addition of ***Salmonella*** **Heidelberg (SH)** to the FDA Egg Safety Plan has the industry questioning why and how this will be initiated. SH in humans has not recently been attributed to eggs and the prevalence of SH in humans has dropped since the late 1990's to 2011 from 1 per 100,000 population to 0.35 per 100,000 in CDC figures from FoodNet. Also, there is no breeder program as there is for SE and it may take five to 10 years before one can be fully assured of a clean product once a breeder program is started. Also, no specific SH vaccines are available as they are for SE. It is estimated that a much higher contamination rate of flocks with SH is present compared to SE.

Poultry welfare concerns continue to be of high to very high concern due to continued activities by activist groups. The increase in concern over day old male euthanasia has come about by some companies stating they are going to require egg products from flocks where day old male euthanasia is not used.

A surprising event occurred in 2011 as the United Egg Producers (UEP) and the Humane Society of the United States (HSUS) agreed to work together to establish federal legislation to require an eventual switch from conventional cage systems to enriched cage systems by 2029. Unfortunately, this attempt at a national standard did not proceed to fruition and died. This reopens the possibility of ballot initiatives that were planned by HSUS in WA and OR. Lawsuits by attorney generals of 6 states against CA have been issued and are being debated in federal courts. Beginning January 1, 2015, all shell eggs sold in CA must be from hens that are given 116 sq. in.

floor space and comply with additional regulations above the FDA Egg Safety Plan regarding SE testing and vaccination that are required by CA.

Vaccine use continues to be the mainstay of disease prevention in the egg layer industry second to biosecurity. The supply of useful vaccines continues to be adequate and appears to be keeping up with the layer industry needs. It will be interesting to see if this good supply of vaccines continues with the consolidations now occurring in the poultry vaccine business.

This is the third year that the AVEP members have been asked for their ideas as to research needs for the layer industry. A summary of the top 5 responses of the 17 members is as follows:

Research Need Area	Number of Respondents
1 – FDN	8
2 – Salmonella control aspects	7
3 – ILT	4
4 – Avian Intestinal Spirochetosis	3
5 – Mycotoxicosis	2
5 – Coccidiosis/necrotic enteritis	2

This list is similar to last year except for the introduction of avian intestinal spirochetosis due to *Brachyspira spp.* in some white and brown egg flocks.

The egg industry has experienced unprecedented profits for the past 12 months. For the 12 months from October 2013 through September 2014, the average egg producer according to the Egg Industry Center has made $6.73 per bird. Normally, the average for a 10-year period is $1 per bird. Exports of eggs to Mexico due their losses of birds due to AI have buoyed the egg prices. Expansion of the egg layer population has been suppressed by uncertainties of housing needs. Feed price decreases in late 2013 and 2014 aided greatly in increasing profits. Exports as a percent of total production averaged 4.8% so far in 2014 compared to 4.5% in 2013.

Iowa (57.7 million) continues to be the lead state in egg production followed by Ohio (29.9 million), Indiana (26.5 million), Pennsylvania (23.9 million), California (15.3 million) and Texas (14.7 million) according to the National Agricultural Statistics Service for August 2014. Total commercial egg layer numbers were 296 million in August 2014, up from 290 million in August of 2013.

Turkey Industry Annual Report – Current Issues Facing the US Turkey Industry

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In preparation for this report to the USAHA Committee on the Transmissible Diseases of Poultry & Other Avian Species, the subcommittee chairman, Dr. Clark, surveyed turkey industry professionals and veterinarians representing a majority (n=28) of the US turkey production regarding the health status of turkeys produced in August 2013 through August 2014. The turkey industry reports several disease challenges for this 12 months varying by geographic regions within a state and across the United States. This report will list, Table 1, the challenges by disease and issues. Of particular interest in 2014 are issues with lack of efficacious drugs, clostridial dermatitis, bordetellosis, blackhead, reovirus digital flexor tendon rupture (TR-DFTR) and colibacillosis.

The "**lack of approved efficacious drugs**" continues to be the top health issue (Table 1). The withdrawal of the NADA (New Animal Drug Application) for enrofloxacin in 2005 for use in poultry leaves the industry with no adequate therapeutic response to **colibacillosis** (ranked #3, unchanged since 2009), or **fowl cholera** (ranked #12 from #17). In July 2011 the sale of roxarsone was suspended; September 30, 2013, the FDA marketing authorization NADA was withdrawn. The controversy over the use of antibiotics in animal agriculture remains a major concern for the turkey industry and for all of animal agriculture.

Clostridial Dermatitis (CD), previously referred to as **Cellulitis**, remains a major disease issue across all geographic regions; as the survey average decreased slightly to a score of 3.5 (from 3.6 in prior year) and ranked #2 (no change), from 3.8 (#2), 3.9 (#2), 4.0 (#2), 3.8 (#2) and 3.3 (#3) in 2012, 2011, 2010, 2009 and 2008, respectively. Analysis indicates range of concern; 50% of respondents score CD a 4 or 5 (severe), 32% score it a 2 or 1 (mild); it was 62%, 76% and 27%, 20%, respectively for the prior two years (2013, 2012). CD is most commonly seen in, but not limited to, commercial male turkeys nearing market age. *Clostridium* Septicum, C. Perfringens type A, or C. Sordelli is isolated from fluid or affected tissue samples of affected or dead birds. Affected turkeys present with two or more of the following clinical signs: subcutaneous emphysema (crepitus); serous or serosanguineous subcutaneous fluid; vesicles on the skin, especially on the breast/inguinal area; moist,

dark, wrinkled skin, especially breast/inguinal area; cellular necrosis (microscopic); organ involvement (spleen/liver); vesicles on the skin, and/or moist, dark, wrinkled skin, on the tail area. The affected flock will have mortality greater than or equal to 0.5 dead per 1,000-birds, fitting the individual bird definition, for two consecutive 24-hour periods. Opinions vary as to risk factors and potential causes of the problem. Some of the key areas to control of CD include: early recognition; removal of mortality 2-3 times per day; medicating affected flocks with appropriate antimicrobials; promptly managing all water spills and wet litter. There has been limited success with vaccinating at-risk flocks with autogenous bacterins and toxoids. Recently, a novel litter amendment has shown some success.

Poult enteritis of unknown etiologies has decreased in importance, to position #10 from #7, with a score of 2.4 (from 2.8). **Turkey Coronavirus** (TCV), as a defined cause of enteritis, was ranked #27 (Table 1), unchanged from #27, with reported cases (Table 2); we began reporting in 2008 with 10 cases (2013, 420). Majority of TCV cases were limited to one geographic area. We conducted an Enteric Health supplemental survey in April 2012; the survey was not conducted this year.

Protozoal Enteritis, attributed to flagellated protozoa, Cochlosoma, Tetratrichomonas and Hexamita, ranked #23 (score 1.8). Several types of protozoa are associated with enteric disease of turkeys. Protozoal enteritis can present with general signs, including dehydration, loss of appetite (off-feed), loose droppings (diarrhea) and watery intestinal contents. Flagellated protozoa include Cochlosoma, Tetratrichomonas and Hexamita. Eimeria and Cryptosporidia are non-flagellated protozoa. Cochlosoma and Hexamita are associated with enteritis, primarily in young turkeys, especially in the summer months. There are field reports of co-infections with Cochlosoma and Tetratrichomonas, or Cochlosoma and Hexamita, or flagellated protozoa and Eimeria.

Single age brooding has been implemented during the last several years to assist in managing diseases on turkeys farms, especially enteric diseases. Historically, production systems included 2 - 3 different ages on a single farm site reared in separate barns, from day-old to market age. The trend is to isolated, specialized brooding facilities. All production is separate hen and tom rearing. The brooding phase for commercial turkeys is rearing about 0 – 5 weeks of age, then the flock is moved to specialty finisher or grow-out barns. Single age brooding may be termed all-in/all-out or single-age or brooder hub. Single age brooding systems can operate in two ways. One option rears the turkeys to slaughter age at the same farm site, without other ages on the farm. Another system of single age brooding involves farm sites dedicated to brooding, then at 5 weeks of age birds are moved to a separate site for finishing; some systems may move birds 0.25 miles up to 20 miles away. In 2014, 55% of brooding was single age, compared to 44% in 2008. Single age brooding is more common in the Southeastern US than the Midwest states. Conversion to single age brooding started in late 1990 following the emergence of PEMS in North Carolina; advantages became obvious and it has expanded to other areas of the US.

Late mortality ranked fourth (#4) health issue and changed from #5 the prior year. Late Mortality may be defined as mortality, in excess of 1.5% per week, in toms (males) 17-weeks and older; mortality is not diagnosed to a specific disease or cause. Excess cumulative mortality of 5 – 10% in toms prior to slaughter has been reported. Late mortality may be associated with physiologic or biomechanical deficiencies following early rapid growth in heavy toms achieving genetic potential; aggressive behavior noted in mature toms; cannibalism; leg problems and/or hypertension.

Leg problems (#6, prior year was #4) are ranked among the top concerns of the turkey industry. Leg problems are a common complaint, such as, spiral fractures of the tibia or femur. Leg Problems may be defined as lameness, particularly in toms, several weeks prior to slaughter. Leg problems are attributed to various conditions (refer to Table 1), including, pododermatitis, fractured femurs, fractured tibia, osteomyelitis (OM), tibial dyschondroplasia (TDC), spondylolisthesis, “Shaky Leg”, etc.

Turkey Reovirus Digital Flexor Tendon Rupture (TR-DFTR) was recognized as a newly emerging disease in 2011. A unique reovirus has been isolated and identified as the cause of tenosynovitis and digital flexor tendon rupture in commercial turkeys. Clinical signs in young flocks are reportedly mild to nonexistent, but can develop into lameness and/or abnormal gait in older flocks, starting at about 12 weeks of age. Affected flocks may also report an increased incidence of aortic ruptures and poor flock performance (weight gain, uniformity). Research is on-going into pathogenesis, virus characterization, diagnostics and epidemiology. Research indicates that the turkey arthritis reovirus is distinct from the recently identified novel reovirus causing arthritis in chickens, and most similar to the turkey enteric reovirus. TR-DFTR was added to the survey in 2011 and ranked #11 (Table 1) with 106 “confirmed” cases or flocks (Table 2). In 2014 TR-DFTR ranked #18 with 150 cases (2013, #26, 39; 2012, #28, 131). A breeder company has implemented an autogenous reovirus vaccination program to induce the maximum production of antibodies and resulting transfer of maternal antibodies. Results show a significant reduction in associated clinical signs in those poults placed from vaccinated flocks. A commercial turkey lighting program of 4-8 hours of continuous dark in a 24-hour period has also been recommended. The combined efforts of breeder vaccination, commercial farm biosecurity and flock management appear to be controlling this disease. Increased recognition of TR-DFTR in 2014 is under investigation but it is suspected that the reovirus has mutated.

Blackhead, also known as Histomoniasis, increased to position #11 (#16 prior year). It is one disease with no efficacious drug approved for use in turkeys. There were 61 reported cases of blackhead (Table 2) an increase from 52 the prior year, and a record 108 in 2010. Losses to blackhead have been severe and sporadic cases are occurring in North America. The disease can be devastating in the individual flocks affected. Nitarsone is the only product approved by the FDA for the prevention of histomoniasis, Dimetridazole was extremely efficacious and previously approved for use in turkeys for the prevention and treatment of blackhead; it was banned in 1987. The lack of any legal treatment for histomoniasis is of concern, especially in the case of valuable turkey breeder candidate flocks. Losses to blackhead have been severe in several areas of Europe, and sporadic cases are occurring in North America.

Heat stress ranked #29 following another hot summer, compared to #12 the prior year. Poult Enteritis Mortality Syndrome (**PEMS**) ranked #34 versus #31 previously, *Ornithobacterium rhinotracheale* (**ORT**) ranked #9 versus #13 previously, and Avian Metapneumovirus (**aMPV**) ranked #35 versus #35. In 2014, *Bordetella avium* became of significant respiratory disease challenge in several geographic regions; bordetellosis ranked #5 (2.9 score) in 2014 compared to #8 (2.5) the prior year.

Mycoplasma Synoviae (**MS**, infectious synovitis) infections, ranked #25 (#24, prior year), are one cause of synovitis. It may be present in flocks 10-12 weeks of age with typically low mortality and low morbidity. There were 41 cases of MS reported (Table 2). The primary breeders have remained free of *M.* Gallisepticum (**MG**), *M.* Meleagridis (**MM**) and MS. Sporadic, but increasingly frequent infections with *Mycoplasma*, both MG and MS, often in association with backyard poultry and broiler breeder flocks is an ongoing concern, having the greatest impact when a breeder flock is infected and has to be destroyed. There were 17 cases of MG reported (Table 2).

Over the past 15 years the US animal agriculture industry has been continually challenged with numerous attempts to ban the use of antibiotics in livestock and poultry. The current attempt at the federal level is with the [113th Congress] **Preservation of Antibiotics for Medical Treatment Act** of 2013, introduced into both the House and Senate [H.R.1150; S.1256], otherwise known as PAMTA 2013. The Senate version is titled S. 1256 **Preventing Antibiotics Resistance Act** (PARA) and is "to amend the Federal Food, Drug, and Cosmetic Act to preserve the effectiveness of medically important antimicrobials used in the treatment of human and animal diseases." The legislation would disallow use of medically important antimicrobials for nontherapeutic uses. The turkey industry opposes PAMTA, a bill that would devastate the ability to protect animal health by unnecessarily and inappropriately removing several classes of important antibiotics from the market. The turkey industry welcomes honest discussion of science-based, pragmatic options allowing producers to farm in the best interests of their animals and customers while providing consumers' assurance our use of these vital, safe and effective production tools is professional, judicious and does not jeopardize these products' effectiveness in human medicine.

In late 2013, Congress passed the **Animal Drug User Fee Act** (ADUFA) to renew user fees for animal drugs. The bill, S. 622, has now been signed into law by the President. ADUFA reauthorizes fees for brand-name and generic drugs for animals through 2018. Under the bill, brand-name animal drug manufacturers would pay $23.6 million in fiscal 2014 and $21.6 million each subsequent year through fiscal 2018. The generic animal drugs industry would pay $7.3 million in fiscal 2014 and $30 million over the next four years. Reauthorization was a top priority for the turkey industry.

Among the industry's primary focuses in 2013 - 2014 continues to be the health of turkeys and ability to utilize approved drugs, especially in light of increased scrutiny from special interests regarding antibiotic resistance. The first related guidance was published in 2003, **Final Guidance #152**, "Evaluating the Safety of Antimicrobial New Animal Drugs with Regard to their Microbiological Effects on Bacteria of Human Health Concern." Since then there has been a great deal of discussion around antibiotic resistance leading to numerous efforts by the Food and Drug Administration's Center for Veterinary Medicine (FDA/CVM) beginning in 2012 with the **Guidance for Industry (GFI) #209** "The Judicious Use of Medically Important Antimicrobial Drugs in Food-Producing Animals." In 2013, FDA/CVM published the proposed rule for the **Veterinary Feed Directive** and **Guidance #213**, "New Animal Drugs and New Animal Drug Combination Products Administered in or on Medicated Feed or Drinking Water of Food Producing Animals: Recommendations for Drug Sponsors for Voluntarily Aligning Product Use Conditions with GFI #209". Guidance #213 provides recommendations for drug companies to voluntarily eliminate production drugs or transition from "production" (growth promotion and feed efficiency) claims to "therapeutic" claims, in order to conform to Guidance #209. All 26 animal drug manufacturers have agreed to comply. In conjunction with this guidance, the Veterinary Feed Directive (VFD), which is expected to be published as a final rule in 2015, will increase the veterinary oversight of the administration of drugs. Given FDA/CVM continues to work through the details of VFD, industry continues to play an active role in helping to shape how they ultimately look, both through comments and participation in FDA and APHIS' public meetings.

Though antibiotic resistance has been a key focus throughout the Obama Administration, recently they have announced some several high level actions. The CDC recently released a report on antibiotic resistance calling for immediate action to address the issue due to its severity. Though there was discussion of human medicine,

animal antibiotics received significant attention. Following on the heels of this report the **President's Council of Advisors on Science and Technology** (PCAST) published a report on antibiotic use in human medicine and agriculture -- **Combating Antibiotic Resistant Bacteria** (CARB). The report includes an Executive Order which calls for a national response to antibiotic resistance by establishing a Presidential Advisory Council run by HHS in consultation with USDA and Department of Defense. This group, along with a task force, is supposed to establish a **National Action Plan** by February 15, 2015 to achieve five goals: (1) slow the emergence and spread of antibiotic resistance; (2) strengthen surveillance; (3) identify rapid diagnostics for resistant pathogens; (4) facilitate the development of new treatment and control method; and (5) improve collaboration across agencies. To collect better data to inform these goals, USDA's Food Safety Inspection Service (FSIS), Agricultural Research Service (ARS) and Animal and Plant Health Inspection Service (APHIS) are working with FDA/CVM. The industry will work closely with these Agencies on determining what data should be collected and how it will be done.

A major, growing concern of the turkey industry over the past several years has been the impact of feed prices on feed availability, and on potential animal health impacts of feed alternatives. The **Renewable Fuels Standard** (RFS) has distorted feed costs for turkey producers, as well as the rest of the livestock and poultry industries. Today, livestock and poultry feed accounted for ~4.4 billion bushels (40.8% of domestic production), while ethanol consumed ~4.6 billion bushels of corn (42.7%). The result has been corn stocks at near-record lows and corn prices at near-record highs, leading turkey producers to search for alternative feed sources, and reduce production overall. The distillers' grains that are byproducts of ethanol production do not have a major impact on feed availability, as only about 10% of a turkeys' feed ration can be comprised of DDGs. The turkey health impacts of such altered-diets are currently a subject of concern and research for turkey producers. Further, with growing attention on antibiotic usage, the Center for Food Safety (CFS) and the Institute for Agriculture and Trade Policy (IATP) submitted a petition to the FDA in April of 2013 encouraging a ban on the use of antibiotics in ethanol production when DDGs are sold as animal feed for food producing animals. This debate further complicates the feed availability and antimicrobial resistance issues.

The industry continued work on developing the **Federal and State Transport** (FAST) **Plan for Movement of Commercial Turkeys** in a **High Pathogenicity Avian Influenza** (HPAI) Control Area, and Turkey Risk Assessment. The goal of this work is to facilitate business continuity and economic survival of participating non-infected turkey operations in a Control Area after an outbreak of HPAI, and to help assure the continuous availability of safe turkey meat to consumers. Recent outbreaks of Low Pathogenicity AI (LPAI) in the U.S. (including in turkeys), as well as its continued have underscored the need for such programs in responding to a potential AI outbreak. Regarding disease surveillance, the industry has continued to voice strong support for the maintenance of the **National Poultry Improvement Plan** (NPIP) in the face of increased government spending cuts. NPIP is a vital state-federal-private partnership for the turkey industry, as well as the broiler and egg industries, and APHIS has continued to show strong support for the program, having hired additional staff for the program in 2014, and maintaining their officers in Conyers, Georgia, instead of moving it to the Washington, D.C. area. The industry is also supportive of federal efforts to update and modernize ARS' **Southeast Poultry Research Laboratory** in Athens, Georgia.

In August of 2014, the Food Safety and Inspection Service (FSIS) published the final **New Poultry Inspection System** (NPIS) rule, which will modernize the inspection of turkeys and other poultry in the United States. In establishments that volunteer to transition to the new inspection system, FSIS inspectors will be allowed more flexibility to patrol the plant and provide scientific oversight to ensure the plant is meeting the required food safety performance standards. Federal inspectors will be stationed at the end of the production line to verify every poultry carcass meets the federal regulations, and plant employees will have an expanded role in inspecting carcasses for quality standards on the inspection line.

In 2013, turkey production **decreased** to 7,276.800 from 7,561.905 million pounds (live weight) in 2012. Overall domestic per capita consumption for turkey products **remained flat at** 16.00 lbs in both 2012 and 2013. The preliminary number for 2014 is **15.70 lbs** turkey consumption per capita, which is the **lowest level since 1988**. Production in 2013 **decreased to 240.00 million** head with an average live weight of **30.32 lbs**. In 2012, 253.500 million head were produced with an average live weight of 30.32 lbs. (Reference: National Turkey Federation Sourcebook, October 2014).

Upland Gamebird Industry Report

Bill MacFarlane, MacFarlane Pheasants, Janesville, WI

Founded in 1929, MacFarlane Pheasants is the largest pheasant producer in the United States, hatching nearly 2 million pheasants and partridges yearly and raising over 500,000 to maturity.

Most large Gamebird producers belong to a trade association, called the North American Gamebird Association (NAGA). NAGA was founded 83 years ago in 1931 to represent producers and gamebird hunt club

businesses. NAGA publishes a magazine for members as well as regular communications providing information on regulatory and legislative issues in Washington and the states. The group shares business tips and best practices among members. NAGA helps to connect the industry that is spread across the country and represents the community to the public and to the government.

Gamebird producers are acutely aware of the part they play in protecting the US poultry industry from avian disease. In addition, these producers face scrutiny by sectors of the public because they raise birds in captivity for consumption as well as for hunting, activities that some do not support. Though some in the larger poultry industry have not seen benefit in interacting with the gamebird industry, continued dialogue and coordination will allow the two industries to join forces on equally beneficial programs. NAGA advocates for open and active dialogue with other poultry producer segments as it recognizes the need to be a responsible partner with the larger poultry industry. Disease concerns have led most gamebird hatcheries and breeders to become NPIP monitored. NAGA has encouraged NPIP participation, resulting in a steady increase in desire to be a part of disease prevention programs.

NAGA represents the entire gamebird industry supply chain including hatcheries and breeder flocks, terminal producers who grow birds to market age from day old chicks, hunting preserves who buy birds from terminal producers for release and finally meat producers and processors. In many cases the gamebird industry is vertically integrated, similar to the larger poultry industry.

The gamebird industry is a thriving one with a product that has real market value. Overall, more than 5 million pheasant are sold each year to hunt clubs or for consumption. Bobwhite and Coturnix quail account for 15 million additional birds, and Chukars add another 3 million. Kansas, Minnesota, Ohio, Pennsylvania, South Dakota, and Wisconsin make up the largest of the pheasant producing states. Alabama, Georgia, North Carolina, and Texas represent the top quail producing states.

The modern gamebird industry is growing and striving to improve in every aspect of the business, including bio-security and disease concerns, and hopes to continue to partner with the larger poultry industry to address these concerns.

Backyard and Small Commercial Poultry Industry Report

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The number of backyard and small poultry production flocks continue to increase in many states in the U.S. Along with this growth are diseases that are infrequently seen in the commercial integrated poultry flocks due to current management and biosecurity practices. Very little information is known collectively about these small flocks and their disease status. In 2012-2014, a survey was distributed to state and university diagnostic laboratories to get more information on the common diseases routinely found in their small poultry flock submissions. In the 2014 disease survey, nineteen laboratories in seventeen states responded with backyard and small production (<1,000 birds) poultry flocks diagnoses in cases they received from August 1, 2013 through July 31, 2014. This information was compiled from 1,628 diagnoses collected from Alabama, Arkansas, Delaware, Georgie, Illinois, Kansas, Louisiana, Maryland, Minnesota, Missouri, New Jersey, New York, Pennsylvania, South Carolina, Texas, Virginia and Wyoming. In the 2012 and 2013 surveys, 623 total diagnoses were collected from 12 states, and 1,034 total diagnoses were collected from 9 states, respectively (Table 1).

Table 1: State and University Animal Diagnostic Laboratories Survey Participants by Year.

Year	AL	AR	CA	CO	DE	GA	IL	KS	LA	ME	MD	MI	MN	MO	NC	NJ	NY	PA	SC	TX	VA	WV	WY	No. of Diag.
2014	X	X			X	X	X	X	X		X		X	X		X	X	X	X	X	X		X	1,628
2013		X	X							X	X					X	X	X	X			X		1,034
2012		X		X	X					X		X		X	X	X	X	X	X					623

The survey was separated into disease/condition categories (including bacterial, fungal, metabolic, neoplastic, non-neoplastic viral, nutritional, parasitic, and other type diagnoses) and by avian group type (chicken, turkey, game bird, duck, pigeon and other types of poultry). One laboratory submission case could contain multiple significant disease or condition diagnoses. The number of birds submitted and the number of submitted cases were not recorded.

In the disease/condition categories during the last three years, the top three diagnoses continue to be bacterial, parasitic and neoplastic type diseases with 608 bacterial diagnoses (37%), 459 parasitic diagnoses (28%), and 188 neoplastic diagnoses (12%) included in the 2014 survey. The numbers of total diagnoses within each disease/condition category for the 2012-2014 surveys are shown in Table 2.

Table 2: Numbers of Total Diagnoses by Diagnosis Category for 2012-2014.

Diagnosis Category	2014	2013	2012
Bacterial	608 (37%)	241 (23%)	217 (35%)
Parasitic	459 (28%)	267 (26%)	243 (39%)
Neoplastic	188 (12%)	249 (24%)	56 (9%)
Viral (Non-neoplastic)	144 (9%)	80 (8%)	45 (7%)
Metabolic	82 (5%)	63 (6%)	*
Other	60 (4%)	71 (7%)	18 (3%)
Fungal	57 (4%)	39 (4%)	21 (3%)
Nutritional	30 (2%)	24 (2%)	23 (4%)
Total	1,628	1,034	623

*Not included in 2012 survey as a separate category

The top ten diseases/conditions for the 2014 survey, in descending order, include: mycoplasmosis at 16% of the total diagnoses, coccidiosis (11%), nematodes (10%), colibacillosis (7%), Marek's Disease (6%), salmonellosis (4%), adenocarcinomas (3%), ascites (3%), candidiasis (2%), and staphylococosis/cestodes (2%). Chickens were the largest avian group with 75% of all the disease/condition diagnoses, probably since chickens are more routinely submitted to laboratories for necropsies than any other avian group. Lower on the list of number of diagnoses were game birds (9%), turkey (8%), pigeon and duck (3% each), and other types (2%) (Table 3).

Table 3: 2014 – Numbers of Total Diagnoses in Diagnosis Category Separated by Avian Group

Diagnosis	Chicken	Gamebird	Turkey	Pigeon	Duck	Other
Bacterial	467 (38%)	31 (21%)	75 (56%)	14 (33%)	13 (36%)	8 (29%)
Parasitic	344 (28%)	51 (35%)	45 (33%)	11 (26%)	4 (11%)	4 (14%)
Neoplastic	180 (15%)				1 (3%)	2 (7%)
Viral	99 (8%)	18 (12%)	9 (7%)	13 (31%)		5 (18%)
Metabolic	72 (6%)				9 (25%)	1 (4%)
Fungal	38 (3%)	13 (9%)	2 (1%)	3 (7%)		1 (4%)
Other	28 (28%)	14 (10%)	2 (1%)	1 (2%)	9 (25%)	6 (21%)
Nutritional	12 (1%)	15 (10%)	2 (1%)			1 (4%)
% of Total Diagnoses	75%	9%	8%	3%	3%	2%

The top bacterial diseases diagnosed in the 2014 survey include mycoplasmosis (*M. synoviae* and *M. gallisepticum*), found mostly in chickens, colibacillosis and salmonellosis. Two laboratories included comments of diagnosing *Salmonella* serogroup D in chickens in four of their cases, two of which were *S.* Enteritidis. Similar to last year, parasitic diseases accounted for over 28% of all diagnosed diseases with coccidiosis and nematodiasis being the most numerous. Marek's Disease continues to be the top disease diagnosed in the neoplastic category in chickens. Interestingly, the incidence rate of neoplastic diseases category was half the amount this year at 12% of the total diagnoses compared to 24% in 2013, and 9% was reported in 2012. The top non-neoplastic viral diseases diagnosed included infectious laryngotracheitis, avian pox and infectious bronchitis primarily in chickens. Ascites was reported as the top metabolic condition (3% of all diagnoses) over fatty liver hemorrhagic syndrome (1%) that was reported as the top metabolic category last year. Candidiasis and aspergillosis continue to be the only diagnoses in the fungal category. For nutritional problems, rickets was the top diagnoses at 1%, found more in game birds than in chickens, and a few cases of specific vitamin (A, D, E) and calcium deficiencies in chickens and game birds. Other diseases and conditions diagnosed included toxicosis (including salt and sulfa drugs in game birds; and mycotoxins and lead poisoning in ducks, chickens and other species), trauma, and unknown etiology or no diagnosis found. (Table 4).

Table 4: 2014 - Number of Total Diagnoses for Each Disease or Condition Reported in the Survey

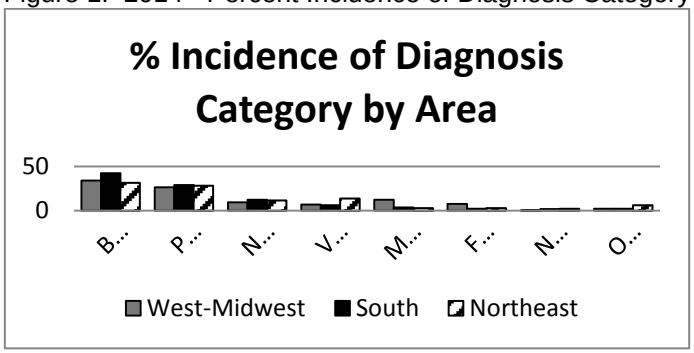
Diagnosis Category	Disease or Condition	No. of Total Diagnoses	Percentage of Total Diagnoses	Avian Group Comments
Bacterial	Mycoplasmosis (*M.* Synoviae 130, *M.* Gallisepticum 127, not specified 5)	262	16%	C 15%
	E. coli	120	7%	
	Salmonellosis	61	4%	C > T > GB
	Staphylococcus	38	2%	C > P > D
	Avibacterium	33	2%	C
	Clostridia	28	2%	C > GB > T
	Pasteurella Multocida	32	2%	C > T > O > D
	Mixed BacteriaL Infections	22	1%	
	Mycobacteriosis	4	< 1%	C
	Pseudomonas	3	< 1%	D > C
	Listeriosis	2	< 1%	C
	Brevibacterium, Enterococcus, Erysipelas	1 each	< 1%	C, C, GB
Parasitic	Coccidosis	175	11%	C > P > O > GB/T
	Nematodes	156	10%	C > GB > T
	Cestodes	38	2%	C > GB
	Mites	30	2%	C > T
	Lice	29	2%	C > T
	Histomoniasis	21	1%	T > C > GB > O
	Trematodes	4	< 1%	D
	Gnats, Toxoplasmosis	2 each	< 1%	C
	Sticktight Fleas, Trichamonasis	1 each	< 1%	C, P
Neoplastic	Marek's Disease	102	6%	C
	Adenocarcinoma	56	3%	C
	Leukosis/Sarcoma	27	2%	C > GB/O
	Leiomyoma, Reticuloendothiasis, Squamous Cell Carcinoma	1 each	< 1%	C, GB, D
Viral	Infectious Laryngotracheitis	35	2%	C
	Avian Pox	32	2%	C > GB > T
	Infectious Bronchitis	26	2%	C
	Pigeon PMV	13	1%	P
	Avian Influenza	13	1%	C > O
	Avian Reovirus	5	< 1%	C
	Infectious Bursal Disease	5	< 1%	C
	Chick Anemia Virus	4	< 1%	C
	Marble Spleen Disease	3	< 1%	GB
	Quail Bronchitis	5	< 1%	GB
	Newcastle (APMV-1)	2	< 1%	GB
	West Nile Virus	1	< 1%	O
Metabolic	Ascites	52	3%	C
	Fatty Liver Hemorrhagic Syndrome	20	1%	C
	Amyloid	9	1%	D
	Hepatopathy	1	< 1%	O
Fungal	Candidiasis	39	2%	C > GB > O > P

	Aspergillosis	18	1%	C > P > T
Nutritional	Rickets	14	1%	GB > C
	Vitamin D Deficieny	5	< 1%	C
	Vitamin A Deficieny	4	< 1%	GB
	Calcium Deficiency	3	< 1%	GB
	Osteoporosis	2	< 1%	C
	Vitamin E Deficiency	2	< 1%	C
Other	Unknown or No Diagnosis	14	1%	
	Toxicosis	11	1%	D/GB > C
	Trauma	10	1%	C > D > GB > O
	Impaction	5	< 1%	
	Gout	4	< 1%	C > GB
	Hatchery Management	3	< 1%	P
	Emaciation, Sinusitis	2 each	< 1%	C, C/O
	Anthracosis, Choke, Encephalocele, Foreign Body Perforation, Internal Layer, Periostitis, Dermatitis, Urolithiasis, Uterine Rupture	1 each	< 1%	T, C, C, D, C, O, O, C, C
Total Diagnoses		1628		

There were a few differences in the types and incidence rates of diagnoses between the laboratories located in the West-Midwest, South and Northeast areas of the U.S. The southern laboratories reported a little higher total number of bacterial diagnoses. Higher fungal and metabolic diagnoses were reported in the West-Midwest area and the Northeast area reported more non-neoplastic viral diagnoses (Figure 1).

Note: Statistical analysis was not performed on any of these data points.

Figure 1: 2014 - Percent Incidence of Diagnosis Category Separated by Area



Avian Influenza and Newcastle Disease Sub-Committee Report

David Suarez, DVM, USDA-ARS, Athens, GA

A number of countries reported both low pathogenic avian influenza (LPAI) and highly pathogenic avian influenza (HPAI) in the last year. The Asian lineage H5N1 continues to be the most important with the virus endemic in China, Vietnam, Egypt, Indonesia and likely endemic in several other countries including Bangladesh, Nepal, and Cambodia. New outbreaks were reported in North Korea, Libya, India, and Russia. The appearance of re-assortment viruses, which have the Asian lineage H5 gene but different neuraminidase genes, appear more prevalent this year. At least three variants were reported including H5N2 in China, H5N6 in China, Laos, and Vietnam, and H5N8 in South Korea and Japan. The H5N6 variant is concerning because it has already been detected in three different countries. A different H5N2 was detected in Taiwan, but this virus is unrelated to the other outbreaks. A H5N2 low pathogenic virus of Mexican H5N2 lineage has circulated in Taiwan since 2003, but in late 2012 the virus mutated to the HPAI form. The report in 2014 is a reoccurrence of the earlier outbreak.

A new H7N2 HPAI outbreak occurred in Australia from an apparent wild bird source and appears to be controlled. Multiple reports of LPAI have been reported, but mostly from the U.S. and Europe, which likely reflects either under reporting or lack of surveillance.

Multiple subtypes of virus have also been reported in humans in 2014. The human cases can be divided into a conjunctivitis with some flu-like symptoms or severe respiratory infection with atypical pneumonia and a high case fatality. The less serious human cases have been caused by both LPAI and HPAI, including H7N7 in Italy, H7N3 in Mexico, and H9N2 in Hong Kong. The severe disease can also be caused by LPAI and HPAI including H7N9, H10N8, and H5N6 in China and H5N1 in a number of different countries. The zoonotic potential of avian influenza continues to be an ongoing concern.

Newcastle disease virus remains endemic in a large part of the world. The virus, although a single serotype, has many different genotypes. A variant of genotype VII appears to be of some concern because it has been detected in Israel, Pakistan, and Indonesia in the last couple years. Although vaccines are widely available, outbreaks in vaccinated flocks continue to be a problem in endemic countries.

Dr. Suarez reported that the 9th International Avian Influenza Symposium will be held Sunday, April 12, 2015 – Wednesday, April 15, 2015 in Athens, GA. The 3rd International Symposium on Neglected Influenza Viruses will be April 15-17 2015 in Athens, GA.

Research Update Southeast Poultry Research Laboratory (SEPRL)

David Suarez, Darrell Kapczynski, Erica Spackman, Michael Day, and Qingzhong Yu, USDA-ARS, Athens, GA

Dr. Suarez provided an update on the Biocontainment Laboratory and Consolidated Poultry Research Facility Modernization project. Funding has been requested in the FY14 and FY15 President's budget. It is the only building project requested by ARS. It has not been included in either the House or Senate appropriations bill to date.

Avian influenza virus

The detection of HPAIV by antigen capture later flow devices (LFD) was evaluated at 12 hour intervals in chickens and detection was correlated with clinical condition. Dead birds were tested either immediately after being found dead or were held an additional 12 hours to simulate field conditions. Detection of virus correlated directly to virus shed, but not always with clinical condition. While the highest virus titers were frequently seen in sick and dead birds, apparently healthy birds could shed sufficient titers to be detected by the devices. Additionally, in rare cases, sick and dead birds did not shed sufficient virus for detection with LFD. Importantly, delaying testing of carcasses by 12 hours did not impact detection; in fact the highest titers were recovered from this group. Current sample collection paradigms which target sick and dead birds are optimal, however it should be noted that samples from these populations can till yield false negative results.

Highly pathogenic avian influenza viruses (HPAIV's) remain a threat to poultry worldwide. Avian influenza viruses, including HPAIV, are usually non-pathogenic for ducks and other wild aquatic birds, with the exception of some Asian lineage H5N1 HPAIVs which can cause severe disease in ducks. Ducks have been implicated in the dissemination of H5N1 HPAI, and some duck species, particularly mallards, can potentially be long-distance vectors of the virus. With the continuous occurrence of HPAI outbreaks in poultry it's necessary to address the role of wild birds in the transmission and spreading of HPAIV's. We conducted a study in which we inoculated 2-weeks-old mallard ducks (*Anas platyrhynchos*) intranasally with 106 EID50 of one of eleven strains of HPAIV subtypes H5 or H7, including isolates from different years and countries. Although no clinical signs or mortality were observed, ducks became infected with all of the viruses examined and transmitted the viruses to contacts. Viral shedding occurred by both the oropharyngeal and cloacal routes for more than 11 days in almost all ducks. Viruses that had circulated for longer periods of time in poultry, like the Mexican H5N2 HPAIV, were less infectious for ducks. These results raise concerns about possible spreading of HPAIV's by infected wild ducks.

In June of 2012, a H7N3 highly pathogenic avian influenza (HPAI) virus was identified as the cause of a severe disease outbreak in commercial laying chicken farms in Jalisco, Mexico. This region is responsible for approximately 55% of the eggs produced in Mexico, and infection with this virus severely affects the reproductive tract resulting in misformed or shell-less eggs. The HPAI virus had high sequence similarity of greater than 97% to wild bird viruses from North America in all eight gene segments examined indicating a wild bird source for the LP to HP outbreak. Because of high sequence similarity to the HPAI virus, the Mexican government immediately identified a 2006 Cinnamon Teal H7N3 (A/CT/2006) isolate to use as part of a vaccine control program. Originally, three commercial laboratories were authorized to produce the inactivated vaccine, which was distributed by the Mexican authorities. At the end of 2012, with no new outbreaks reported there were hopes of eradication. However, by early 2013 multiple Mexican states reported new outbreaks of the virus. Many of the new outbreaks were from states outside of Jalisco, indicating the virus had escaped the original containment zone. In 2014,

further H7N3 HPAI outbreaks were reported in Guanajuato, indicating the virus continues to persist. The government has subsequently increased the number of commercial vaccine companies authorized to produce the vaccine to approximately ten. Vaccination schedules for layer type birds in these affected regions range from 6-15 individual injections over the life of the bird, with swab samples submitted each month for flock surveillance testing. Thus, it does not appear that this virus will be eradicated from the region in the near term and continues to present a danger to the US poultry industry.

In vaccine studies, both U.S. and Mexican H7 avian influenza virus (AIV) were tested as antigen in experimental vaccines and injected into chickens three weeks prior to challenge. All H7 vaccines tested provided >90 % protection against clinical disease after challenge and decreased the number of birds shedding AIV and the titers of viral shedding. In a second experiment, 26 week-old egg-laying hens were vaccinated either singly or doubly with the A/CT/2006 vaccine and challenged against the HPAI virus. All vaccinated birds reduced shedding of virus compared to sham vaccinated birds and were protected against drops in egg production. These studies demonstrate origins of the 2012 Mexican H7N3 HPAI virus and provide support for vaccination of poultry as part of an eradication program against this virus.

Infectious laryngotracheitis

Chicken infectious laryngotracheitis (ILT) and Newcastle disease (ND) are two of the most economically important respiratory infectious diseases of poultry. The current commercial ILT vaccines are either not safe or less effective. Therefore, there is a pressing need to develop safer and more efficacious ILT vaccines. In the present study, we generated Newcastle disease virus (NDV) recombinants expressing the glycoproteins B (gB) or D (gD) of infectious laryngotracheitis virus (ILTV) using reverse genetics technology. These recombinant viruses were safe, stable and immunogenic, and replicated efficiently in birds. Vaccination of chickens with these recombinant viruses conferred complete clinical protection against ILTV and NDV challenge. These novel bivalent vaccines can potentially be mass-administered via aerosol or drinking water to large chicken populations at low cost, which will have a direct impact on poultry health, fitness and performance.

Enteric diseases

Characterization of the complex viral community present in the poultry gut continues, with three main areas of focus in the past year: 1) comparative metagenomics to determine the viruses and/or viral genes associated with enteric disease and performance problems in the field; 2) continuing molecular epidemiology to investigate novel and re-emerging cases of viral enteric disease in the field; and, 3) the design and validation of molecular diagnostic assays for the novel enteric viruses initially characterized at SEPRL using a metagenomic approach. A comparative metagenomic analysis of the complete viral and bacterial communities present in SPF chickens placed in the field on selected commercial and back yard broiler chicken farms revealed markedly altered enteric microbiomes compared to pre-placement intestinal samples. Of particular interest was the observation that the sentinel birds were colonized by members of the enteric Picornaviridae that were absent in the pre-contact birds. The bacterial community was altered as well, particularly among members of the Lachnospiracea/Clostridium and Lactobacillus families and genera. In collaboration with industry stakeholders, the re-emerging problem of turkey enteric coronavirus (TCoV) continues to be monitored in the Southeastern United States. Real-time and conventional RT-PCR were used to monitor and characterize the rapidly spreading TCoV among numerous turkey flocks, revealing novel isolates of TCoV and ruling out infection with a variant infectious bronchitis virus (IBV) from adjacent chicken farms. A molecular characterization of novel turkey-origin picobirnavirus (PBV) using a fully validated RT-PCR assay developed at SEPRL revealed that the turkey PBV is unique among the PBVs and may not fit previously described genotyping categories developed for the mammalian PBVs. Finally, enteric samples received from several turkey flocks in Arkansas that were experiencing non-TCoV enteritis were confirmed to be enteric picornavirus positive using a novel RT-PCR assay developed at SEPRL. This assay was used to monitor the shedding of enteric picornavirus in experimental birds and to monitor attempts to propagate the picornaviruses in embryonated turkey eggs.

Newcastle Disease Virus

Virulent Newcastle disease virus (NDV) is not normally found in the United States and is considered a foreign animal disease. Because virulent NDV is found widely around the world, movement of the virus into U.S. poultry remains a constant threat. The U.S. strategy for new introductions are to rapidly detect outbreaks using real-time RT-PCR tests to detect virus through our NAHLN system of veterinary laboratories and then quickly eradicate infected flocks. The current rRT-PCR screening test targets a conserved region of the matrix gene and identifies most NDV viruses, both low and high virulent viruses. If the matrix test is positive, then a second test is reflexively used that can specifically identify virulent virus by targeting the fusion cleavage site. The matrix test, although performing well against Mexican lineage viruses, has been documented to have low sensitivity or even have false negatives for some viruses. Because of this concern alternative tests are needed to the matrix test to assure sensitive and specific assays are available. Using the large amount of NDV sequence found in the public databases, new rRT-PCR tests were developed using single nucleotide polymorphism (SNP) analysis to to identify the most conserved regions of the genome. A total of eight different regions that were highly conserved

and were amenable to a rRT-PCR test were empirically tested to identify the most promising tests for additional study. Three tests were bench validated to have high sensitivity and specificity that will provide alternatives to the matrix test if needed.

US Poultry and Egg Association Research Update
Gregorio Rosales DVM, Aviagen, Inc., Huntsville, AL, for John Glisson, DVM

The USPOULTRY research program, founded in 1963, has a long history of providing funding for practical applied research to supply solutions to important problems and stimulate innovation in the poultry industry. Throughout its history the research program has provided a list of research priorities to researchers so that they could be guided in choosing topics for research proposals that have been identified by the poultry industry as critically and currently important. The research proposals are evaluated by the Foundation Research Advisory Committee (FRAC), a panel of fifteen industry experts, and the best proposals are recommended for funding. The research program is funded jointly by USPOULTRY and the USPOULTRY Foundation. The structure of the program has been refined over the years to successfully provide a system to stimulate the submission of high quality research proposals and provide an unbiased, thoughtful evaluation of the proposals.
In recent years the poultry industry has found itself facing new challenges for which research-based solutions are not yet available. USPOULTRY and the USPOULTRY Foundation developed a strategy to direct additional research funding toward particular critical research topics aimed at finding solutions for these new challenges. As part of this strategy, in the fall of 2013 a second research program, called the Board Research Initiative (BRI), was created. The BRI is designed to run alongside the traditional USPOULTRY program. The programs operate separately and do not compete for funding or resources.

The two USPOULTRY research programs operated similarly in many ways but there are some important differences. The traditional USPOULTRY research program has a standing request for proposals (RFP) each year on May 1 and November 1 to which researchers can submit research proposals on any topic on the USPOULTRY research priorities list. This research priorities list can be viewed on the USPOULTRY website and it is updated every two years. The BRI releases special RFPs on specific topics. These topics are chosen by the Boards of Directors of USPOULTRY and the USPOULTRY Foundation. The RFPs released by the BRI are very focused and specify the research questions and areas of focus sought in the research proposals. The Boards of USPOULTRY and the USPOULTRY foundation choose the topics for the BRI from a list developed for them by USPOULTRY staff. These topics originate from ideas submitted by USPOULTRY members. Topic ideas can be submitted anytime to John Glisson (jglisson@uspoultry.org) or John Starkey (jstarkey@uspoultry.org) for consideration as part of the BRI. Just like in the traditional USPOULTRY research program, research proposals are evaluated by the FRAC and the FRAC recommends which proposals should be funded by USPOULTRY and the USPOULTRY Foundation.

In its initial year the BRI released two RFPs, each funded at $125,000. The first RFP was titled, “Exploration of Systemic Salmonella Infection in Chickens and Turkeys and Determination of the Relationship with Salmonella in Finished Ground Product”. The research proposal funded from this RFP was from Auburn University and was titled, “Determining the Dose, Time and Route of Challenge and the Eventual Sites of Colonization of Two *Salmonella* Serovars”. The second RFP was titled, “Investigation of the Influence of Transportation Conditions on Chickens and Turkeys”. A research proposal from the University of Arkansas titled, “Characterizing thermal Micro-environment during Broiler Transportation” received funding on this topic.
This year two new topics have been chosen and RFPs on those topics will soon be released. The new BRI topics are, “Investigation of the Pathways for Introduction, Dissemination, and Detectability of Salmonella during Second Processing” and “Reduction of *Salmonella* Contamination of Commercial Eggs”. Both of these topics are very important to the poultry industry and research funded as a result of these RFPs promises to provide needed information to address these issues.

The USPOULTRY Board Research Initiative is an exciting new program which is putting the resources of the poultry industry to work to meet important challenges. USPOULTRY and the USPOULTRY Foundation are very pleased to be able to provide this important resource to the poultry industry.

NLRAD-NAHRS Update
Stan Bruntz, DVM, USDA-APHIS-VS, Fort Collins, CO

An update on the proposal for a United States National List of Reportable Animal Diseases (NLRAD) and on the NLRAD- National Animal Health Reporting System (NAHRS) was presented. A formal announcement through Gov Delivery has been sent out requesting review and input on the following documents: ‘Proposal for a

U.S. National List of Reportable Animal Diseases (NLRAD)' concept paper and the USDA-APHIS 'VS Framework for Response to Emerging Animal Diseases in the United States'. A U.S. NLRAD will be a uniform, science- and policy-based, nationally supported standardized list of animal diseases. It will provide the basis for consistent reporting with uniform case findings and reporting criteria. The U.S. NLRAD will include both notifiable and monitored diseases. Notifiable diseases are high priority diseases that must be reported by anyone who identifies occurrence of the disease. Monitored diseases occurrence is routinely tracked and data reported to the federal government through State Animal Health Officials (SAHO's). Support for a U.S. NLRAD has been expressed through multiple animal health organizations, including through AAVLD/USAHA, and NASAHO resolutions. A U.S. NLRAD will be initially implemented through Federal-State cooperation and eventually formalized through Federal regulatory action.

The NLRAD-NAHRS functions under the auspice of the joint USAHA/AAVLD Animal Health Surveillance and Information Systems Committee. The USAHA/AAVLD NLRAD-NAHRS Steering Committee includes representatives from the AAVLD, USAHA, USDA-APHIS-Veterinary Services (VS), SAHO's, and experts representing major commodity groups. The NLRAD-NAHRS Steering Committee provides input to NLRAD-NAHRS on the U.S. NLRAD; NLRAD-NAHRS general operation; and direction of the NLRAD-NAHRS to meet the needs of animal health personnel. Dr. Bruntz presented activities and issues related to the NLRAD-NAHRS including implementation of a U.S. NLRAD; updates to the NLRAD-NAHRS Web Reporting Tool; and adapting VS representation on the NLRAD-NAHRS Steering Committee due to VS's reorganization and other changes. Dr. Bruntz announced that Dr. Bruce Stewart-Brown, who has been the poultry representative on the NLRAD-NAHRS Steering Committee for several years, has requested that due to work commitments he be replaced on the committee. Dr. Bruntz, on behalf of the NLRAD-NAHRS chairs, thanked Dr. Stewart-Brown for his work on the committee and strong support for taking the U.S. NLRAD concept forward. Members of the TDP Committee who may be interested in filling this open position are requested to contact either the TDP Chair or Vice Chair.

National Animal Health Monitoring System/Layers 2013

Lindsey Garber, DVM, USDA-APHIS-VS, Fort Collins, CO

Salmonella Enteritidis (SE) is a food-borne pathogen that is associated with illness following consumption of improperly prepared and/or undercooked eggs. In 2010, the Food and Drug Administration (FDA) implemented an egg rule to control SE on farms producing eggs for the table egg market. The FDA used information from a 1999 National Animal Health Monitoring System (NAHMS) Layer study in their assessment of the need for and economic impact of the egg rule. As practices have changed substantially since 1999, it was determined that updated information on practices would be useful to both the industry and government agencies. Therefore, NAHMS conducted a study in summer 2013 to estimate the prevalence and evaluate risk factors for SE on commercial layer farms, as well as to assess changes in management practices since 1999 relevant to SE control and prevention.

Although we attempted to keep differences in study design between the two studies to a minimum, there were some differences which may have had an effect on our ability to have comparable estimates. For the NAHMS Layers '99 study, a sample of farms was selected from the National Agricultural Statistics Service (NASS) list of operations with 30,000 or more laying hens in 15 states[a]. Severity of rodent problem on each participating farm was assessed by data collector observation. Additionally, swabs from manure, egg belts, elevators, and walkways were collected from poultry houses and submitted to the Agricultural Research Services (ARS) laboratory in Athens, GA for culture.

For the 2013 study, a sample of farms having 3,000 or more laying hens was selected from the FDA list of registered premises in 19 states[b]. An in-person questionnaire was administered that addressed management practices relevant to SE, such as biosecurity, rodent control, molting and vaccination. No biologic samples were collected. Producers were asked about testing for SE in the layer house environment between June 1, 2012 and May 31, 2013. Testing may have been by culture, PCR, or other rapid tests. Producers were guaranteed that their responses would be kept confidential. Only farms with 30,000 or more laying hens were included in the analysis for comparison to the 1999 study.

A higher percentage of farms fed pullets pre/probiotics in 2013 compared to 1999, while a lower percentage of farms gathered eggs by hand or molted their flocks. For farms that did molt in 2013, the most common procedure was to feed an alternative diet rather than to restrict or withhold feed. There was a significant increase in cage-free housing; 18.7% of farms had at least 1 cage-free house in 2013 (11.8% of houses) compared to 0.8% of farms (0.6% of houses) in 1999.

A higher percentage of farms processed eggs on farm in 2013 compared to 1999, and nearly all farms stored eggs at <50º F. Producers reported less severe problems with rodents in 2013 compared to 1999; traps and

sticky tape were a more common rodent control method and cats were less common. Frequency of cleaning and disinfecting procedures for feeders, hoppers, water tanks, and houses were similar in both years.

In 2013, an increased percentage of farms monitored SE in pullets, routinely tested for SE in the layer house, and participated in a SE QA program compared to 1999. Vaccination of pullets against *Salmonella* was rarely performed in 1999 (5.4% of farms) whereas nearly all farms did so in 2013 (98.7%). The most common protocol was to give pullets a series of 2 live vaccines via spray followed by a bacterin injection, although many other protocols were used. For approximately half of the farms, the first vaccine was administered in the hatchery.

In the 1999 study, 7.1% of layer houses were environmentally positive for SE via culture. In the 2013 study, 1.0% of flocks tested between June 1, 2012 and May 31, 2013 tested positive for SE. No flocks from farms with <30,000 layers tested positive and 1.2% of flocks from larger farms were positive. The percentage of flocks positive for SE ranged from 0.3% in the Northeast region to 2.0% in the Central region.

Compared to negative farms, a higher percentage of positive farms had a rodent index of 11 or higher (moderate to high), routinely molted their flocks, and had a down time of 10 days or less. A lower percentage of positive flocks had been vaccinated against *Salmonella* as pullets compared to negative flocks.

[a] AL,AR,CA,FL,GA,IN,IA,MN,MO,NE,NC,OH,PA,TX,WA

[b] AL,AR,CA,FL,GA,IL,IN,IA,MI,MN,MO,NE,NC,OH,PA,TX,WA,WI,New England (considered as one state)

Avian Disease & Oncology Lab (ADOL) Research Update

John Dunn, Hans Cheng, Aly Fadly, Mohammad Heidari, Henry Hunt, Huanmin Zhang
USDA-ARS Avian Disease and Oncology Laboratory (ADOL), East Lansing, MI

Employing Genomics, Epigenetics, and Immunogenetics to Control Diseases Induced by Avian Tumor Viruses

Marek's disease (MD) is a T cell lymphoma disease of chickens induced by the Marek's disease virus (MDV). Currently, the main control strategy is vaccination. However, it is likely that widespread usage of MD vaccination has led to the emergence of more virulent field strains. Selecting for MD genetic resistance is a sustainable and proven control strategy, and fits very well into the rapidly growing implementation of genomic selection. As genomic selection requires molecular markers associated with the trait of interest, such as MD resistance, the key is to identify these genetic markers.

Gene expression is a major factor accounting for phenotypic variation. Taking advantage of allele-specific expression (ASE) screens, we identified SNPs in specific genes using experimental layers. Analysis of an MD resource population genotyped with a custom SNP array yields a heritability estimate of 0.53 for MD genetic resistance while the ASE SNPs (genetic markers) alone account for 83+% of the genetic variance. To validate the association of ASE SNPs with MD genetic resistance, sires were genotyped, EBVs (estimated breeding values) based on SNPs and pedigree calculated, and then bi-directionally selected based on the SNP EBVs. Progeny tests demonstrate that after only one generation of selection, there was greater than 20% difference in MD incidence. Compared to pedigree, genomic selection on ASE SNPs was 61% higher, indicating that use of genetic markers is clearly superior. We conclude that ASE SNPs are functionally linked to causative polymorphisms that alter transcriptional levels in genes that manifest the changes in disease incidence, thus, showing variation in cis-regulatory elements is the major mechanism that accounts for variation in MD genetic resistance between these two experimental lines.

Studies were also conducted on the role of host genetics affecting MD vaccine efficacy. Earlier studies using B-congenic lines of chickens by scientists at ADOL showed the major histocompatibility complex (MHC) significantly affect MD vaccine protective efficacy. Research data showed chickens of similar genetic background, but carrying the *B*-haplotypes 2, 13, 15, or 21, respond to serotype 1 types of vaccine better, whereas chickens with B-haplotype 5 respond to serotype 2 types of vaccine better than serotype 1 vaccine, measured by MD incidence. Recent studies using inbred lines of the same MHC background chickens clearly showed both serotype 1 (CVI988/Rispens) and serotype 3 (HVT) vaccines are capable to convey equally good protection in chickens relatively resistant to MD. Strikingly different protection by HVT was observed between lines of chickens sharing a common MHC type but with known difference in resistance to MD, which indicate genes outside of the MHC domain also significantly affect vaccine protective efficacy.

Genetic and Biological Determinants of Avian Tumor Virus Pathogenicity, Transmission, and Evolution

The cloning of the MDV genome as an infectious bacterial artificial chromosome (BAC) clone has led to major advances through our ability to study individual gene function by making precise insertions and deletions in the viral genome. MDV BAC clones are likely to replace wild type MDV field strains used in all aspects of MDV research due to advantages that include 1) precise manipulation of the viral genome, 2) viral genomes that are stable and can be maintained independently of propagation in eukaryotic cells, and 3) shipping BAC-cloned

viruses is significantly easier and cheaper than shipping cell-associated viruses. We acquired virulent MDV BAC clones that have been generated by researchers around the world and produced a standardized virulence rank. Clones were pathotyped to compare virulence rank to prototype field strains using the standard pathotyping assay. The results indicated viruses derived from BAC clones encompassed all three virulent pathotypes (vMDV, vvMDV and vv+MDV). By standardizing results through the use of BAC-cloned MDVs, future studies from various laboratories can be more easily compared between studies.

Studies were conducted on the influence of altering the di-codon bias of select MDV genes on pathogenicity of the virus. More than one set of three nucleotides (or codon) can produce the same amino acid, which are called synonymous codons. All species studied to date demonstrate a preference for certain codons over other synonymous codons (codon bias), a preference which is also observed for pairs of codons (di-codon bias). Previous studies using poliovirus and influenza virus as models have demonstrated the ability to cause attenuation by replacing frequently used di-codons with infrequently used synonymous di-codons. We analyzed di-codon usage in the 18,742 referenced chicken genes and 86 protein-coding genes in the Md5 strain of MDV and found a clear bias for preferential use of some di-codons and rare utilization of other di-codons. We replaced commonly used di-codons with synonymous uncommonly used di-codons for the MDV gene UL54 (ICP27), a transactivator of immediate early genes. This altered virus was less virulent with a pronounced decrease in tumors and increased survivability compared to the control. This is the first time this technique has been used to lower the virulence of any herpesvirus in animals or humans and it demonstrates that this could be a new way to generate vaccines used for diseases caused by herpesviruses, such as MD in chickens.

In previous studies, we have shown strain AF-227 of endogenous subgroup E avian leukosis virus (ALV-E) and serotype 2 MDV play an important role in the enhancement of spontaneous lymphoid leukosis (LL)-like tumors in an ADOL chicken line, named RFS. This line of chickens lacks all endogenous virus genes and is susceptible to infection with all subgroups of ALV including subgroup ALV-E. The results suggest that the incidence of spontaneous LL-like tumors in chickens that harbor endogenous ALV was higher than in chickens that lack ALV-E following vaccination with serotype 2 MDV at hatch.

We conducted studies to evaluate the protective efficacy of a high passage level of a recombinant MD virus vaccine candidate named rMd5 REV-LTR BAC. Based on results obtained from testing the pathogenicity of several passages of the virus in maternal antibody (Mab)-negative chickens, we determined that the optimal passage level of rMd5 REV-LTR BAC to be used in protective efficacy studies is passage 70. Three protective efficacy trials were conducted using rMd5 REV-LTR BAC at passage 70 along with two other experimental recombinant vaccines and commercially available MD vaccines. Groups of Mab-positive and Mab-negative 15I X 7 chickens were vaccinated at day of hatch with 2000 plaque forming units (pfu) of various vaccine viruses, and challenged at 5 days post-vaccination with 500 pfu of a very virulent plus (vv+) MDV, strain 686 at passage 10. Passage 70 of rMd5 REV-LTR BAC virus provided protection comparable to that provided by the most effective currently available commercial vaccine, namely Rispens following challenge with a vv+MDV, suggesting that this virus is a good candidate vaccine that can be used in flocks where a vv+MDV challenge is expected. Experiments to study the efficacy of rMd5 REV-LTR BAC in embryonically (in-ovo) vaccinated chickens are ongoing.

Studies were also conducted to investigate the effect of MDV infection on cecal tonsils (CT) structural changes and gene expression profiling in MD-susceptible and resistant chicken lines. The data analysis revealed that MDV causes the loss of germinal follicular centers within the CT of both lines during lytic infection. The atrophy the CT, however, was transient and there were no visible differences between the CT of the infected and control birds of either line by 21 days post infection. IFN-β and IFN-γ were up-regulated in the CT of both infected lines during lytic infection but the expression levels of both genes were much higher in the susceptible line than the resistant line. Similar pattern of expression was observed for IL-6, IL-10, IL-12, IL-18, IL-13, and iNOS. IL-8 was the only cytokine expressed at higher levels in the CT of the resistant line during the lytic and reactivation phases of infection. This study provides further insight into the mechanism of MDV pathogenesis and tissue specific immunological responses to viral infection.

Industry Concerns with AI Response Plans

David Shapiro, DVM, Perdue Foods LLC, Salisbury, MD

I used to give a presentation circa 2006 in which I named the “Bird Flu PanicDemic”, explaining that while Avian Influenza did pose some threat to both humans and poultry, the dangers were wildly exaggerated by the media and in common perception. Today’s technology and surveillance are much greater than in those days, but now I am the one panicking as I think of how the next big Avian Influenza event will turn out.

The title says “Industry Concerns”. I don’t know if that is true. These are my concerns. They should be carefully considered by both industry and government so that we can improve our response plans.

LPAI and HPAI events involve industry, state governments, and the federal government. In the past, they tended to be industry events with varying amounts of state and government involvement. Now they are massive state/federal undertakings with the major stakeholder (the poultry industry) at risk of being a buffeted pawn rather than a key participant. All parties are well-intentioned but I worry that we are setting ourselves up for failure when next faced with a serious emergency poultry disease situation.

My concerns were elicited by the two recent LPAI events (small commercial turkey flock in Maryland and auction birds in Delaware). My main worries include the decreasing incident management by industry in favor of state and federal officials; overly complex and tortuous state plans; lack of discretionary and delegated authority for Incident Commanders and operational team leaders; certification madness; with all testing, disinfectants, participants too prescriptively defined; desire to plan for every eventuality rather than simply being prepared

A detailed chart showing Lessons, Warnings and Suggested Tasks follows. This same presentation and chart were also presented at the 2014 National Meeting on Poultry Health and Processing in Ocean City, Maryland.

LESSONS	WARNINGS	TASKS
Due to increased complexity of state plans and increased state/federal oversight, two relatively minor incidents disrupted and threatened a large portion of the USA turkey and broiler industries.	Incidents much less severe (disease-wise) than past events, could damage the poultry industry much more.	State, Federal, and Industry need to immediately review State Plans.
Overly detailed and complex plans, put Incident Commanders in a bind with little flexibility to rely on veterinary discretion.	Same as above.	Same as above. Re-write with more discretionary flexibility to incident commanders.
Both farm parties involved lacked veterinary representation and there is some question if they and their birds enjoyed adequate advocacy.	Everybody with an animal should have a veterinarian-of-record.	Everybody with an animal should have a veterinarian-of-record or be assigned one during emergencies.
Because of a challenging situation (high density of market age birds and inflexible state plan), IC was forced to work through exceptions and send birds to market with AI testing pending.	You don't want to be at the podium during the press conference when we send birds with a positive LPAI isolate to market.	Don't send birds to market with AI tests pending. Write plans to reduce this likelihood.
Practice of using ELISA for meat bird AI clearance and AGID only to rule out screening positives on ELISA is standard practice almost everywhere due to higher frequency of false positives with AGID.	Serology for AI clearance of meat turkeys is asking for trouble. Using AGID instead of ELISA for this is even less sensible.	Run antigen testing for meat bird AI clearance with, at most, targeted usage of ELISA.
Uninhibited drawing of quarantine circles has unintended consequences of hindering chick/poult placement and/or bird movement even when risk is very low.	An incident involving lots of backyard tracebacks/traceforwards could paralyze a region, even though there could actually be zero or very little LPAI.	Decouple backyard and auction compartments from commercial compartment. Clear epilinks should be pursued but coupling these two compartments is not supported by past evidence.
We look harder than anyone else for LPAI. No surprise that we find more.	No good deed goes unpunished.	NCC and NTF and NPIP need to re-examine the current 100% testing protocols.
The more information made readily available by email reduces the need for conference calls.	If everyone is paralyzed waiting for the next conference call, we are not effectively utilizing technology.	Electronic communication should be used more than concalls or face-to-face meetings.
Desire for over zealous testing puts everyone and the birds in a bind.	Don't send in massive samples just to satisfy scientific curiosity. Sampling and testing should focus on determining positive or negative status.	USDA needs to negotiate better trade arrangements with countries regarding OIE reporting and AI detection, especially with those countries which have less strict testing and reporting requirements than do we (which would be all of them).
Ambiguous test results are one of the major causes of prolonged events	Re-testing of "suspect" samples rather than re-sampling will paint us into a corner one day from which we will have difficulty in escaping.	"Suspect Positive" results (and samples) should be thrown out and the flock re-sampled, rather than just re-testing the suspect sample, delaying movements and extending quarantines.
Counties and addresses are not locations. They increase anxiety and slow effective responses.	If we don't increase transparency, we will lose credibility among ourselves.	Use decimal lat/lon coordinates. There is no excuse for anything else.
We already know how to get to Carnegie Hall.	We have done more paperwork than beta-testing with the new plans compared to the old plans.	A few tabletops might open our eyes as to the tasks we've set for ourselves. Keep those IC structures current!
Shapiro / redacted VPDTF Meeting Presentation Notes / June 19, 2014 / regarding recent MD and DE LPAI incidents		

Low Pathogenicity Avian Influenza (LPAI) H5N8 in Stanislaus County. California

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Background: On April 14, 2014 five live and four dead adult quail from a commercial Japanese quail (*Coturnix japonica*) layer flock were submitted to the California Health and Food Safety Laboratory in Turlock, California, due to increased mortality in the flock. Pharyngeal swabs were tested for avian influenza virus (AIV) by rRT-PCR and reported positive for AIV H5 subtype and negative for AIV H7 subtype on April 18th. Swabs were then submitted to the National Veterinary Services Laboratory (NVSL). On April 19th, NVSL reported that pharyngeal swabs tested by rRT-PCR were positive for the AIV H5 subtype and negative for the AIV H7 and N1 subtypes. The amino acid sequence at the hemagglutinin protein cleavage site was compatible with North American LPAI virus. The sequence was 99.1% similar to A/American green-winged teal/Wisconsin/10OS3127/2010. An H5N8 virus was isolated from the specimen. The H5 is 98.2% similar to A/mallard/California/1435/2013 (H5N5) based on sequence from the complete hemagglutinin gene. Chicken

pathogenicity testing was compatible with LPAI virus. Full genome sequencing was performed by Dr. Webby's group at St. Jude in Memphis, TN. The CA H5N8 was compared to the Korea H5N8 (HPAI) and no relationship was detected. A short stalk in the N8 sequence indicated that the quail virus would adapt to chickens.

Epidemiology: A Foreign Animal Disease Diagnostician began the initial outbreak investigation on April 18. The index premises consisted of a quail flock and a Peking duck flock. The quail flock consisted of two (2) houses (a layer and a brooder). The affected quail layer house contained approximately 50,000 laying hens and 6000 adult males. The cages were in rows and the quails in each row were of the same age group. Quails were hatched at approximately nine (9) week intervals and placed in the quail brooder house. The quail brooder house contained 32,000 quails (three weeks old) and 7,000 (eleven weeks old) males. There were nine (9) additional houses on this premises that housed Peking ducks for egg production. Each house contained approximately 2,000 adult layers and 400 adult males of the same age group for a total of 21,600 ducks. Replacement ducks were hatched at five (5) weeks intervals. Breeders for both species were selected from the existing populations randomly. Two lagoons were utilized for flushing waste from the quail houses and some areas of the duck houses. The index farm has an incinerator and daily mortality for all species was incinerated.

There were two contact premises (a brooder and a layer) with Peking duck flocks owned by the same company as the index farm and considered to be epidemiologically linked but not affected. The brooder premises contained approximately 16,500 Peking ducks (14,000 female and 2,500 male). The layer premises contained 22,000 Peking ducks (18,000 female and 4,000 male). Daily mortality was transported from the contact premises to the index farm for incineration. The index premises and the contact premises were quarantined on April 18th.

The hatchery and an egg washing facility were located on the index premises. At approximately 5 week intervals, day old ducklings were transported from the index premises to the brooder premises. Cull male ducklings were frozen and donated to a local wildlife rehabilitation center. Ducks were returned to the index premises from the brooder premises to begin egg production. At the conclusion of a 45 week production cycle at the index premises, each cohort was molted and transported from the index premises to the associated layer premises to complete a second 45 week production cycle. Spent ducks were transferred from the associated layer premises to a slaughter plant. The carcasses were then processed for pet food. The eggs were transported to the index premises for processing.

Cull quail (spent hens and males) were frozen in a commercial freezer and sold to falconers. Duck eggs were sanitized at the egg washing facility and the majority of duck eggs were moved to the incubators for balut production or for hatching replacement ducklings. Some duck eggs were diverted to be sold as salted eggs. Peewees and eggs with double yolks were sold fresh. Quail eggs, duck eggs and quail carcasses were sold wholesale to interstate and intrastate distributors and markets.

Eradication: Depopulation via euthanasia (CO_2) began on April 21, 2014 and completed on April 25, 2014. Disposal of carcasses, frozen carcasses and eggs were via landfill. The litter was composted on site and disked into a fallow field. The houses were cleaned and disinfected and left empty for thirty days. Restocking was permitted following negative environmental tests. Flocks were tested 30 days after placement.

Surveillance: Contact premises were tested weekly for four weeks and then released from quarantine. Commercial poultry in the 10 kilometer zone were tested twice. Non-commercial premises in the three kilometer zone were tested. In addition, poultry premises on feed truck delivery route were tested.

Conclusion: The objective of the response was to contain the H5N8 LPAI virus to the affected premises and prevent transmission to commercial or backyard poultry operations. Mission accomplished.

Off-Site Carcass Disposal Challenges in FAD Outbreaks

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Disposal of animal carcasses after a catastrophic event, whether disease or natural disaster related can often create unique and difficult challenges to State and Local officials. Options for carcass disposal include on farm options such as composting and burial as well as off-site options such as rendering and landfill. The biosecurity and transport challenges associated with using offsite resources such as rendering and landfills require additional planning and logistical considerations to allow those options to be used especially for events such as FAD outbreaks. The North Carolina Department of Agriculture and Consumer Services (NCDA & CS) worked collaboratively with West Texas A & M, USDA APHIS, Department of Homeland Security (DHS) and other State and Industry SME's to explore logistical challenges, identify resource gaps, and produce guidance for utilizing off-site disposal resources (rendering and landfills) specifically for a Foot and Mouth Disease Outbreak. Though the Poultry Industry has worked many of these issues for avian diseases, one tool that was developed as part of the project likely has benefit in avian disease response planning. The Carcass disposal calculator tool assists response personnel as they work through the logistics for events with large scale carcass disposal challenges.

Notifiable Avian Influenza: A Practical Response and Tabletop Exercise in Minnesota

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A series of avian influenza and broiler movement activities were organized by the Minnesota Board of Animal Health (BAH) and the University of Minnesota (UMN) to enhance preparedness for possible Notifiable Avian Influenza (NAI) events in Minnesota. The activities were held in January and February of 2014 and focused on normal poultry movements and the risks of these movements during an NAI event. These types of exercises highlight the impact that disease events can have on companies and communities, facilitate successful communication during an event, and cultivate a cohesive public-private partnership.

The first activity was an Incident Command System (ICS) and Communications Workshop held for Minnesota's Emergency Disease Management Committee (EDMC). The Minnesota H5/H7 Low Pathogenic Avian Influenza (LPAI) Initial State Response and Containment Plan (ISRCP) require the use of an ICS to manage an H5 or H7 LPAI event. In order for the EDMC to become familiar with ICS, an Executive's version of ICS was presented that provided an overview of the ICS structure and chain of command for a unified response. For the communications section of the workshop, a panel of poultry industry and public communications experts was assembled to identify communication needs during an NAI event and discuss how communications can impact business continuity and disease response.

The follow up activity was a three-day event that started out with a business continuity panel discussion with Minnesota poultry industry Chief Executive Officers (CEOs). The panel reviewed the normal product flow of commodities in their companies, the impacts of movement restrictions during an AI event and the need for a coordinated response. The following day the poultry movement discussions continued with a series of presentations from industry and state and federal government personnel. Topics covered included Minnesota's diverse poultry industry, regulatory responses, risk assessment use during a NAI response and the Highly Pathogenic Avian Influenza Secure Broiler Supply Plan. To enhance stakeholders understanding of poultry movement, participants had an opportunity to visit broiler facilities including a hatchery, a broiler farm, and a processing plant. These visits were facilitated by broiler company personnel and included in-depth discussions of the processes and movements involved with each operation. The three-day event concluded with a tabletop exercise designed by the Minnesota Board of Animal Health with input from the United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services (USDA-APHIS-VS) titled "Notifiable Avian Influenza: A Practical Response in Minnesota." The goal of the tabletop exercise was to demonstrate implementation of Minnesota's ISCRP, also known as "The Minnesota Plan" and practice responding as a unified force to a H5/H7 LPAI introduction with collaboration from all stakeholders. The exercise was designed to illustrate the first seven days of a response to an H5/H7 LPAI introduction in Minnesota. Each day of the fictitious scenario new findings were presented by the moderator and questions were posed to the participants. Time was allowed for discussion, interaction and comments in small groups with major decisions captured at the end of each section. Various documents were used as exhibits throughout the exercise including disease alerts, quarantine documents, premises mapping and press releases. These exhibits helped to simulate actual communication tools that may be used during an NAI response and to aid the participants in their decisions.

Results from written evaluations revealed that this exercise was valuable in terms of the opportunities provided for hands-on learning and in-person interaction with other animal health professionals. These types of exercises and the working relationships that develop with other stakeholders help build the foundation for a unified, practical and responsible response to an NAI event in Minnesota.

Secure Food Supply Plans for the Poultry Industry- 2014 Update

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Since 2006 there has been an effort through a public-private partnership approach that involves government, industry and academic representatives to develop plans to support continuity of business (COB) for the poultry industry. These Secure Food Supply Plans are meant to reduce the unintended consequences that a standard response to an outbreak of highly pathogenic avian influenza (HPAI), likely involving quarantine and stop movement orders, would have on the poultry industry. These plans seek to support the resiliency of the poultry industry and address the preparedness and response goals of the United States Department of Agriculture

(USDA) Animal Plant Inspection Service (APHIS) Veterinary Services (VS). Ultimately the plans provide for the managed movement of key animals and commodities from non-infected flocks under permit, through science and risk based approaches that allow continuity of operations for the industry while maintaining and ideally enhancing HPAI control.

The secure food supply plans for the poultry industry are broken down into three groups: Secure Egg Supply Plan (SES), Secure Broiler Supply Plan (SBS), and Secure Turkey Supply Plan (STS). Each plan consists of industry segment specific working groups that involve representatives from industry, government and academia who meet periodically to update and refine the plans as necessary. A key component to the plans is the development of proactive risk assessments, looking at a commodity or live bird movement in their respective production cycles. The risk assessments utilize quantitative and qualitative risk estimations to evaluate the possibility of transmission of HPAI from infected but undetected poultry through the movement of live birds or poultry products. These assessments are then used to guide the development of mitigations needed to move that commodity or live bird for that production segment with an acceptable level of risk. This includes the development or evaluation of process guidelines and tools that support the managed movement and the proposed components including surveillance, elevated biosecurity, holding periods, etc. that are needed to allow the managed movement of that commodity. Developed guidelines can be used by an incident commander to issue movement permits. These permits would be used to manage movement of commodities and live poultry into, within and out of a control area.

The Broiler Sector Working Group has made great progress focusing on the movement of live broilers located in a control area to slaughter during a HPAI outbreak. Assessment of the risk pathways is complete, and measures and protocols to be implemented during an outbreak have been developed, including active surveillance protocol options, establishment of a pre-movement isolation period (PMIP), and biosecurity measures for critical operational visits during the PMIP. A related outreach/education effort was held in February, 2014 through a joint APHIS, Minnesota Board of Animal Health, Industry and University of Minnesota effort. The event focused on broiler movement, with participation of academia, state and federal officials, and industry stakeholders. The outcomes of the exercise were: (1) a deeper understanding of the constrains that govern the HPAI outbreak events, (2) identified gaps in the Secure Broiler Supply Plan and explored ways to address them, (3) educated stakeholders about working through a difficult scenario.

The Turkey Sector Working Group has made significant progress looking at the movement of Day-Old Poults and Hatching Eggs within and out of a control area during a HPAI outbreak. The results and associated procedures and guidelines are being incorporated into the Secure Turkey Supply Plan. Current focus is on the movement of live birds to slaughter: data collection and evaluation is ongoing for incorporation into the risk assessment and formulation of movement guidelines. The website is in development, with launch anticipated later this year.

The Egg Sector work has focused on outreach to industry and government stakeholders. As the SES plan is the most mature of all the secure food supply plans, there is ongoing effort focused on education and adoption of the SES plan with industry and regulatory stakeholders. Current focus is on the top 10 egg producing states as well as interested/engaged states. Outreach has utilized a “tri-state” model in which three neighboring states are brought together with the objectives to: further educate attendees about the SES plan; focus on the movement of egg products during a HPAI outbreak; encourage networking: and plan next steps for action considering a HPAI outbreak for that tri-state region. This approach was used previously with IA, MN and WI, and was used most recently with IN, MI and OH in June 2014. The workshop included a total of 58 people representing industry, state and federal officials, and academia. Additional efforts related to the SES include, work to increase the ability for states participate in the SES preparedness component are underway to starting with attempts to identify an appropriate independent third party auditing firm to conduct biosecurity audits under the authority of the state and to develop the SES data portal to be used nationally.

In October 2014, a cooperative agreement was established with Colorado State University, department of Agricultural and Resource Economics to begin work on an economic and consequence assessment. Although the current secure food supply plan control measures are considered to be voluntary guidelines and are appended to existing HPAI response plans, if HPAI outbreak response results in regulatory rulemaking, analyses that result in potential regulatory decisions that would have an impact on the public must be in compliance with relevant statutory requirements and international guidelines. The economic assessment will be conducted with support and oversight from the Center for Epidemiology and Animal Health, Epidemiological and Economic Modeling and Risk Assessment teams, and will work through existing secure food supply poultry sector working groups lead by the University of Minnesota, Center for Animal Health and Food Safety.

In summary, work is progressing well in the development of secure food supply plans for movement of poultry and egg industry products in the face of an HPAI outbreak. The work is dependent on being an inclusive process, with the participation of multiple stakeholders through the public-private partnership model. This collaborative effort leads to accurate risk and science based plans and guidelines to inform risk management decisions

associated with the managed movement of live birds and poultry commodities key to maintaining continuity of business during a HPAI outbreak.

2014 Activities- Broiler Sector Working Group

- Secure Broiler Supply Website
  - Available at www.securebroilersupply.com
- Broiler Hatching Egg Risk Assessment and Broiler Day Old Chick Risk Assessment
  - Available at www.securebroilersupply.com
- Broilers to Slaughter Risk Assessment
  - Risk Assessment (release and exposure pathways): completed (September 2014)
  - Development of measures and protocols implemented during an outbreak: complete (May 2014)
  - Writing: started (August 2014)
- Broiler HPAI Exercise
  - Successfully held in MN (February 2014)

2014 Activities- Turkey Sector Working Group

- Secure Turkey Supply Website
  - In Beta mode, anticipated launch spring 2015
- Turkey Hatching Egg Risk Assessment
  - Risk Assessment draft in review, CEAH (Sept 2014)
  - Manuscript in review for publication
- Turkey Day Old Poults Risk Assessment
  - Risk Assessment revised draft in review, CEAH (Aug 2014)
- Turkeys to Slaughter Risk Assessment
  - Expert Opinion Survey on biosecurity, aerosol and local area spread (Spring 2014)
  - Normal mortality modeling in progress
  - Updating of recommended guidelines in progress

2014 Activities- Egg Sector Working Group

- Secure Egg Supply Website
  - Available at www.secureeggsupply.com
- Outreach
  - Tri state SES conference with Indiana, Michigan, and Ohio June, 2014.

The World Organization for Animal Health (OIE) Update – Poultry

Michael J. David, DVM, National Director International Animal Health Standards, National Import Export Services USDA, APHIS, Veterinary Services, Riverdale, MD

Every year, the World Organization for Animal Health (OIE) updates existing terrestrial animal code chapters or drafts new ones. At its May 2014 General Session, the World Assembly of Delegates adopted new text to several existing chapters. Pertinent to the poultry industry are the following updated Code chapters:

Animal Welfare: In 2013 a new chapter on Animal Welfare and Broiler Chicken Production was adopted. This year, this chapter received some minor updates and corrections to clarify several of its articles.

Responsible and Prudent Use of Antimicrobial Agents in Veterinary Medicine: This chapter continues to be updated to improve its understanding and readability. The United States has commented and intervened several times during the past 3 years to address the fact that the OIE recommendations related to the prescription of antimicrobial agents are in conflict with our current legislation. In the United States a number of antimicrobial products are available to producers of livestock and poultry as over-the-counter medications. These products are legally available and require neither a prescription nor oversight by a veterinarian. While veterinary oversight is strongly encouraged in the United States for all uses of antimicrobial products and, in many cases producers have a strong and durable relationship with their veterinarian, these products are legally available for use without these requirements. As such, the OIE guidelines would ask the United States to make policy that is in conflict with the legal statutes in this country.

Infection with Avian Influenza and Newcastle Disease Viruses: The Code Commission recommended some changes in treatment procedures to inactivate the AI and Newcastle disease viruses in products such as feathers, poultry meal and feather meal. These changes were incorporated into the corresponding Articles of their respective code chapters and adopted.

National Poultry Improvement Plan 2014 Annual Report
Dr. Denise L. Brinson, USDA-APHIS-VS-NPIP, Conyers, GA

The National Poultry Improvement Plan is a Federal-State-Industry cooperative program. There are 49 Official State Agencies and 99 Authorized Laboratories. Official NPIP disease monitoring classifications include: U.S. Pullorum Typhoid Clean, U.S. Mycoplasma Gallisepticum Clean & Monitored, U.S. Mycoplasma Synoviae Clean & Monitored, U.S. Mycoplasma Meleagridis Clean, U.S. Salmonella Enteritidis Clean and Monitored, U.S. Sanitation Monitored, U.S. Salmonella Monitored, U.S. Avian Influenza Clean, U.S. H5/H7 Avian Influenza Clean for poultry breeding flocks, and U.S. H5/H7 Avian Influenza Monitored for commercial (production) poultry flocks.

Pullorum-Typhoid Status: There were no isolations of *Salmonella* Pullorum in commercial poultry in FY2011, FY2012, FY2013, or FY2014. There were no isolations of *Salmonella* Pullorum in backyard birds in FY2013 or FY2014. There have been no isolations of Salmonella Gallinarum since 1987 in any type of poultry in the US. U.S. Pullorum-Typhoid Clean participating hatcheries include: 225 egg and meat-type chicken hatcheries, 37 turkey hatcheries, and 734 waterfowl, exhibition poultry and game bird hatcheries.

NPIP U.S. Pullorum-Typhoid Clean Participating Breeding Flocks and Number of Birds are listed below:

Egg-Type Chickens
237 Flocks with 6,233,761 birds
Meat-Type Chickens
3,192 Flocks with 72,671,121 birds
Turkeys
492 Flocks with 4,886,147 birds
Waterfowl, Exhibition Poultry, and Game Birds
5,601 Flocks with 1,574,450 birds
Meat-Type Waterfowl
93 Flocks with 213,191 birds

Avian Influenza Status: In FY2014 (July 1, 2013-June 30, 2014), there were two isolations of Avian Influenza in commercial poultry in the US:

H7N3 isolated in a New Jersey commercial game bird hunting preserve/breeding farm
H5N8 isolated in a California commercial quail layer flock

Table 1: 2014 NPIP U.S. Avian Influenza Clean and U.S. H5/H7 Clean Participating Breeding Flocks; and U.S. H5/H7 Avian Influenza Monitored Participating Commercial Flocks:

Subpart	Flocks	Birds	Tests
Egg-Type Chicken Breeders	285	4,767,282	25,196
Table-Egg Layers-Commercial	5,151	1,287,343,146	78,217
Chicken Breeders	5,921	100,934,447	304,670
Chickens-Commercial	76,823	6,181,374,286	1,145,549
Turkey Breeders	949	8,785,331	36,575
Turkeys-Commercial	19,275	323,465,462	170,558
Waterfowl, Upland Game birds, Ex. Poultry	2,123	1,152,151	34,384
Upland Game birds, Waterfowl,	2,563	37,502,099	33,294

Raised for Release Upland Game birds, Raised for Release Waterfowl-Commercial			
Total	113,090	7,945,324,204	1,828,443

***Mycoplasma gallisepticum, Mycoplasma synoviae,* and *Mycoplasma meleagridis* positive breeding flocks - National Poultry Improvement Plan FY2014**				
	WEGBY	**Egg-Type**	**Meat-Type**	**Turkeys**
M. gallisepticum	30	2	5	1
M. synoviae	15	14	50	2
M. meleagridis	0	0	0	1

Authorized Laboratories Activities: The University of Georgia Poultry Diagnostic & Research Center provides a quality assurance panel of convalescent contact infected chicken sera against MG and MS to authorized laboratories as a check test tool as well as a MG/MS PCR check test. The National Veterinary Services Laboratories issues a group D Salmonella check test, Salmonella serotype proficiency check test and an Avian Influenza check test for the Agar Gel Immunodiffusion test annually for Authorized Labs of the NPIP. Laboratory training provided to the authorized labs included a Salmonella Isolation and Identification Workshops, a Mycoplasma Diagnostic Workshop, and an Avian Influenza Diagnostic Workshop during FY2014 in Georgia.

NVSL AVIAN INFLUENZA and NEWCASTLE DISEASE ACTIVITIES REPORT – FY 2013

Mia Kim-Torchetti, DVM, Diagnostic Virology Laboratory, National Veterinary Services Laboratory, Ames, IA

The National Veterinary Services Laboratories (NVSL) in Ames, IA, in coordination with the National Animal Health Laboratory Network (NAHLN), received avian samples for testing in fiscal year (FY) 2014 arising from National Poultry Improvement Plan (NPIP) and Live Bird Market (LBM-BYD) surveillance programs, foreign animal disease (FAD) investigations, import and export activities, wild bird surveillance, and other diagnostics. While the majority of the samples are received for confirmation testing, it is currently not possible to separate confirmations from other testing due to limitations of the laboratory information management system and inconsistent information received on submission forms. Ability to discriminate such testing will improve future analyses and will contribute to better understanding of surveillance data.

This summary focuses on of avian influenza (AI) and Newcastle disease (ND) detection in domestic poultry. For FY2014, the number of samples received for molecular testing and virus isolation by purpose is summarized in **Table 1**. A decrease noted in samples received for import testing between FY2013 and FY2014 is the result of a large import effort in FY2013 and does not represent a decrease in routine testing. Pet bird and psittacines made up the majority of import testing, while export testing is conducted predominantly for chickens (~400 tests per year). All import and export samples tested for FY2014 (n=2081) were negative for AI and ND.

Live Bird Marketing System (LBMS), Backyard Birds and Exhibition Birds. As part of the ongoing LBMS surveillance for presence of avian influenza virus (AIV) and avian paramyxovirus type-1(APMV-1), the NVSL tested 658 specimens in 260 submissions from 24 states (AL CA CT DE FL KS LA MA MD ME MO NH NV NY OH OK OR PA RI SD TX VA WA WY) by virus isolation in embryonated chicken eggs and, when appropriate, by real-time RT-PCR (rRT-PCR). All remaining LBMS surveillance specimens were tested at the State level. In FY2014, AIV (n=11) or APMV-1 (n=29) was isolated from 6.5% (29/658) of specimens tested. For low pathogenic avian influenza (LPAI; **Table 2**), an LPAI H7N2 was isolated from chickens in a PA poultry auction/backyard flock similar to a 1999 NY LBM virus (first confirmed H7 in PA since 2007), LPAI H7N7 was isolated from chickens at a poultry auction in DE, and there were molecular detections of H5 (LPAI by sequence analysis of swab material) from LBM Muscovy ducks in PA and quail and guinea hens at a poultry auction in NJ (no virus was isolated).

Other AIV isolated are listed by H-type in **Table 2**. 29 APMV-1 viruses were isolated from 10 states (CA DE FL MA MD NJ NY OH PA RI). Pathogenicity of representative APMV-1 isolates obtained from birds was determined by the intracerebral pathogenicity index (ICPI) test and/or by analysis of the deduced amino acid profile at the fusion protein cleavage site. All were characterized as low virulent (lentogenic pathotype) strains.

Commercial Poultry. Surveillance for AIV in commercial poultry is conducted under provisions of the National H5 and H7 Low Pathogenicity Avian Influenza Control Program implemented in September, 2006. Although most of the testing is performed locally, the NVSL provides reagents for the agar gel immunodiffusion (AGID) test and controls for the rRT-PCR test in addition to confirmation and identification testing of positive specimens. For commercial poultry during FY2014, there was a serologic detection of H5N2 in a flock of turkeys reporting previous clinical signs (no virus was detected); an LPAI H5N8 of wild bird origin was detected in quail; and an LPAI H7N3 also of wild bird origin in pheasants sampled under the H5/H7 Clean program. Other AIV isolated are listed by H-type in **Table 2**.

AI Antibody Subtyping. The NVSL received 254 submissions (1578 sera) for AI antibody confirmation and subtyping in FY2014 from 28 states predominantly from chickens and turkeys. Antibodies to influenza H1 and/or H3, with N1 and/or N2 antibodies were detected predominantly in turkey samples (97%) where vaccination is common; over two thirds of samples were from OH with sporadic detections from 20 other states (AL CT FL IA KS MA MI MN MO NC NH NV PA SC SD TN TX VA VT WI). Antibody was also detected as follows: H2 (NH: chicken, MN: turkey), H4 (MN: turkey; virus isolated – refer to **Table 2**), H5N2 (PA: turkey – serologic only detection; listed above in Commercial), H6 (PA: chicken, TX: mixed), H6N8 (MN: turkey; virus isolated – refer to **Table 2**), and H7 (NY: chicken [pet], NV: Sage Grouse [captive wild bird] – both serologic only).

Surveillance in Wild Waterfowl. Since the curtailment of the National Wild Bird Surveillance Program in March of 2011, NVSL has supported the surveillance of AI in wild waterfowl by subtyping (determination of hemagglutinin and neuraminidase subtype) all viruses and pathotyping (amino acid sequencing and/or chicken inoculation) H5 and H7 viruses submitted by university and independent researchers as well as the United States Geological Survey (USGS). Virus isolation (VI) and rRT-PCR testing is conducted on mortality event specimens. In FY2014, 591 wild bird specimens were received for confirmation, subtyping and characterization, and from mortality events for VI and rRT-PCR. Of these 395 AIV viruses were isolated **(Table 3**); all H5 and H7 AIVs were characterized as LPAI viruses of North American lineage and no highly pathogenic avian influenza (HPAI) was detected. The list of H5 and H7 subtypes is in **Table 4**.

Avian paramyxovirus serotype-1 (APMV-1). In FY2014 a total of 86 APMV-1 viruses were isolated from 17 states (AL CA DE FL ID IL MA MD ME MN NC NJ OH PA RI WI WY; includes the 29 LBM isolates mentioned above). Pathogenicity of representative APMV-1 isolates obtained from birds was determined by the intracerebral pathogenicity index (ICPI) test and/or by analysis of the deduced amino acid profile at the fusion protein cleavage site. In FY2014, no vNDV was isolated. Of the 86 isolates, 57 were characterized as low virulent NDV (loNDV) and 22 were identified as pigeon paramyxovirus type-1 (PPMV-1) from racing and other pigeons in 6 states (CA FL ME PA RI WY). PPMV-1 isolates were identified by the HI test with monoclonal antibodies specific for PPMV-1 and sequence analysis of fusion protein cleavage site.

Proficiency Test Panels. For AGID, 129 laboratories were invited to participate in the voluntary proficiency test (PT); 70 panels were shipped (including Mexico (1) and El Salvador (1)). A total of 65 laboratories from 35 states plus Puerto Rico passed with a score of 90% or better. The NAHLN laboratories conducting surveillance testing for AI and/or ND are required to have one or more diagnosticians pass an annual PT to perform official rRT-PCR testing. In FY 2014, AI (matrix/H5/H7) PTs were distributed/approved for 244/246 diagnosticians in 56 laboratories and for 234/242 diagnosticians in 54 laboratories for APMV-1 (Newcastle disease) rRT-PCR. In addition to NAHLN laboratories, AI and ND rRT-PCR proficiency panels were distributed to Canada and Mexico as part of the North American Animal Health Laboratory Network (NAAHLN) harmonization, as well as one to the Dominican Republic. The 2014 international OFFLU AI Ring Trial was also coordinated, prepared and shipped by the NVSL in coordination with the Frederich Loeffler Institute. The panel included 15 samples and participants were expected to conduct Type A, H5 and H7 subtyping rRT-PCR, as well as sequence analysis for molecular pathotyping. Participants included 20 labs (representing 20 countries), including 9 OIE/FAO Reference Centers and 11 Regional Laboratories. While the majority of labs accurately detected influenza A; subtyping by PCR was challenging.

AI Diagnostic Reagents Supplied by the NVSL. The following reagents were distributed for rRT-PCR testing and support of NPIP and LBM surveillance during FY 2014:

AGID Diagnostic Reagents:

- 11,645 units of AGID reagents (antigen and enhancement serum) were shipped to 59 state, university, and private laboratories in 33 states sufficient for approximately 1,397,400 AGID tests
- An additional 543 units (65,160 tests) were shipped to 10 international laboratories (10 countries)

AIV Diagnostic Reagents:

AIV-1 rRT-PCR Controls

- 81 vials of positive amplification control (M, H5 & H7) 19 states; 28 internationally to 6 countries
- 318 vials of positive extraction control 35 states; 7 internationally to 6 countries
- 413 vials of negative extraction control 36 states

APMV-1 Diagnostic Reagents:

LaSota Antigen (inactivated)

- 116 vials (2 ml) to 7 national and 4 international labs

APMV-1 Antiserum

- 65 vials (2 ml) to 4 national and 5 international labs

APMV-1 rRT-PCR Controls

- 27 vials of positive amplification control to 16 states; 8 vials internationally (4 countries)
- 118 vials of positive extraction control to 25 states; 5 vials internationally (4 countries)
-

Table 1. Samples received for avian influenza and Newcastle disease testing during FY2013-14 by purpose.

	FY2013	**FY2014**
IMPORT	4944	1562
EXPORT	378	519
LBM-BYD	649	658
COMMERCIAL	266	283

Table 2. FY2014 AIV isolates from LBM, backyard, and commercial submissions by state and H-type.

Purpose	**Subtype**	**Source**	**State**
LBM/ backyard	H2N5	Duck	WA
	H3N8	Duck	TX
	H4N6	Duck	WA
	H6N2	Chicken	FL
	H6N5	Chicken	TX
	LPAI H7N2	Chicken	PA
	LPAI H7N7	Chicken	DE
Other Commercial	H1N1	Turkey	VA
	H4N2	Turkey	MN
	H6N8	Turkey	MN
	LPAI H5N8	Quail	CA
	LPAI H7N3	Pheasant	NJ

Table 3. Avian influenza isolates from wild birds by state and H-type (n=395; collection dates range from 2012-14).

State (# isolates)	**H-type** (n=395)
AK (1)	H3
AR (3)	H5, H11
IA (20)	H3, H4, H7
ID (8)	H1, H3, H4
IL (15)	H3, H4, H5, H11
IN (2)	H1, H5
KS (1)	H3

LA (55)	H7 (N1, N3, N7)
MD (35)	H1, H2, H3, H4, H5 H6, H9, H10, H11
ME (1)	H13
MN (1)	H11
MO (35)	H1, H2, H4, H5, H6, H9, H10, H11
MS (13)	H1, H5, H7, H8, H10, H11
MT (1)	H3
NJ (7)	H4, H7
OH (159)	H1, H2, H3, H4, H5, H6, H7, H9, H10, H11, H12
SC (4)	H7
TX (1)	H7
WA (1)	H6
WI (31)	H1, H4, H6, H7, H9, H11, H12
unknown (1)	H4

Table 4. Low pathogenic avian influenza (LPAI) subtypes received in FY2014 from wild birds by state (n=90; collection dates range from 2012-14).

LPAI Subtype (# isolates)	**State**
H5N2 (12)	AR, IL, IN, MD, MO, MS, OH
H5N4 (1)	MS
H7N1 (1)	OH
H7N1,3 or 4 (8)	IA, LA, MD, MS, OH, WI
H7N1,7 (31)	LA, NJ, OH
H7N2 (1)	MS
H7N3 (9)	LA, MS, OH, SC
H7N7 (24)	LA, TX
H7N7 (3)	LA

Poultry *Salmonella*, *Mycoplasma*, and *Pasteurella* Diagnostics at NVSL

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***Salmonella* serotyping**

The Diagnostic Bacteriology Laboratory within the National Veterinary Services Laboratories (NVSL) routinely serotypes *Salmonella* isolates submitted by private, state, and federal laboratories as well as veterinarians, researchers and other animal health officials. This report summarizes *Salmonella* serotyping submissions to NVSL from January 1 through December 31, 2013 originating from poultry. *Salmonella* isolates are identified as clinical (clinical signs of salmonellosis from primary or secondary infection) or non-clinical (herd and flock monitoring programs, environmental sources, food). Serotyping data from isolates submitted for research purposes are not included in the summary.

Salmonella serotyping at the NVSL is an ISO 17025 accredited test. Salmonellae are typed using polyvalent and single factor antisera to determine the O and H antigens. Approximately 60% of the sera used at the NVSL are produced in house as previously described. (Ewing) The remaining antisera are purchased from commercial vendors. All sera are subject to extensive quality control testing prior to use. *Salmonella* antigenic formulae are determined as previously described (Ewing) and interpreted via the White-Kauffmann-Le Minor scheme (Grimont). The subspecies designation precedes the antigenic formula for those serotypes other than subspecies I.

From January 1 to December 31, 2013 there were 3912 isolates from chicken sources and 1378 isolates from turkey sources submitted to the NVSL for *Salmonella* serotyping. The most common isolates from chickens and turkeys are listed in Tables 1 and 2 respectively.

The NVSL provided a *Salmonella* Group D proficiency test to assess the ability of laboratories to isolate *Salmonella* from environmental samples and determine the serogroup (specifically group D) of any *Salmonella* isolated. The samples consisted of drag swabs spiked with *Salmonella* and/or common contaminants. The 2013 test included *Salmonella* serotypes Enteritidis, Javiana, Saintpaul, Anatum, Oranienburg, Heidelberg, Ouakam, Virchow, 9,12:non-motile, and an *sdf* negative Enteritidis. Contaminant bacteria included *Enterobacter cloacae*, *Escherichia coli*, *Citrobacter freundii*, *Pseudomonas aeruginosa*, and *Providencia* sp. The test consisted of 10 samples which were shipped to laboratories overnight on ice packs. Laboratories were instructed to use their current protocols to test and were asked to report the results within 3 weeks. The NVSL randomly retained 8% of the test kits and tested them blindly for QA purposes. The results of the proficiency test are shown in Table 3.

Additionally, the NVSL offered *Salmonella* serotyping proficiency tests to allow laboratories to assess their ability to serogroup or serotype *Salmonella*. The panel consisted of 10 pure *Salmonella* isolates, including *Salmonella* serotypes Heidelberg, Senftenberg, Enteritidis, Kentucky, Mbandaka, Anatum, Give, Typhimurium, Berta and Agona. Participants were given the option to perform serogrouping, partial serotyping, or full serotyping of the isolates and were graded based on appropriate identification to the level of typing they performed. The NVSL randomly retained 19% of the test kits and tested them blindly for QA purposes. The results of the proficiency test are shown in Table 4.

Table 1: Most common serotypes in 2013: Chicken

Clinical		**Non-Clinical**	
Serotype	**No. Isolates**	**Serotype**	**No. Isolates**
Enteritidis	71	Senftenberg	570
Kentucky	21	Kentucky	505
Typhimurium	15	Mbandaka	429
Heidelberg	9	Heidelberg	371
Mbandaka	8	Enteritidis	329
All others	58	Typhimurium	201
		Infantis	74
		Cerro	67
		Newport	65
		Montevideo	62
		All others	1057
Total	**182**	**Total**	**3730**

Table 2: Most common serotypes in 2013: Turkeys

Clinical		**Non-Clinical**	
Serotype	**No. Isolates**	**Serotype**	**No. Isolates**
Senftenberg	135	Senftenberg	228
Albany	58	Hadar	115
Bredeney	32	Anatum	109
Montevideo	32	Albany	78
Ouakam	29	Muenster	73
Heidelberg	28	Agona	70
All others	106	Cerro	29
		Saintpaul	26
		Kentucky	19
		4,(5),12:-	18
		All others	193
Total	**420**	**Total**	**958**

Table 3: Summary of NVSL *Salmonella* Group D proficiency test

	2009	**2010**	**2011**	**2012**	**2013**
Participants	40	55	70	73	61

Mean Score	93%	92%	97%	92%	94%
Score Range	100-44%	100-44%	100-85%	100%-29%	100-68%
Below Passing	4	3	0	N/A*	N/A**

Because of the change in grading method, a pass/fail designation was not assigned.
2012 Seven participants scored less than 80%.
2013 Four laboratories scored less than 80%

Table 4: Summary of NVSL *Salmonella* Serotyping proficiency test

	Serogrouping 2012	**Serotyping 2012**	**Serogrouping 2013**	**Serotyping 2013**
Participants	22	13	18	14
Mean Score	98%	92%	98%	98.50%
Score Range	100-90%	100-70%	100-90%	100-90%

***Salmonella* Enteritidis**

The number of *Salmonella* Enteritidis (SE) isolates submitted from chickens in 2013 is shown in Table 5. The most common SE phage types are shown in Table 6.

Table 5: Number of chickens *Salmonella* Enteritidis isolates per calendar year at the NVSL

	2009	**2010**	**2011**	**2012**	**2013**
No. chicken isolates	4761	4987	3940	3502	3912
No. chicken SE isolates	993	1500	776	507	400
SE percent of all isolates	20.9%	30.1%	19.7%	14.5%	10.2%

Table 6: Most common *Salmonella* Enteritidis phage types from chicken sources per calendar year

Rank	**2009**	**2010**	**2011**	**2012**	**2013**
1	8	8	8	8	8
2	13	13	13a	13	13
3	13a	13a	13	RDNC	13a
4	23	RDNC	RDNC	13a	RDNC
5	RDNC	23	23	23	23

RDNC = reacts, does not conform

***Salmonella* Pullorum and Gallinarum**

The NVSL provided 2250 ml of *S*. Pullorum tube antigen, 1575 ml of *S*. Pullorum stained microtiter antigen, and 502 ml of antisera to testing laboratories between January 1 and December 31, 2013. The NVSL conducted 331 *S.* Pullorum microtiter tests in 2013. The NVSL did not identify any *Salmonella* Pullorum isolates in 2013.

Pasteurella* and *Mycoplasma

The NVSL received 145 isolates for somatic typing in 2013. The NVSL also supplied 85 ml of *P. multocida* typing sera.
The amount of *Mycoplasma* reagents are shown in Tables 7 and 8.

Table 6: *Pasteurella* Multocida somatic typing. Table shows number of isolates per fiscal year for each type.

	2009	**2010**	**2011**	**2012**	**2013**
Type 3	54	38	25	38	28
Type 3,4	33	27	12	33	17
Type 1	14	25	17	10	10
All other	62	70	52	100	90
TOTAL	**163**	**160**	**106**	**181**	**145**

Table 7: *Mycoplasma* antisera (ml) provided by NVSL per fiscal year

Antisera	**2009**	**2010**	**2011**	**2012**	**2013**
M. gallisepticum	266	256	306	274	532
M. meleagridis	54	32	54	40	108
M. synoviae	222	256	326	342	672
Negative	162	222	150	175	344
Total	704	766	836	831	1656

Table 8: *Mycoplasma* antigen (ml) provided by NVSL per fiscal year

Antigen	**2009**	**2010**	**2011**	**2012**	**2013**
M. gallisepticum	190	150	195	175	245
M. meleagridis	75	75	95	80	40
M. synoviae	200	215	220	245	290
Total	465	440	510	500	555

Ewing, WH. 1986. Edward and Ewing's Identification of Enterobacteriaceae. 4th edition. Elsevier Science Publishing Co., Inc., New York, U.S. Grimont, PAD, Weill, FX. 2007. Antigenic Formulae of the *Salmonella* Serovars. 9th edition.
WHO Collaborating Centre for Reference and Research on *Salmonella*. Paris, France.

2014 Live Bird Marketing System (LBMS) Avian Influenza (AI) Program Working Group Report

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Beginning in 1994, low pathogenicity avian influenza (LPAI) H7N2 proved to be endemic in live bird markets (LBM) in the northeastern United States. In 1999, the United States Department of Agriculture (USDA) established a LBMS working group to provide support to the states wanting to eliminate LPAI H7N2 that was persistent in the LBMs. In October 2004, the USDA, Animal and Plant Health Inspection Service (APHIS) Veterinary Services (VS) published Uniform Standards for AI Prevention and Control in the LBMS to establish a more consistent approach by participating States in the control of AI in the LBMS. In August 2012, VS published an updated edition of the Uniform Standards.

State participation is voluntary. Participating States will enact regulations for compliance of their live bird markets (LBMs), producers, and distributors. All LBMs, producers, and distributors that supply the retail markets must be registered or licensed with the State and allow Federal and State inspectors access to their facilities, birds, and records. These facilities must also have written biosecurity protocols in place. APHIS coordinates and administers the program. APHIS provides field and laboratory personnel and resources to assist States with implementation and compliance with program requirements.

In February 2014, the annual LBMS working group business meeting was held in Philadelphia, PA, to address the LBMS AI Prevention and Control program concerns. More than 71 participants representing 31 States attended the meeting, including 18 representatives from USDA, APHIS Veterinary Services; 2 representatives from universities; 38 State Department of Agriculture representatives; 8 LBMS/poultry industry stakeholders; and 4 representatives from animal health diagnostic laboratories. Participants discussed the program's progress, shared ideas for continued program development, and agreed on further implementation of the program.

In addition, the working group discussed: (1) the reorganization of APHIS, VS; (2) an overview of the game bird industry (pheasants/chukars) production; (3) the Avian Health line item budget; (4) the FY2014 Avian Health umbrella cooperative agreement work plans; (5) new LBMS spreadsheet for cooperative agreement surveillance data collection; (6) an update of avian influenza A (H7N9) in China; (7) the VS guidance document on indemnity requirements and process issues/procedures for flock plans, compliance agreements, and indemnity claims in cases of H5/H7 LPAI infection in poultry; (8) and update on H7N3 HPAI outbreak in Mexico; (9) an update on the National Veterinary Services Laboratories (NVSL) avian influenza surveillance testing, current nationwide findings and recommended AI diagnostic tests and reporting of results; (10) an update on Zoetis Flu Detect avian influenza rapid test; (11) an update on the NPIP program and preparing for the 42nd Biennial Conference; (12) the review of 2013 LBMS continuing education training held in Pomona, CA; and (13) an update on the Pennsylvania Poultry Handling Transportation Quality Assurance program. Special presentations were

given on avian influenza surveillance, LBMS reviews and accomplishment reports; in Pennsylvania, New York, New Jersey, California, Texas, Florida, Minnesota and New England states; and human Salmonella infections associated with live bird markets. In addition, personnel from the Southeast Poultry Research Laboratory (SEPRL), USDA Agricultural Research Service discussed avian influenza research updates. The working group received an update from the Centers for Disease Control (CDC) on a publication on *Salmonella* and live bird/animal markets and the launching of a CDC website to provide educational materials.

In FY2014, USDA's Biosecurity for Birds campaign continued its efforts to educate the backyard poultry community about ways they can help protect and maintain the health of their birds. Activities included a photo contest with hundreds of entries, the annual calendar, Bird Health Awareness Week in February, two webinars and concurrent twitter chats, fair packages and social media outreach. Social media has been one of the largest growth areas. The campaign launched a Healthy Harry Facebook page and gained more than 2,000 likes in the first week. Now this page is approaching 4,000 likes. The campaign's Twitter account has also grown from around 600 followers to more than 1,100. The Biosecurity for the Birds campaign is also working on plans for FY15, including the development and launch of three new Healthy Harry videos for YouTube.

In fiscal year (FY) 2013, approximately 212,280 tests were conducted for AI surveillance in the LBMS. In fiscal year (FY) 2014, surveillance in the LBMS remains a high priority. Approximately 55,998 tests have been conducted for AI surveillance in the LBMS for the first full quarter and partial second quarter. Tests included agar gel immunodiffusion, real-time reverse-transcriptase polymerase chain reaction (rRT-PCR), antigen capture immunoassay, and virus isolation. For virus isolation and rRT-PCR, each sample may represent five or eleven individual swabs pooled for a composite single sample/test.

Since the H5/H7 LPAI LBMS prevention and control program was initiated in 2004, the number of LBMS H5 and H7 avian influenza positive premises has decreased steadily. In FY 2014, only one detection of H5 viral RNA occurred, but no virus was isolated. In addition, only three detections of LPAI were found in backyard poultry auctions (one H5 viral RNA, one H7N2 LPAI virus and one H7N7 LPAI virus).

Reovirus Infection, Diagnostics and Prevention in Turkeys

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About 60 years ago this year the first isolation of Reovirus was made by Fahey and Crawley (1) and was later linked to tenosynovitis by Walker et al. in 1972 (2). The arthritis and tenosynovitis syndrome in turkeys specifically was first described by Levisohn et al. in 1980 (3) and again by Page et al in 1982. Although the chicken industry has dealt with the various manifestations of Reovirus infection for many years, until about 2011 the turkey industry had not dealt with Reovirus infection to any measurable degree. In 2011 the Minnesota Veterinary Diagnostic Laboratory isolated and characterized Reovirus from submissions of turkey legs with clinical tenosynovitis and arthritis (5). Since that time several groups have been able to replicate and study the disease process of Reovirus induced tenosynovitis in turkeys (6 & 7) and have found that the severity of infection and the ability to isolate the virus from various tissues is strain dependent. And since most avian species have Reovirus in their enteric systems that are non-pathogenic and do not cause tenosynovitis there is a need to differentiate ubiquitous Reovirus strains or even Reovirus strains from other avians such as chickens from those that cause tenosynovitis in turkeys. Currently there is a dearth of useful diagnostic tools available to the practitioner for use in diagnosing and managing Reovirus in turkeys. The three categories of tools that we have currently available are ELISA, virus neutralization and molecular techniques. The purpose of this report is to share with the committee our experiences with managing Reovirus in our turkey operation specifically relating to diagnostic tools and their uses.

We have had a lot of experience using the commercial Reovirus ELISA kits (Synbiotics & IDEXX) that were developed for chickens in our turkey breeding operation in Minnesota. Recently we have focused an even greater amount of attention on these kits to see if we can figure out how to use them in practice. The first step for us was to determine the correlation of reported titers by each of the ELISA testing kits with each other, and we found that they correlated well (ex: 1,000 titer in one was basically a 1,000 titer in the other). Part of our management strategy is autogenous vaccination and we wanted to see what the difference in titer was between vaccinates and controls relative to ELISA titer. We found that we were unable to tell the difference between vaccinate and control birds when using the commercial ELISA kits. This study was repeated and again found that birds housed at our research facility showed no difference between vaccinates and controls. We have developed an in-house ELISA that is specific to both of the strains of field Reovirus isolates used in the vaccine and it is able to demonstrate a difference between vaccinated and control animals. Thus far we are unsure how to use these commercial ELISA's in our operation as there is little correlation to titer and vaccination and titer and clinical Reovirus infection. We are currently comparing our in-house ELISA to the commercial ELISA in the field.

The second tool we have available is the use of virus neutralization assays through Dr Jack Rosenberger's lab. Dr Rosenberger has developed a virus neutralization assay array containing several different Reovirus strains. With this assay you attempt to neutralize a virus you have isolated from a clinical case by using a bank of antisera that has been generated against several different specific Reovirus strains. The limitations of this assay are related to the requirement of having a virus and the amount of cross reaction between sera groups and turnaround time. The delay from the time of having a flock that has clinical Reovirus, then determining if it is bad enough to warrant virus isolation attempts, then determining if you think it is different enough from the Reovirus infections currently going on that you are not confident the vaccination program will work (meaning has there been a genetic shift in the virus), then to get it to Dr Rosenberger for the assay and then the results back and interpreted is extensive. Once you do get the results back it is not uncommon to have some cross reaction in the assay and there doesn't appear to be a strong correlation with ELISA assay titers and the virus neutralization assay titers.

The third class of tools, molecular based tools, is relatively new and are really still being developed by various groups (8-11). This class of tools may hold the most promise as there appears to be some degree of ability to delineate enteric and chicken Reovirus strains from those causing tenosynovitis in turkeys. And the ability to run these tests on different sample types may yield a quicker turnaround time. The majority of the work with these tests have been on known viruses and in the research setting and over the next year we will hopefully see how they perform in the field when performed on unknown samples and different sample types.

In summary, we have a dearth of diagnostic Reovirus tools in turkeys that correlate with vaccination and virus neutralization and clinical disease. The promise of newer techniques that decrease turnaround time and don't require virus isolation and extensive reagent costs is encouraging but need to be field tested. A tool that can determine if a bird is carrying or shedding a Reovirus that is pathogenic and will cause tenosynovitis in her or her offspring through vertical transmission would be invaluable.

A Simulation Based Evaluation of Active Surveillance Protocol Options for the Movement of Broilers to Slaughter

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In the event of an outbreak of Highly Pathogenic Avian Influenza (HPAI), emergency response would involve stamping out of infected premises as well as restrictions on moving poultry and poultry products from within a Control Area. Movement restrictions aimed at controlling the outbreak may also result in unintended consequences such as disruptions to business continuity. On the other hand, the unrecognized or unintentional movement of infectious birds may result in further disease spread. Pre-movement active surveillance is a key mitigation measure to differentiate between infected and uninfected flocks and to enable the managed movement of uninfected broilers to slaughter.

Active surveillance protocol options considered by the Secure Broiler Supply workgroup all involve testing two pooled samples of swabs taken from dead birds via the influenza matrix gene real-time reverse transcriptase polymerase chain reaction test (rRT-PCR) at National Animal Health Laboratory Network (NAHLN) labs. However, protocol options differ with respect to specific aspects such as the number of swabs per pooled sample, the timing of the tests in relation to the scheduled movement, or inclusion of supplementary Antigen Capture (AC) testing near the time of load-out. The different protocol options have their advantages and disadvantages for application in specific outbreak scenarios. For example, in scenarios where the turnaround time needed to obtain results from NAHLN labs is anticipated to be more than 12-hours,[1] protocols with earlier sample collection times for rRT-PCR tests would be more appropriate. The addition of flock-side testing very close to load-out using AC test kits offers logistical benefits without requiring additional lab facilities. The objective of evaluating multiple active surveillance protocol options is to incorporate flexibility in emergency response plans and support risk managers in their choice of an active surveillance protocol option given their relative pros and cons.

A key strategy to increase confidence that HPAI infected broilers are not moved is implementation of a pre-movement isolation period (PMIP) ahead of the scheduled movement date. In essence, PMIP requires implementing very high biosecurity for a few days before scheduled movement to slaughter. The PMIP involves restricting most farm visits for the specified duration prior to movement except for critical visits such as feed

[1] Current USDA APHIS HPAI emergency response plans assume same-day turnaround for receiving test results. For samples collected in the morning and submitted to NAHLN labs for rRT-PCR testing that morning, results are assumed to be available to the Incident Command at the end of the same business day.

delivery or emergency repairmen. Critical visits are performed with strict biosecurity protocols including personal protective equipment (PPE) and vehicle cleaning and disinfection (C&D). In general, exposure close to the time of movement is relatively less likely to be detected via active surveillance due to the reduced time for HPAI to spread and disease mortality to occur. PMIP is aimed at minimizing chances of exposure close to movement. In addition to comparing the performance of various active surveillance protocols, we evaluated the impact of PMIP in conjunction with active surveillance on the likelihood of moving infectious broilers to processing.

Methods

The following active surveillance protocol options were compared with respect to the probability of HPAI detection on various days post exposure of a broiler house relative to the time that the flock is scheduled to be moved to slaughter.

Comparison 1: The use of 11 vs. 5 swabs in each pooled sample for rRT-PCR testing in the baseline active surveillance protocol compared in terms of HPAI detection likelihood. In this comparison, the active surveillance protocol involved testing one pooled sample for every 50 dead birds from each house on the premises on two consecutive days before movement where the second (later) rRT-PCR sample is collected within 24 hours of movement.

Comparison 2: The impact of collecting rRT-PCR samples one day earlier due to logistical constraints was evaluated. This option provides for a longer turnaround time to receive test results. In this analysis, the detection likelihood when rRT-PCR samples are collected at 18 and 42 hours prior to movement (e.g., the baseline active surveillance protocol) was compared with detection when samples for rRT-PCR testing are collected earlier at 42 and 66 hours prior to movement.

Comparison 3: This comparison was performed in two parts to evaluate the impact of supplementary AC testing by industry veterinarians close to the time of movement in addition to the rRT-PCR testing performed at NAHLN labs. In the first part (**Comparison 3a**), the baseline RT-PCR protocol was compared to rRT-PCR testing with the addition of flock-side AC testing. In the second part (**Comparison 3b**), the detection likelihood when rRT-PCT samples are collected earlier due to logistical constraints (42 and 66 hours prior to movement) was compared to the case when AC testing is performed close to movement in addition to rRT-PCR.

A recent study at the USDA's, Agricultural Research Service, Southeast Poultry Research Laboratory, was undertaken to provide data on AC test performance in dead birds infected with HPAI viruses. Data from 46 dead birds for the HPAI H5N2 Pennsylvania strain and 14 dead birds for the HPAI H7N3 Jalisco strain were used in the current analysis. Using a Bayesian approach, we estimated a mean diagnostic sensitivity of 97.9% (95% credibility intervals 92 to 99.9%) for HPAI H5N2 and 57% (33 to 80%) for HPAI H7N3 in dead birds. The wider interval for the case of HPAI H7N3 is due to the smaller sample size and correspondingly greater uncertainty. For HPAI H5N1 (multiple clades), we estimated a diagnostic sensitivity of 86% (33 to 80%) in dead birds using available data from published scientific literature.

A stochastic chain binomial disease transmission model was utilized for simulating HPAI disease spread and disease mortality on various days post infection of the house. Simulation models of active surveillance were then used to predict disease detection considering factors such as the HPAI transmission model results, normal daily mortality, and sensitivity of the diagnostic tests. For the purposes of this analysis, we assumed that diagnostic test sensitivities for AC tests could range from 60 to 80%, and the diagnostic sensitivity for rRT-PCR was 86.5%. In addition to diagnostic testing, a daily mortality above 0.3 percent of the house was considered as a trigger for HPAI detection (i.e., unexplained high mortality was detected through enhanced passive surveillance).

Results and Discussion:

Comparison 1: Simulation results indicate that using a rRT-PCR pooled sample with 11 swabs per pool resulted in a moderate gain in detection probability compared with pools containing 5 swabs each (i.e., approximately 12% of simulation iterations where the house become exposed 3 days prior to movement).

Comparison 2: The results also indicate that collecting rRT-PCR samples earlier to accommodate logistical constraints (i.e., a longer turnaround time to receive results from the NAHLN lab) could result in an as much as a 30% decrease in HPAI detection probability in simulation iterations where the house became exposed 3 to 4 days prior to the time of movement. These results indicate that it is critical to test as close as logistically feasible to the time of movement.

Comparison 3: Our results indicate that supplemental flock-side testing conducted by industry veterinarians has the potential to enhance HPAI detection probability, particularly in situations where there are logistical constraints as in the previous comparison. In **Comparison 3a**, where the second rRT-PCR test sample is collected within 24 hours of movement, supplementary AC testing (with an assumed diagnostic sensitivity of 60%) provided nearly a 20% gain in detection probability in cases where the house became exposed 2 or 3 days prior to the time of movement. In **Comparison 3b** with earlier rRT-PCR sample collection in anticipation of a more than a 12-hour turnaround time to obtain test results, supplementary AC testing provided more than a 30% gain in detection probability in cases where the house became exposed 2 or 3 days prior to the time of movement (**Figure 1**). However, we note that even though the diagnostic sensitivity of the AC tests has been found to be high (mean

greater than 80%) for dead birds infected with HPAI H5N1 or HPAI H5N2 strains, there is some uncertainty on the estimate for other HPAI strains. In addition, it was assumed that pooling of up to 5 swabs in an AC test sample would not adversely impact diagnostic sensitivity. Further studies on these aspects would increase confidence in the application of AC tests in specific outbreak scenarios.

Simulation model results indicate that an effective PMIP of 5 days or more, in conjunction with the RRT-PCR active surveillance close to the time of movement, would result in high likelihood of detecting HPAI exposures by the time of movement (**Table 1**). Because movement of people and equipment are considered to be the main mechanism of secondary spread between poultry, very strict biosecurity during a few days before movement would be effective in reducing exposure to HPAI.

Table 1. Simulation model results showing the predicted probability of HPAI detection if the flock (house) could only become exposed to HPAI virus prior to implementation of PMIP biosecurity measures.

	Predicted HPAI detection probability under various PMIP durations		
Active surveillance option (dead bird testing)	**4 Days**	**5 days**	**6 days**
rRT-PCR testing of a pooled sample of **5 swabs** each on 2 consecutive days	96%	98%	99%
rRT-PCR testing of a pooled sample of **11 swabs** each on 2 consecutive days	98%	99%	99%

The

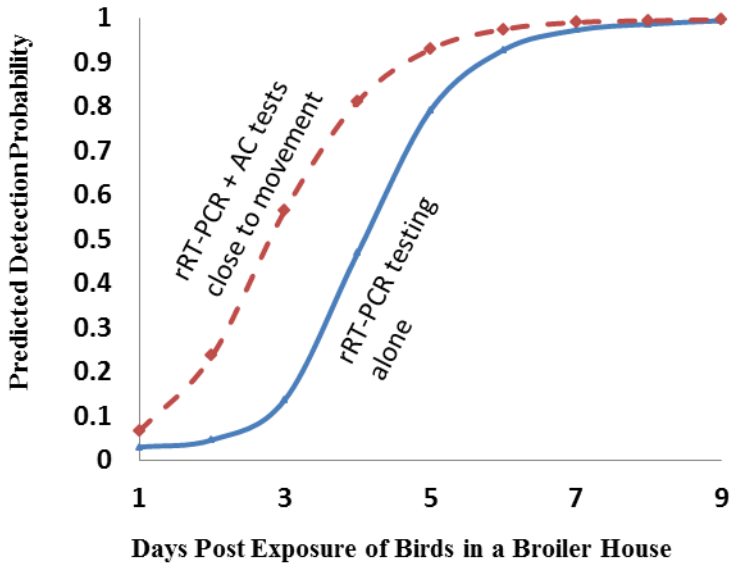

Figure 1. Predicted detection probability with or without AC tests when rRT-PCR samples are collected earlier by one day due to logistical constraints.

Chicken Gut Microbiome and *Salmonella*

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Food-borne infections following the consumption of poultry meat and egg products contaminated with *Salmonella enterica* is a major public health concern. In the USA, *Salmonella* affects more than 1.4 million individual annually that results in ~15,000 hospitalizations and ~400 deaths. While there are thousands of *Salmonella* serotypes, *S.* Typhimurium (ST) and *S.* Enteriditis (SE) are the two most important with respect to pathogen associated food-borne illness in poultry foods. ST and SE, account for approximately 40-60% of all reported *Salmonella* infections. The gut microbiota plays an important role in the digestion of complex plant fibers and polysaccharides. It also provides protection against colonization by invasive pathogenic organisms (colonization resistance). Furthermore, it has been shown in humans that the gut microbiota is essential for the proper development of the host's immune system. Clearly, there is plethora of information about the human's gut microbiome and how it can control pathogen colonization, but little information is available about the chicken's intestinal microbiota and its role in resistance to diseases (i.e., *Salmonella*). The use of probiotics and prebiotics to modulate the gut microbiota is becoming more common for enhancing human health. The use of probiotics in chickens has been suggested as a replacement to antibiotics as growth promoters. In addition, there are no published reports on the influence of vaccination against *Salmonella* on the diversity of the bacterial species in the intestinal tract (or the oviduct). In this presentation, I will provide an overview of the chicken gut microbiome, and present data from our current research program that aims to define the role of the chicken microbiota in *Salmonella* transmission and persistence in poultry flocks. We employed pyrosequencing of the 16S rRNA bacterial tag-encoded FLX amplicon to determine the effects of age of the birds, vaccination, and supplementation of the diet with the prebiotic GOS on the diversity of the microbial species in the intestinal tract of chickens. . The deep sequencing data were "denoised" and grouped into OTUs (Operational Taxonomic Units) at a 97% level to approximate phylotypes/species-level. The counts of each OTU in each sample were used to perform alpha and beta diversity calculations, and the measurements were used with sample metadata to create graphic visualizations. A combination of Unifrac significance, principal coordinate analysis (PCoA) using Fast Unifrac, and network analysis were used to evaluate the similarities between bacterial communities, and compare samples based on treatment. We also examined the correlation between the microbiome diversity and resistance to *Salmonella* challenges. The data show that both vaccination and supplementation of the diet with the prebiotic GOS were beneficial in reducing the persistence of *Salmonella* in the challenged birds. [USDA-NIFA-AFRI 2012-68003-19621].

USAHA Committee on Salmonella Report
Doug Waltman, Georgia Poultry Laboratory Network, Oakwood, GA

The USAHA Committee on Salmonella met on October 21, 2014 and received presentations from:
Dr. Stacey Bosch from the Center for Disease Control (CDC) discussed the Multistrain Salmonella Outbreaks in 2013-2014. She described how the CDC can identify outbreaks of Salmonella that are due to multiple serotypes or multiple PFGE clusters. She reviewed the *Salmonella* Heidelberg outbreak in chicken (2013-2014) where CDC has identified isolates comprising 7 PFGE clusters. A second example was the outbreak from Live Poultry caused by *Salmonella* Infantis, Newport and Hadar. A third example was the outbreak from organic sprouted chia powder caused by *Salmonella* Newport, Hartford, and Oranienburg.
Brenda Morningstar-Shaw presented the annual NVSL *Salmonella* update.
Dr. Heather Harbottle from the Food and Drug Administration (FDA) gave a presentation on *Salmonella* enteric serotypes and antimicrobial resistance trends as reported from the National Antimicrobial Resistance Monitoring System (NARMS). NARMS is a national public health surveillance program that monitors the susceptibility of enteric bacteria to antimicrobial agents of medical importance in order to help assess the impact of veterinary antimicrobial use on human health. The program is comprised of three Arms; 1) Human Arm at CDC, 2) Animal Arm at USDA, 3) Retail Arm at the FDA. All three Arms report resistance trends in non-Typhoidal *Salmonella*, *Campylobacter*, E. coli, and Enterococcus species. CDC collects clinical isolates from all 50 states. FDA works with FoodNet and State Public Health Laboratories to collect retail meat samples from grocery stores in 14 states. All 14 states culture for *Salmonella* and *Campylobacter,* four states (GA, OR, TN, MD) culture for E. coli and Enterococcus. The Animal Arm has historically been comprised of HACCP samples collected by USDA-Food Safety Inspection Service (FSIS) from animals at slaughter. Beginning in 2013, the Animal Arm of NARMS is adding an "in-plant" sampling program whereby cecal sampling will be conducted. Cecal samples better reflect animal status and are less confounded by plant events. A randomized, nationally representative testing of slaughterhouses was designed. An "on-farm" pilot sampling program has been initiated by NARMS and is led by USDA-Agricultural Research Service (ARS) in partnership with universities and industry. The goals of this program include evaluating the logistical challenges and the potential value in adding a pre-harvest component to NARMS, examining the differences in resistance on farm and at slaughter, and exploring this data collection program as point for obtaining antimicrobial drug use information.

Dr. John Linville of USDA/FSIS reported on the FSIS Initiatives to Reduce Human Exposure to *Salmonella*. He shared about the baseline studies that FSIS has conducted in preparation for the new Performance Standards which are currently in rule making. The new standards will be for comminuted chicken and turkey and for chicken parts.

Dr. Dan McChesney presented a CVM *Salmonella* Surveillance Update. Studies have shown that the prevalence of *Salmonella* in pet food (1.7%), pet treats (3.5%), animal feed (6.3%) and plant based ingredients (8.8%) are relatively low. Animal feed ingredients (48.3%) had the highest percentage of *Salmonella*. An evaluation of serotypes isolated in feed were compared to the most common isolates from humans. There were very few common serotypes.