Poultry On-Farm Antimicrobial Resistance Progress Report

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Introduction

Antimicrobial resistance (AMR) continues to be a pressing public health concern. The Food and Drug Administration (FDA) began a program in cooperation with the U. S. Department of Agriculture (USDA) to monitor the level of resistance to many of the medically-important antimicrobial agents in bacteria such as *Salmonella* sp., *E. coli* and *Campylobacter* sp. that were isolated from poultry in processing plants. The concern is that the isolates collected in the processing plant might not reflect the diversity of resistance present on the farm and the pressures, such as antibiotic use, that occur on the farm. Furthermore, the poultry industry is undergoing dramatic changes with respect to antibiotic usage, in part due to FDA GFI #209, #213 and the Veterinary Feed Directive, and in part due to consumer demand.

An important gap in our scientific understanding of AMR is whether antibiotic use, from hatchery to slaughter, actually contributes to changes in the prevalence of antibiotic resistance. Although the broiler industry has dramatically reduced its antibiotic use on-farm, antibiotic resistance in some bacteria has persisted. By collecting on-farm antimicrobial use and resistance data from the same farms, we can begin to close this information gap. Collecting on-farm data that include antibiotic use and resistance from the same farms is a better way to assess the relationship between the two, rather than trying to correlate national datasets.

Approach

The current goal of the On-farm Monitoring of Antimicrobial Use and Resistance in U.S. Broiler Production study is to have a national representation of the U. S. broiler chicken industry by enrolling companies that collectively account for at least 50% of annual production. The proposed design is to enroll complexes within participating companies, with complexes selected by company representatives. Each complex is then sampled quarterly, with approximately 4 (between 4 and 8, depending on complex enrollment) farms selected for sampling. One house on each selected farm is sampled. No farm is sampled more than once per calendar year.

From each sampled house, we collect 2 composite litter samples and then culture for *Salmonella*, *E. coli*, *Campylobacter*, and *Enterococcus* using standard methods. The samples are collected between 21 days-of-age and slaughter; ideally, the samples are taken as closer to slaughter age as possible.

Presumptive colonies of *Salmonella*, *Campylobacter,* and *Enterococcus* are confirmed by PCR. *Salmonella* isolates are serotyped by an Intergenic Sequence Ribotyping (ISR) method developed by Dr. Jean Guard at USDA:ARS. *Campylobacter* isolates are speciated into *C. jejuni*, *C. coli* or *Campylobacter* sp. by a multiplex PCR approach. *Enterococcus* isolates are speciated into *E. faecium*, *E. faecalis* or *Enterococcus* sp. by a multiplex PCR approach. Antibiotic susceptibility testing is performed with the Sensititre system.

Results (these are fictitious results for this mock report)

Complex Z1Z

The following table shows the sampling conducted in Complex Z1Z. Age is at time of sampling is calculated as the number of days between Dates of Placement and Sampling.

Complex: A4H				
	Placement (Age)	***Salmonella***	***Campylobacter***	***E. coli***
Quarter 1 2020				
Farm 1	1/30/2020 (41)	+	-	+
Farm 2	1/28/2020 (42)	-	+	+
Farm 3	2/4/2020 (32)	-	+	+
Farm 4	2/5/2020 (32)	-	+	+
Quarter 2 2020				
Farm 1	5/12/2020 (31)	+	+	+
Farm 2	4/29/2020 (47)	+	+	+
Farm 3	4/26/2020 (52)	-	+	+
Farm 4	5/11/2020 (31)	+	+	+

The specific antibiotic susceptibility patterns for the *Salmonella* and *Campylobacter* isolates are shown in the figure below. In this heat map, green represents Susceptible, yellow represents Intermediate and red represents Resistant for the respective antibiotic. The acronyms for the different antibiotics are explained in the table below. For *Salmonella*, the serotype is provided (if it has been completed). For *Campylobacter*, the species is provided.

Salmonella

Quarter	Farm	Serotype	GEN	STR	AUG	AXO	FOX	FIS	SXT	AZI	MER	AMP	CHL	CIP	NAL	TET
Q1	1	Hadar														
Q1	1	Hadar														
Q2	1	Infantis														
Q2	1	Infantis														
Q2	2	Kentucky														
Q2	2	Kentucky														
Q2	4	Kentucky														
Q2	4	Braenderup														

Campylobacter

Quarter	Farm	Species	GEN	CLI	AZI	ERY	MER	FFN	CIP	NAL	TET
Q1	2	jejuni									
Q1	2	jejuni									
Q1	3	coli									
Q1	3	coli									
Q1	4	jejuni									
Q1	4	jejuni									
Q2	1	coli									
Q2	1	coli									
Q2	2	jejuni									
Q2	2	jejuni									
Q2	3	jejuni									
Q2	3	jejuni									
Q2	4	jejuni									
Q2	4	jejuni									

Antibiotic acronyms used in the heat maps throughout this document.

Abbreviation	Antibiotic		Abbreviation	Antibiotic
GEN	Gentamicin		**AZI**	Azithromycin
STR	Streptomycin		**MER**	Meropenem
AUG	Amoxicillin / clav acid		**AMP**	Ampicillin
AXO	Ceftriaxone		**CHL**	Chloramphenicol
FOX	Cefoxitin		**CIP**	Ciprofloxacin
FIS	Sulfisoxazole		**NAL**	Nalidixic Acid
SXT	Trimeth / sulfamethox		**TET**	Tetracycline
CLI	Clindamycin		**ERY**	Erythromycin
FFN	Florfenicol			