

Antimicrobial resistance in fecal *E. coli* and *Salmonella* isolates of small poultry flocks in Ontario, Canada

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Small poultry flocks

- Non-quota
 - ≤ 299 broiler chickens
 - ≤ 99 layer chickens
 - ≤ 49 turkeys
- Non-commercial
 - < 300 waterfowl
 - < 300 game birds



Background

- > 16,000 small flocks registered with the Chicken Farmers of Ontario in 2016
- Poultry can be a source of zoonotic pathogens
- Emergence of resistance to antimicrobials commonly used to treat bacterial infections in commercial poultry flocks in Ontario is well documented (e.g., CIPARS)
- Only one study [Lebert et al. 2017], which was conducted in provincially inspected slaughter plants, has documented resistance to antimicrobials in small flocks in Ontario

Project objectives

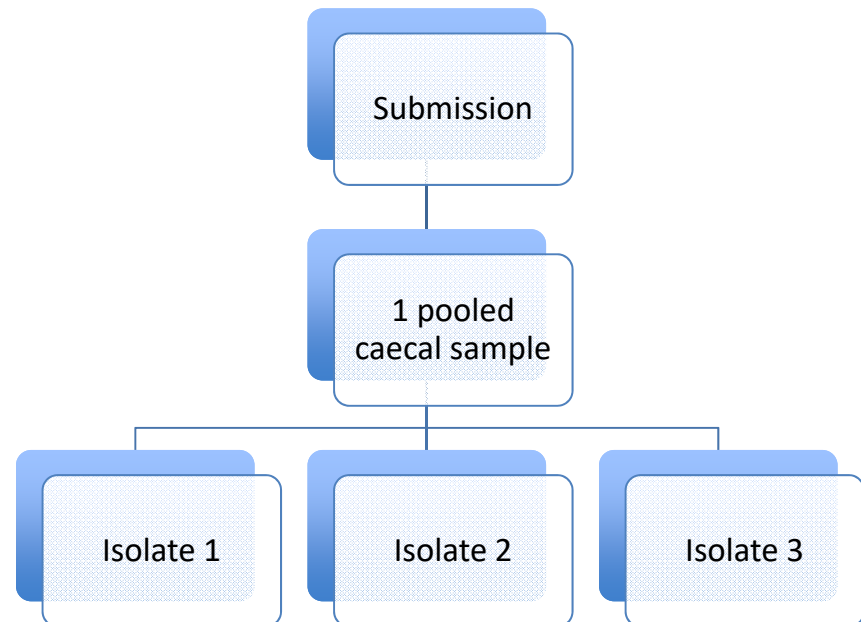
1. To determine the most common causes of mortality in Ontario small flocks
2. To determine the prevalence of pathogens in Ontario small flocks
3. To evaluate antimicrobial resistance (**AMR**) patterns of zoonotic pathogens (*Salmonella enterica*, *E. coli*, *Campylobacter*) in Ontario small flocks

Study Design

- Prospective surveillance study of small flocks conducted in Ontario between October 2015 and September 2017
- Small flock owners could submit sick or dead birds (maximum of 5) to the Animal Health Laboratory, University of Guelph for a necropsy and diagnostic testing

Methods - Laboratory

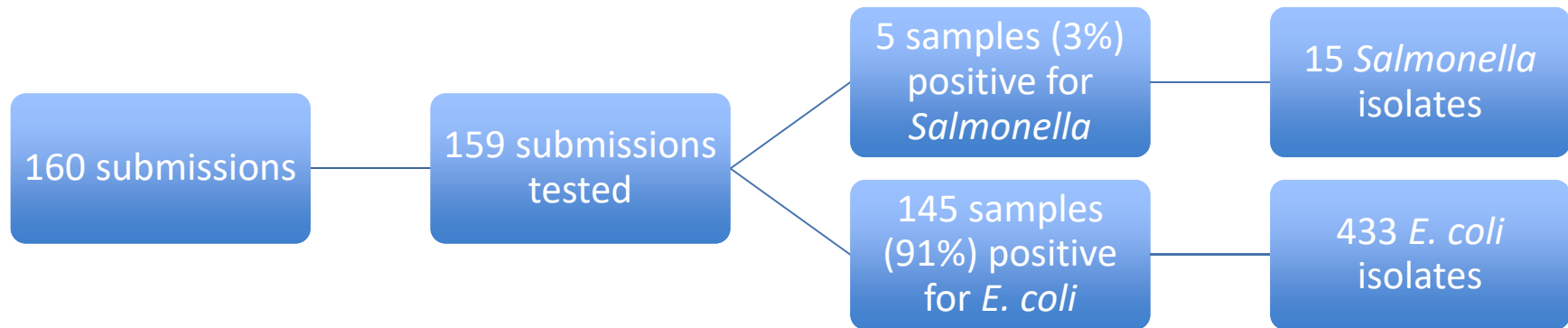
- A pre-set array of microbiologic tests were conducted on each submission
- Samples were cultured for *Salmonella* & *E. coli*
- Isolates were tested for susceptibility to 14 antimicrobials (broth microdilution method)



Methods - Statistical

- Isolate-level prevalence with exact binomial 95% confidence intervals
- Sample-level prevalence: ≥ 1 isolate
- Clustering: Jaccard binary similarity coefficient
- Multidrug resistance (**MDR**): ≥ 3 classes

Results - Descriptive



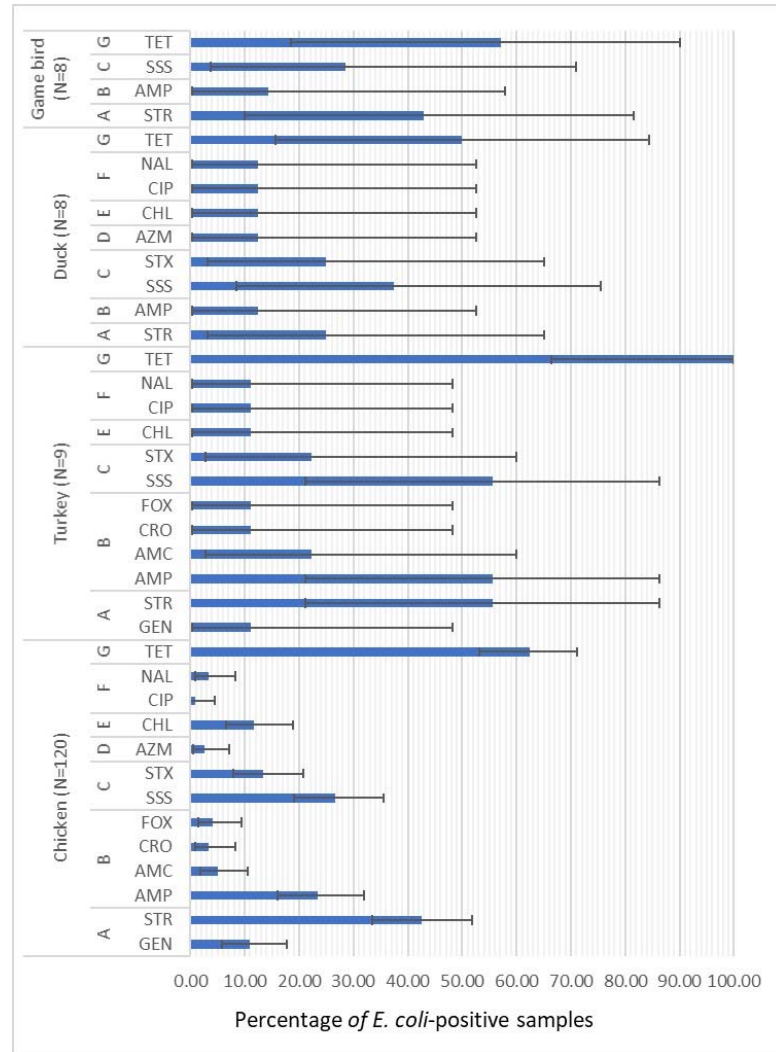
Results - *Salmonella*

- All three isolates from each pooled sample were of the same serovar and showed the same resistance profile
- 9 isolates were pan-susceptible
- 3 isolates were resistant to streptomycin
- 3 isolates were multidrug resistant:
 - Streptomycin – sulfisoxazole - trimethoprim-sulfamethoxazole - tetracycline

Percentage of *E. coli* isolates that were resistant

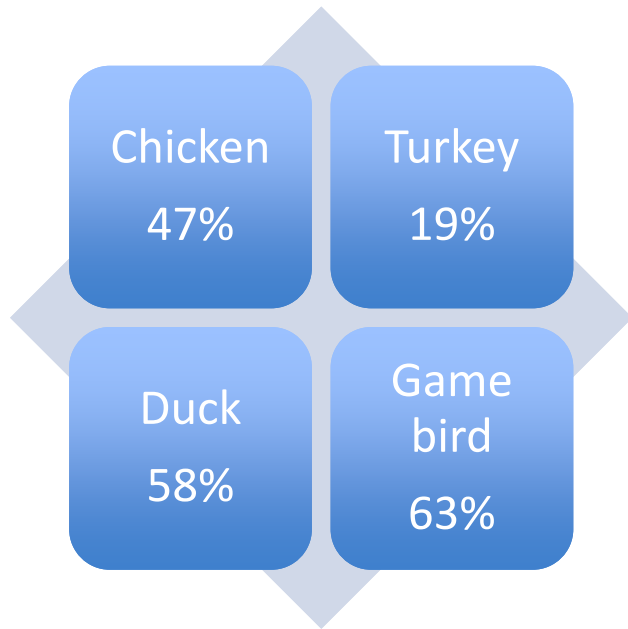
Class	Agent	Chickens (N=358)	Turkeys (N=27)	Ducks (N=24)	Game birds (N=24)
Aminoglycosides	GEN	6.4	3.7	0	0
	STR	29.3	37.0	8.3	33.3
β-Lactams	AMP	15.9	40.7	4.2	4.2
	AMC	2.2	7.4	0	0
	CRO	1.1	7.4	0	0
	FOX	1.4	3.7	0	0
	MER	0	0	0	0
Folate inhibitors	SSS	17.0	37.0	20.8	8.3
	STX	8.4	11.1	16.7	0
Macrolides	AZM	1.4	0	8.3	0
Phenicol	CHL	4.8	11.1	4.2	0
Quinolones	CIP	0.3	11.1	4.2	0
	NAL	2.2	11.1	4.2	0
Tetracyclines	TET	43.3	81.5	41.7	37.5

E. coli:
Sample-level
prevalence of
resistance

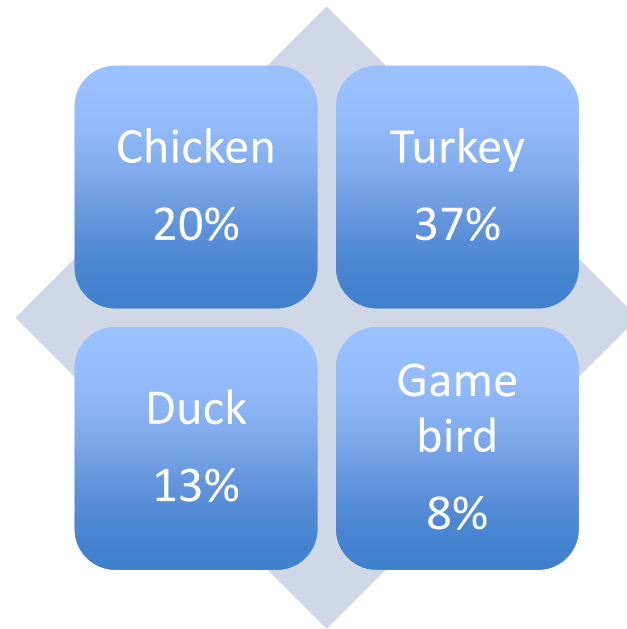


E. coli – Susceptibility & resistance

Pan-susceptible

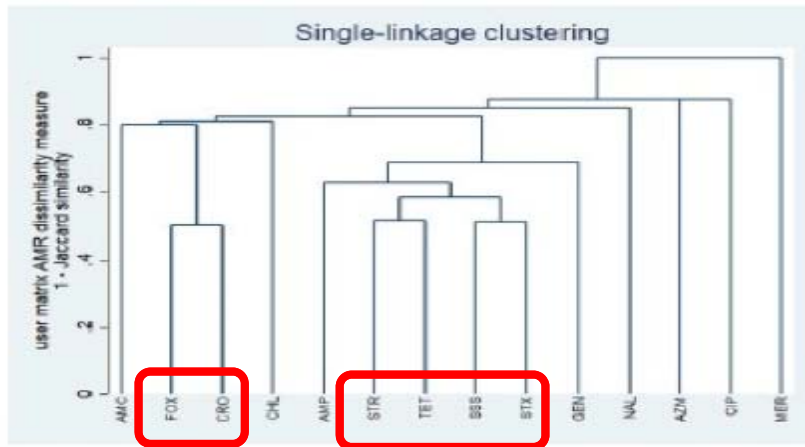


MDR

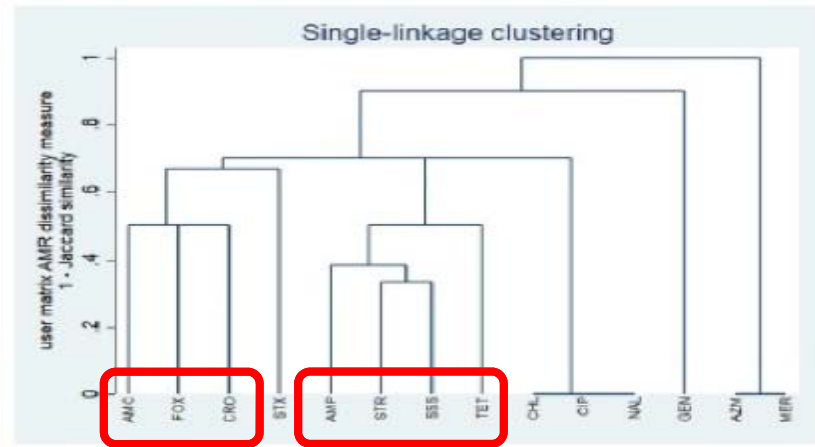


Most common AMR patterns in chickens:
AMP - STR - TET (6%) and STR - TET (5%)

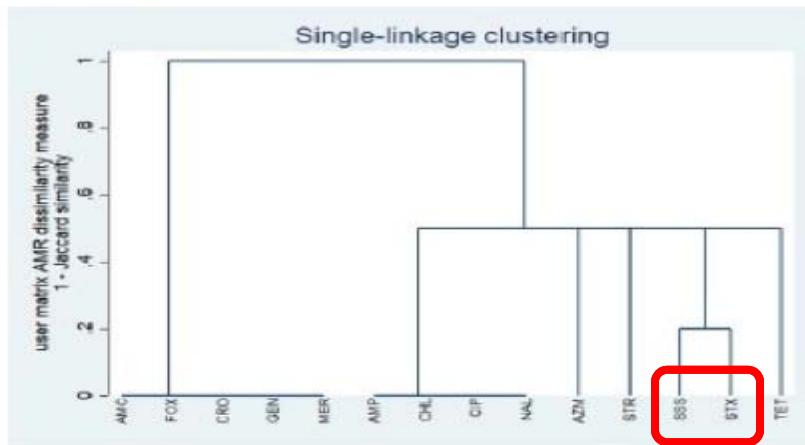
a) Chicken (n=358)



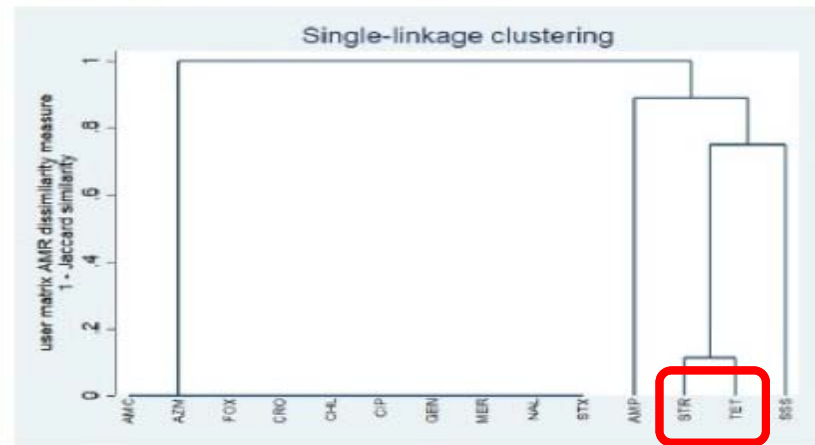
b) Turkey (n=27)



c) Duck (n=24)



d) Game bird (n=24)



E. coli - Summary of key findings

1. Moderate to high frequency of resistance to **tetracycline, streptomycin, sulfonamides, and ampicillin**
 - Frequently used to treat bacterial infections in poultry
2. Very low frequency of resistance to **cephalosporins, carbapenems, macrolides, and quinolones**
 - Classified in Canada as being of very high or high importance in human medicine
3. Chicken isolates had concurrent resistance to **streptomycin, tetracycline, sulfisoxazole, and trimethoprim-sulfamethoxazole**
 - Clusters of turkey, duck, and game bird isolates included many of the same antimicrobials

Importance

- ~ 70% of flock owners keep birds for eggs and/or meat
- ~ 40% keep birds as pets





Merci !

