

Escherichia coli Colonizing Crows as a Sentinel of Antimicrobial Resistance in Saskatoon, Canada

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INTRODUCTION



Escherichia coli is a common pathogen in people and animals and is frequently included in antimicrobial resistance surveillance studies as an indicator of resistance in the Gram-negative microbiota. The emergence of the broad spectrum β -lactamases in *E. coli* has been

particularly concerning. Recently, ESBL producing *E. coli* have been isolated from wild birds in Canada. The American Crow (*Corvus brachyrhynchos*) is one of the most widespread North American birds, living in natural habitats and also in those associated with humans. It has an omnivorous diet that includes invertebrates, vertebrates, eggs, vegetation, carrion and discarded human food; they therefore have a high degree of interaction with humans both in where they live and what they eat (2). Furthermore, our research group has previously screened various avian species for resistant *E. coli* and found that crows have a high rate of colonization with *E. coli* (~90%), making them a good candidate to be a sentinel species for resistance surveillance (1). We have also previously demonstrated that the presence of antimicrobial resistance in avian *E. coli* is significantly associated with urban (vs. rural) birds. The objective of this study was therefore to describe the antimicrobial susceptibility of *E. coli* colonizing crows in the Saskatoon region over a 3-year period.

OBJECTIVES

1. To determine the susceptibility of *E. coli* isolated from crows between 2014 and 2017
2. To determine the type of ESBLs that are present in resistant *E. coli*
3. To determine the strain type (using MLST) of ESBL producing *E. coli*

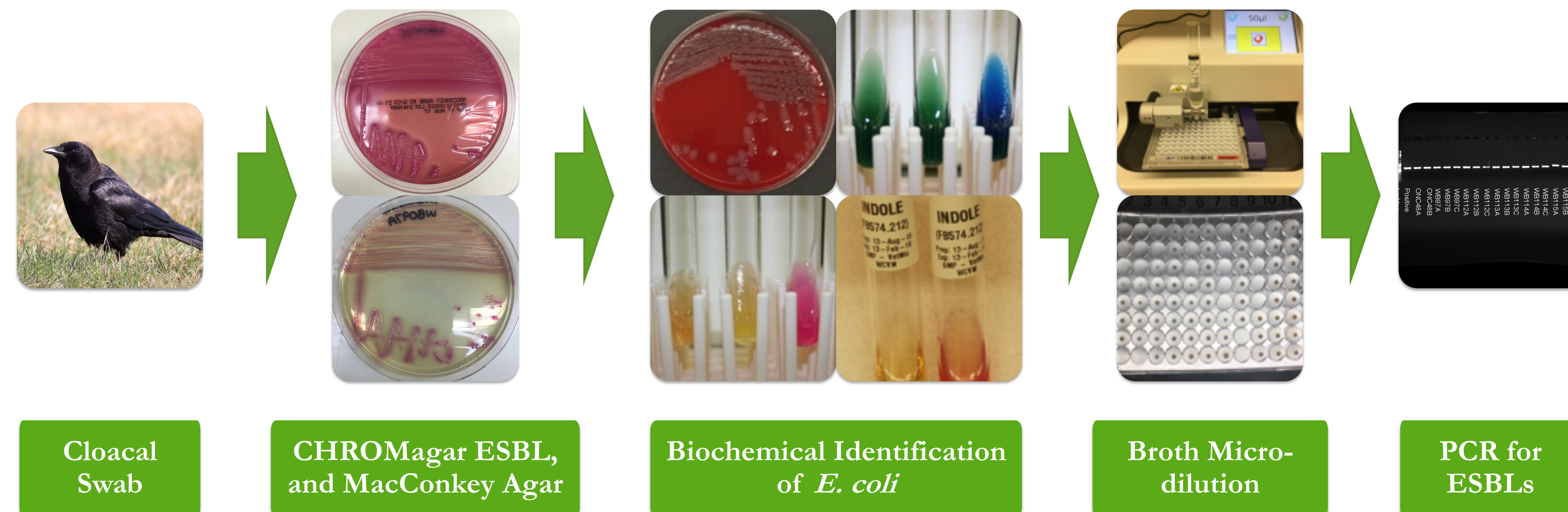
MATERIALS & METHODS

Between 2015 and 2017, samples were collected from crows presenting to the exotic medicine service at the Western College of Veterinary Medicine. Concerned members of the public routinely bring injured or distressed wildlife for medical treatment, providing a unique opportunity to sample free ranging animals. Cloacal swabs were collected prior to the administration of any medications and plated on MacConkey and CHROMagar ESBL for the isolation of *E. coli*. Three isolates per bird were saved, and antimicrobial MICs were determined by broth microdilution and agar dilution. Isolates resistant to the β -lactams were screened for ESBL and AmpC genes by PCR; amplicons were identified by sequencing. Isolates producing ESBLs were further characterized by MLST.

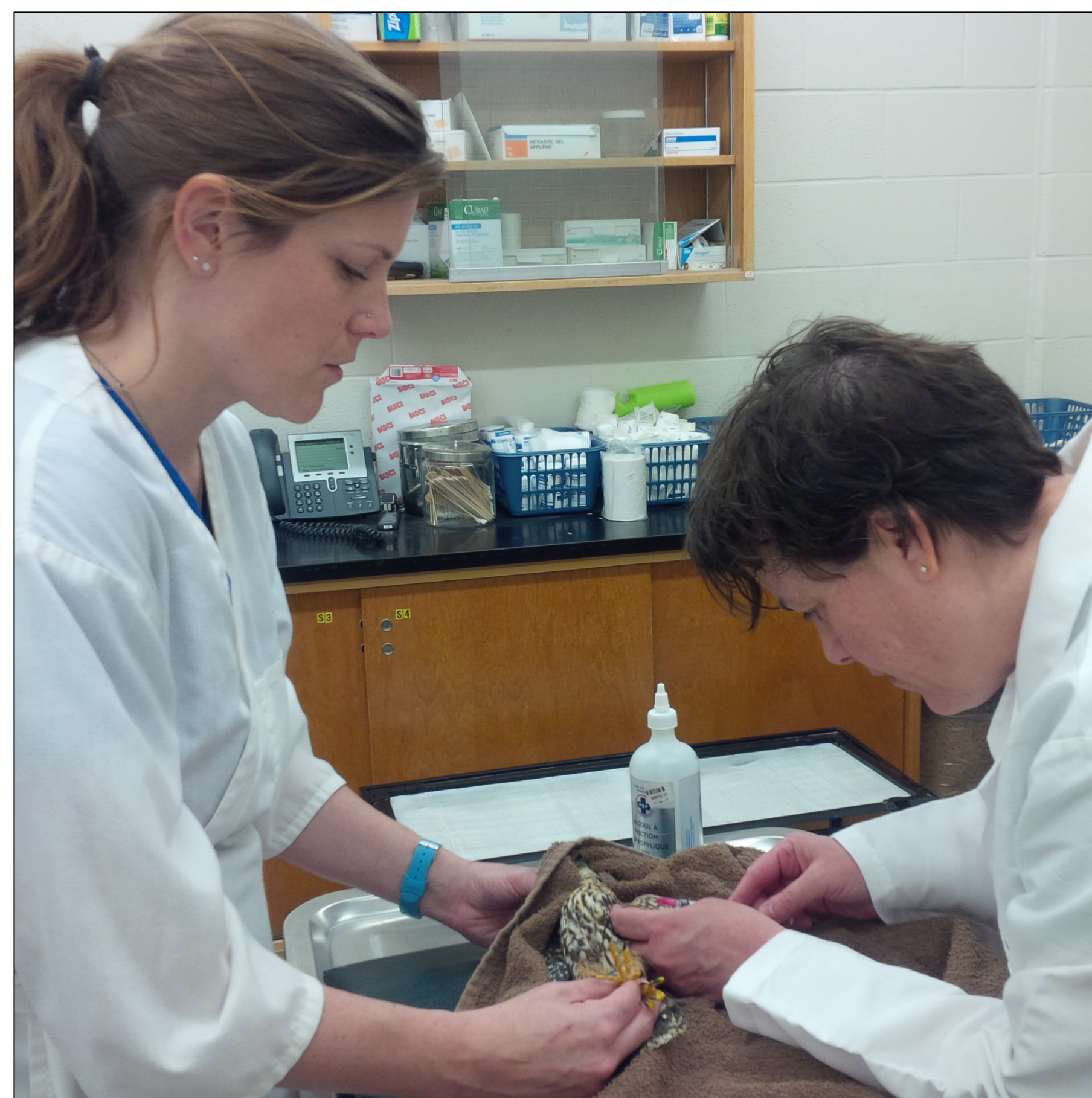


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RESULTS



Dennilyn Parker (Avian and Exotic Medicine Specialist) and Jacqui Valmont collecting blood from an injured Merlin

A total of 65 crows presenting to the exotics service were sampled over the three-year study period. *E. coli* was isolated from a total of 55 (85%) of birds sampled. Tetracycline and ampicillin resistance was most common, identified in isolates recovered from 17 (31%) and 15 (27%) birds respectively. Ceftriaxone resistant isolates were recovered from 6 (11%) of birds, including 5 colonized with CTX-M-15 producers. No ST131 strains were identified among CTX-M producers. The small number of birds sampled in 2015 (n=9) precluded a meaningful statistical evaluation for trends in resistance over time. No colistin resistance (as determined by agar dilution) was detected.

Table 1. *E. coli* Recovery Rate

Year	Number Sampled	Number Positive	Percent Positive
2015	9	5	56%
2016	28	24	86%
2017	28	26	93%
Overall	65	55	85%

Figure 1. Proportion of Birds Colonized With *E. coli* Resistant to Each Antimicrobial

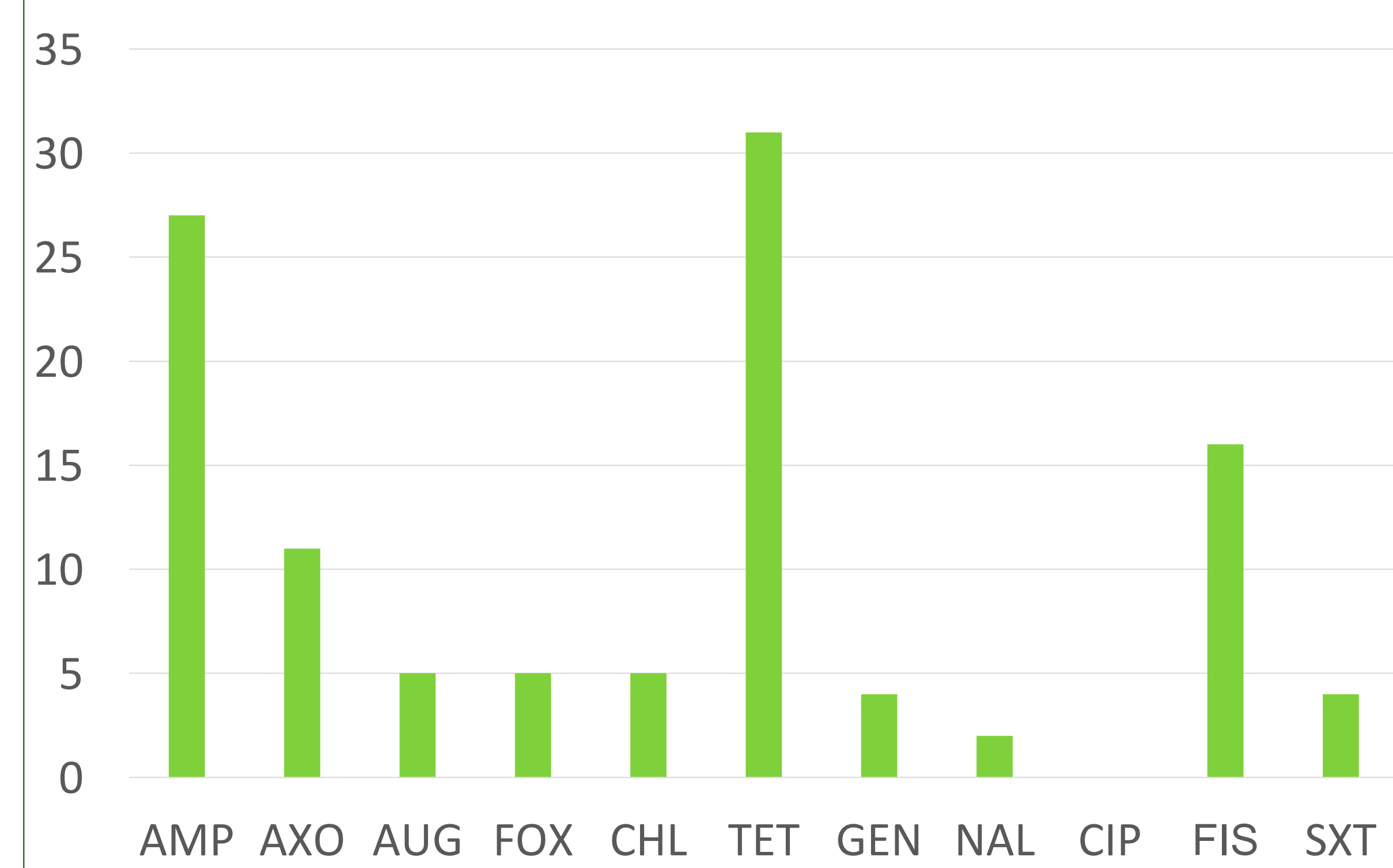


Table 2. Resistance Profiles and Sequence Types of ESBL Producing Strains

Isolate ID	Year	Resistance Phenotype	β -lactamase	Sequence Type (<i>adhE-ϵumC-gyrB-icd-mdh-purA-recA</i>)
WB097A	2015	AMP+AXO+TET +FIS	CTXM-15	ST ND (6-29-33-16-11-7-325)
WB112A	2016	AMP+AXO+TET +FIS	CTXM-15	ST88 (6-4-12-1-20-12-7)
WB113A	2016	AMP+AXO+TET +FIS	CTXM-15	ST88 (6-4-12-1-20-12-7)
WB114A	2016	AMP+AXO+TET +FIS	CTXM-15	ST5104 (6-4-12-1-20-12-126)
WB115A	2016	AMP+AXO+TET +FIS	CTXM-15	ST ND (603-4-12-1-20-12-7)

DISCUSSION

- Resistance to clinically important antimicrobials was identified
- Four out of five CTX-M-15 producing *E. coli* were closely related (single locus variants), suggesting that this strain may play an important role in the epidemiology of antimicrobial resistance in the Saskatoon region
- Due to the sentinel nature of crows this data can be extrapolated to conclude that resistance is widely disseminated in the community, and that these birds may play a role in the transmission of resistant strains
- The wildlife and exotic medicine service at the WCVI provides a unique opportunity to conveniently and cost effectively sample free ranging wildlife species for the identification of resistant organisms

The role of animals in the epidemiology of antimicrobial resistance is poorly understood, and almost nothing is known about wildlife (3). The presence of ESBL producing *E. coli* in crows, which thrive in urban anthropogenic niches suggests that this species may be a useful sentinel for resistance in the community. Previous studies by our research group (1) found that birds from urban settings are significantly more likely to be colonized with resistant *E. coli* than those from rural settings. Future investigations to define the relationship between *E. coli* isolated from crows and isolates infecting people and domestic animals are required to contextualize these findings to better understand if resistance among crow *E. coli* is predictive of resistance in other species.



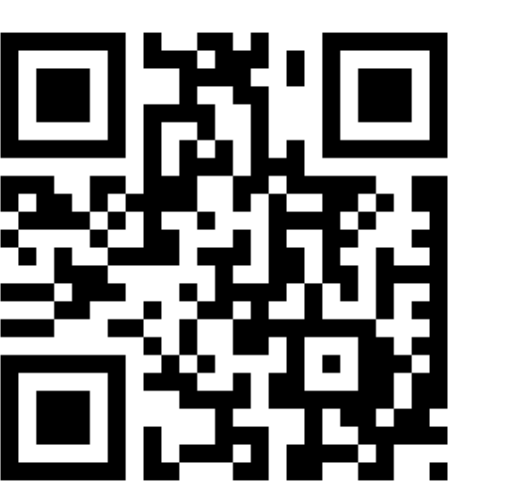
Boreal and Barred Owls under the care of the WCVI Wildlife Service

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