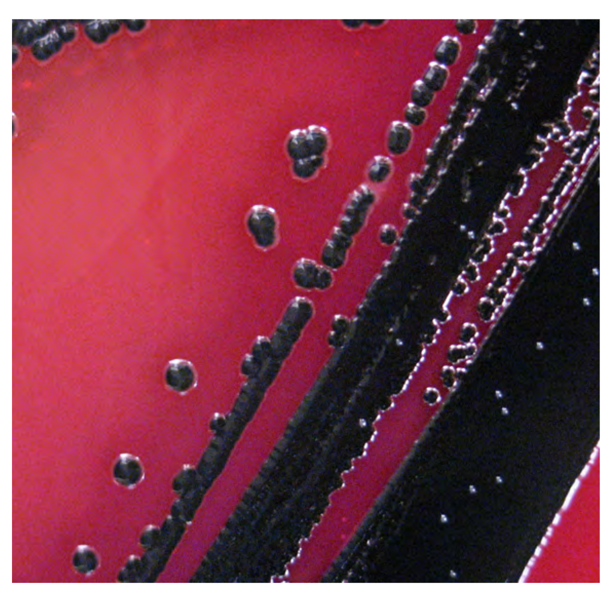
Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

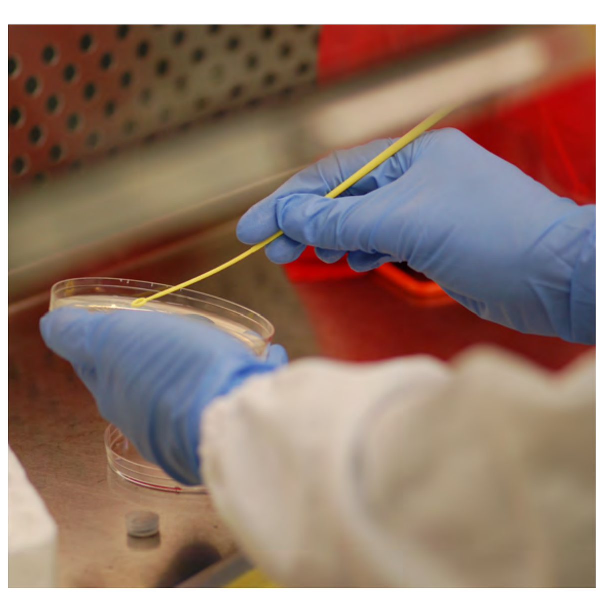





2019 INTEGRATED FINDINGS




CIPARS Canadian Integrated Program for Antimicrobial Resistance Surveillance

Programme intégré canadien de surveillance de la résistance aux antimicrobiens PICRA

Government of Canada Gouvernement du Canada

Canada

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

Working towards the preservation of effective antimicrobials for humans and animals.

Canadian Integrated Program for Antimicrobial Resistance Surveillance

Également disponible en français sous le titre :

Programme intégré canadien de surveillance de la résistance aux antimicrobiens (PICRA) 2019 : Résultats intégrés

To obtain additional information, please contact:

Public Health Agency of Canada
370 Speedvale Avenue West, Guelph, ON N1H 7M7
E-mail: phac.cipars-picra.aspc@phac-aspc.gc.ca

This publication can be made available in alternative formats upon request.

Publication date: November 2021

Cat.: HP2-4/2019E-2-PDF
ISBN: 978-0-660-41019-7
Pub.: 210446

Suggested Citation:

Government of Canada. Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) 2019: Integrated Findings. Public Health Agency of Canada, Guelph, Ontario, 2021.

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ADDITIONAL INFORMATION

phac.cipars-picra.aspc@phac-aspc.gc .ca

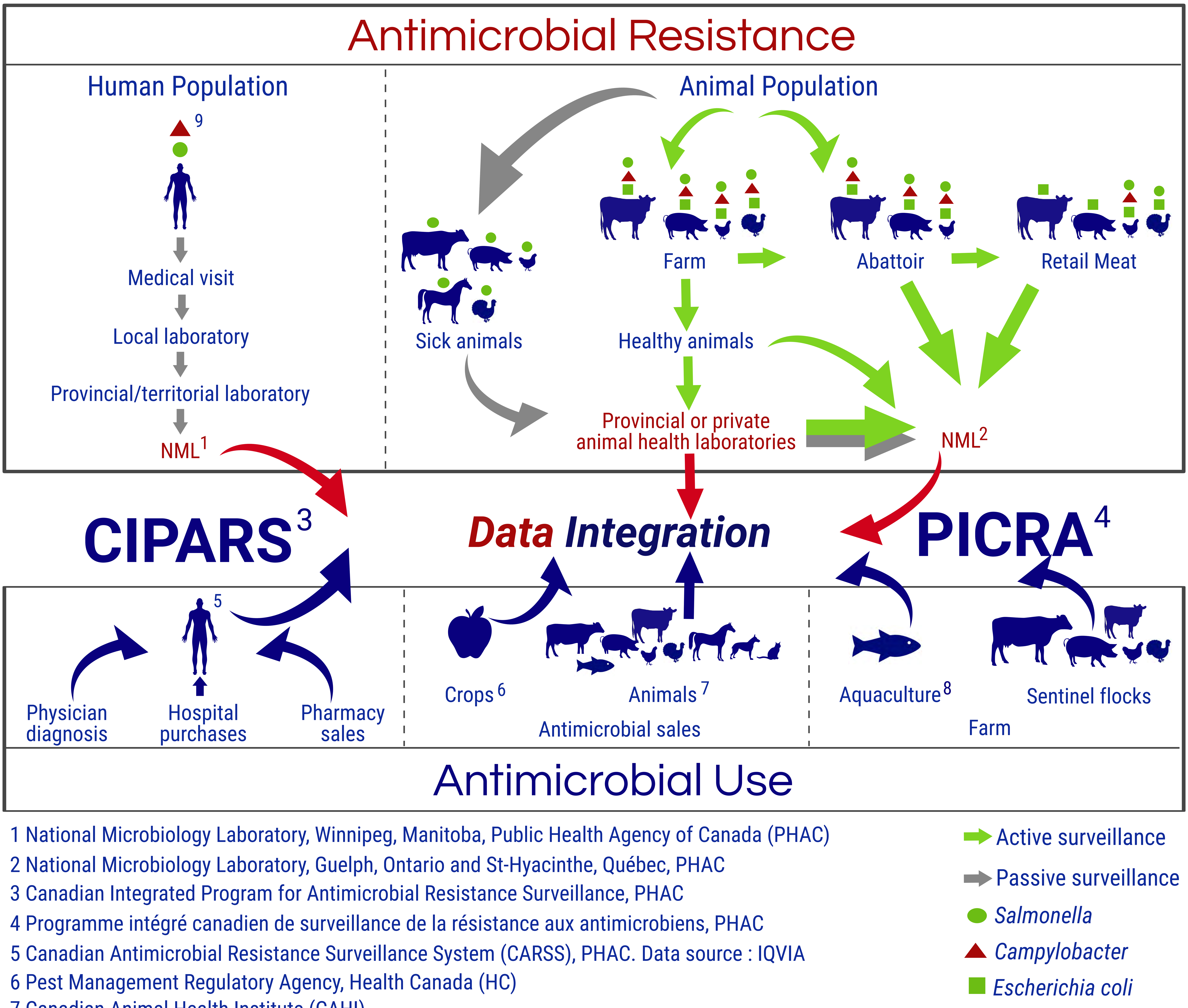
CIPARS 2019: Executive Summary

CIPARS 2019: Figures and Tables

CIPARS 2019: Design and Methods

CIPARS Activities

The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) brings together diverse sources of data in a robust and sound manner.



1 National Microbiology Laboratory, Winnipeg, Manitoba, Public Health Agency of Canada (PHAC)
2 National Microbiology Laboratory, Guelph, Ontario and St-Hyacinthe, Québec, PHAC
3 Canadian Integrated Program for Antimicrobial Resistance Surveillance, PHAC
4 Programme intégré canadien de surveillance de la résistance aux antimicrobiens, PHAC
5 Canadian Antimicrobial Resistance Surveillance System (CARSS), PHAC. Data source : IQVIA
6 Pest Management Regulatory Agency, Health Canada (HC)
7 Canadian Animal Health Institute (CAHI)
7 Veterinary Antimicrobial Sales Reporting, HC Veterinary Drugs Directorate and PHAC
8 Fisheries and Oceans Canada
9 FoodNet Canada, PHAC

2019
KEY FINDINGS

01 | INTEGRATED ANTIMICROBIAL USE

- Antimicrobial sales (kg) **decreased** by 10% between 2018 and 2019.
- Sales for production animals (livestock, aquaculture, horses) **decreased** by 11% (kg) and **decreased** by 12% (after adjusting for the biomass in mg/PCU).
- In comparison to 2018, sales for use in pigs, poultry, and aquaculture **decreased**; sales for use in cattle, horses, cats and dogs, and small ruminants **increased** in 2019.

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02 | INTEGRATED ANTIMICROBIAL USE AND RESISTANCE

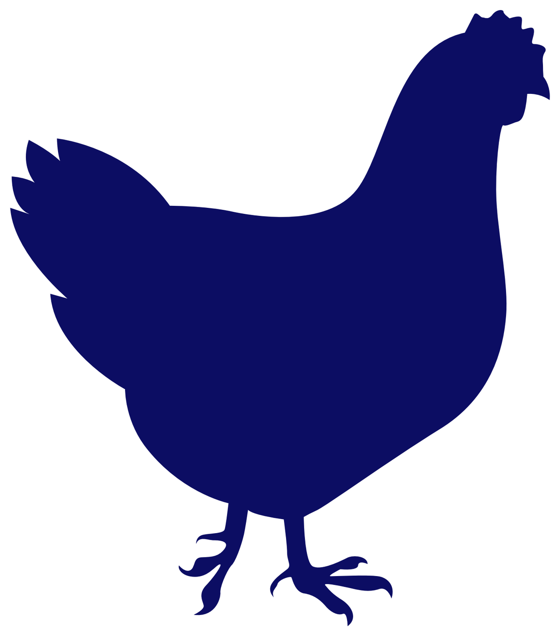
- Integrated farm surveillance data is reported for broiler chickens, grower-finisher pigs, and turkeys.
- Farm surveillance found that AMU either remained **stable or decreased** across these animal species.
- For grower-finisher pigs, data indicate continued use of medically-important antimicrobials for **growth promotion** was reported (on one sentinel farm in 2019).
- For turkeys, the number of *Campylobacter* isolates resistant to ≥ 1 antimicrobial classes **decreased**.
- The number of *Salmonella* isolates resistant to ≥ 1 antimicrobial classes from broiler chickens **increased**.
- The percentage of isolates resistant to ≥ 3 antimicrobial classes remained relatively **unchanged** for these animal species; with the exception of a decrease in *Salmonella* resistant to ≥ 3 antimicrobial classes in turkeys.
- Flock or herd mortality remained **unchanged**.

03 | INTEGRATED ANTIMICROBIAL RESISTANCE

NEW *SALMONELLA* ENTERITIDIS AND QUINOLONE RESISTANCE IN HUMANS (page 21)

Salmonella Enteritidis, the most common serovar from sick people, has been **decreasing**.
However, nalidixic acid resistance in *S*. Enteritidis isolates has been **increasing**.
Nalidixic acid resistance in *S*. Enteritidis is more common in cases with a history of travel outside of Canada.

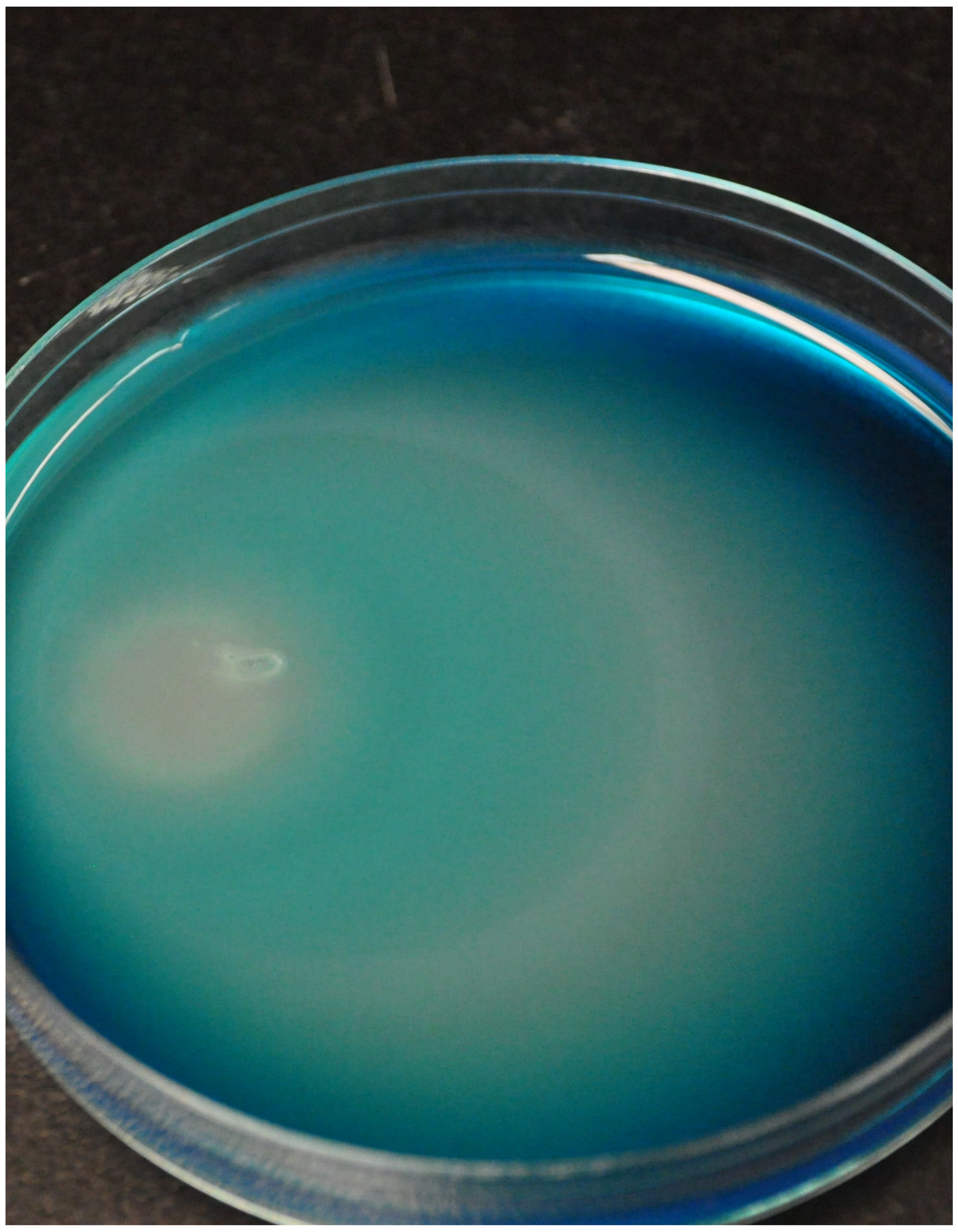
DETECTION OF QUINOLONE-RESISTANT *SALMONELLA* ENTERITIDIS FROM CHICKEN(S) (page 23)



Prior to 2018, quinolone (nalidixic acid) resistance was observed **once** in *S*. Enteritidis agri-food isolates.

Though numbers are still small, in 2018 and 2019, nalidixic acid resistance in *S*. Enteritidis isolates from chickens and chicken meat was detected in multiple provinces and multiple surveillance components.

SALMONELLA RESISTANT TO 6 or 7 ANTIMICROBIAL CLASSES (page 24)



Though the numbers are still small, we continue to see an **increase** in *Salmonella* isolates resistant to 6 or 7 of the 7 antimicrobials classes tested from humans, animals, and food in 2019.

SALMONELLA HEIDELBERG FROM CATTLE (page 25)

In 2019, this included drug-resistant *Salmonella* Heidelberg from healthy cattle; observed for the **first time**.

INTEGRATED ANTIMICROBIAL USE

ANTIMICROBIAL CATEGORIZATION

Antimicrobials are grouped into categories based on their importance to human medicine and the potential consequences of resistance to these drugs:

Medically important antimicrobials:

Category I: Very high importance

Examples: 3rd generation cephalosporins, fluoroquinolones

Category II: High importance

Example: macrolides

Category III: Medium importance

Examples: tetracyclines, sulfonamides

Category IV: Low importance

Examples: ionophores, flavophospholipids

Antimicrobials of low importance (Category IV, with the exception of flavophospholipids) were removed from the integrated AMU reporting. Data will be available in other CIPARS products.

Categorization system developed by Health Canada's Veterinary Drugs Directorate.
Chemical coccidiostats are considered uncategorized antimicrobials.

Antimicrobial Use: Comparison of Humans, Animals, and Crops

Comparison of Humans, Animals, and Crops

NEW THE VETERINARY ANTIMICROBIAL SALES REPORTING (VASR) SYSTEM

- New Health Canada regulations required manufacturers, importers, and compounders to report annual sales of medically important antimicrobials intended for use in animals.
- To meet this requirement, the Public Health Agency of Canada and Health Canada designed and developed the online reporting tool VASR.
- The VASR system collects data on the quantity of antimicrobials sold or compounded by animal species and by province/territory.
- The majority of data for sales in this report includes information from manufacturers and importers and does not include compounder data.

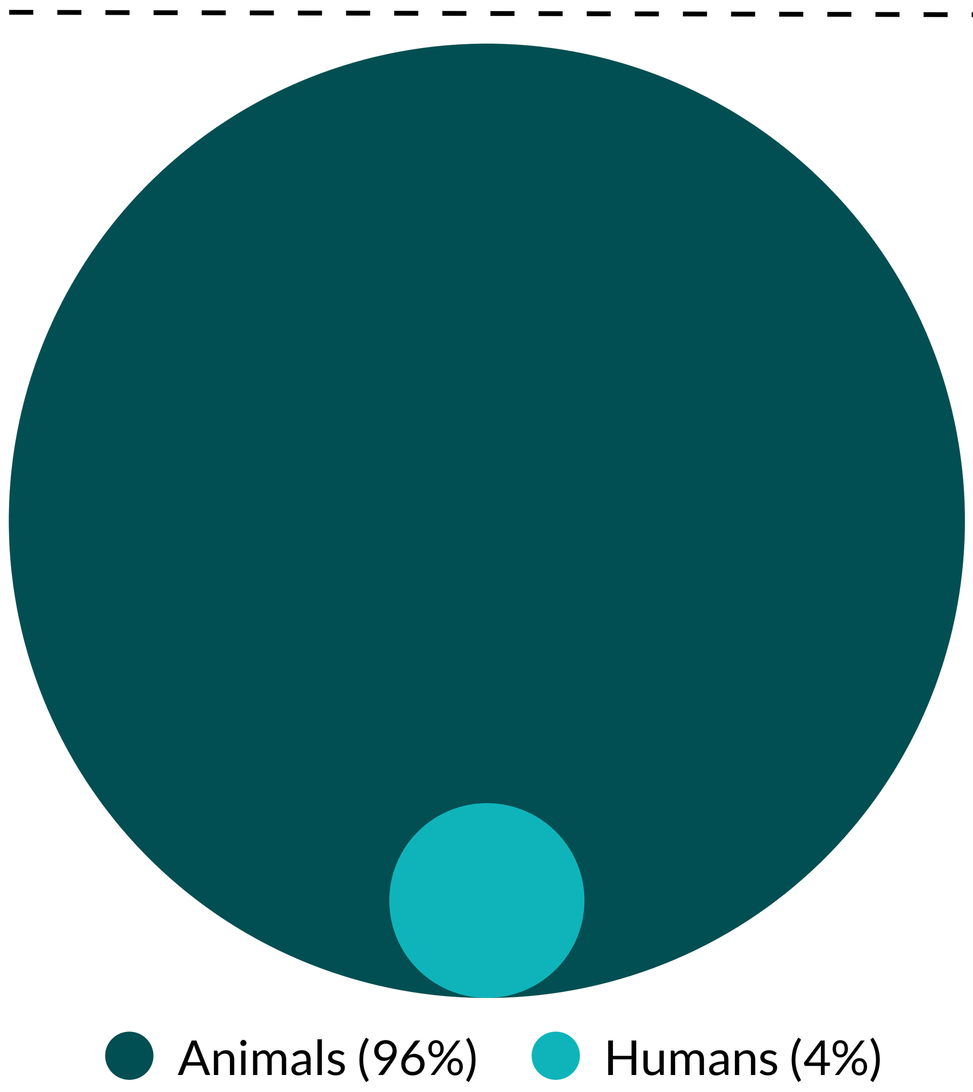
OVERALL SALES IN 2019

12% (since 2018)

Antimicrobials sold (kg adjusted by biomass) in production animals (decreased sales of tetracyclines, sulfonamides, penicillins, and macrolides).

~ (approximately) **1.4x**

More antimicrobials were sold for use in production animals than humans after adjusting for underlying biomass.



~ 23x

More animals than people in Canada.

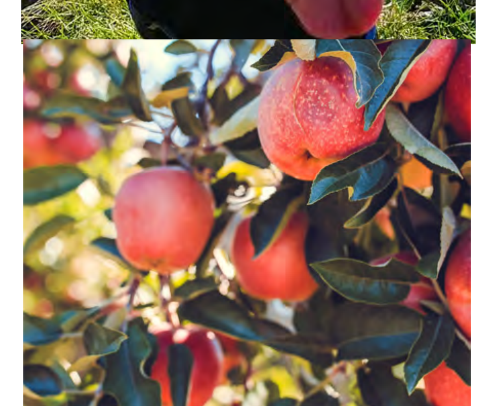
The animal population is an underestimation, as fish are not included.

Of the antimicrobials sold in 2019:

- 78% were intended for **production animals**

- 22% were intended for **humans**

- <1% were intended for **cats and dogs**



- <1% were intended for **crops**

1%

of antimicrobials sold in animals were in Category I.

Tetracyclines ~ 51% of the overall sales.

ANTIMICROBIAL SALES (2019) BY SPECIES*

(comparisons are between 2018 and 2019)

Poultry

- Top classes sold: NIR**, penicillins, and tetracyclines
- 9%↓ in kg sold
- Small quantities (<1 kg) of fluoroquinolones and 3rd generation cephalosporins were manufactured or compounded for use in poultry between 2018 and 2019

Beef Cattle

- Top classes sold: tetracyclines, macrolides, and amphenicols
- 13%↑ in kg sold
- ↑ in sales of Category I antimicrobials by 6% (74 kg)

Pigs

- Top classes sold: tetracyclines, macrolides, and penicillins
- 21%↓ in kg sold
- ↓ in sales of Category I antimicrobials by 24% (123 kg)

Dairy Cattle

- Top classes sold: tetracyclines, diaminopyrimidine -sulfonamide combinations, and penicillins
- 15%↑ in kg sold
- ↓ in sales of Category I antimicrobials by 25% (112 kg)

Aquaculture

- Only tetracyclines and amphenicols were sold in 2019
- 29%↓ in kg sold

Cats and Dogs

- Top classes sold: penicillins, 1st or 2nd generation cephalosporins and β-lactamase inhibitors
- 17%↑ in kg sold
- ↑ in sales of Category I antimicrobials by 24% (711 kg)

*For additional information on veal calves, horses, small ruminants, and other animals, please refer to the CIPARS 2019 Figures and Tables.

** NIR = not independently reported.

SPECIES COMPARISONS

Figure 1. Antimicrobial sales data (kg): overall kilograms

The majority (kg) of the antimicrobials sold were intended for use in pigs, cattle, and poultry.

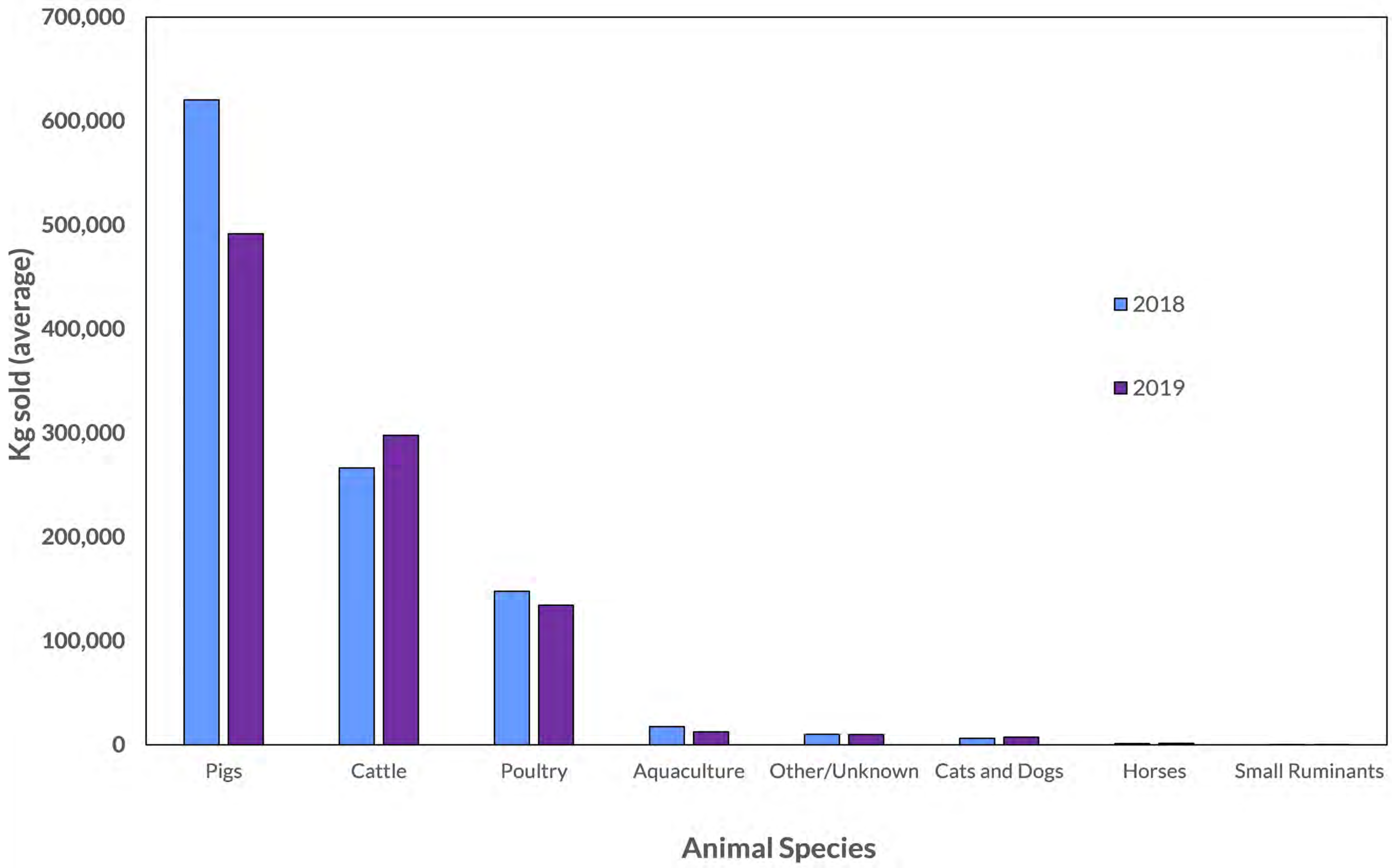
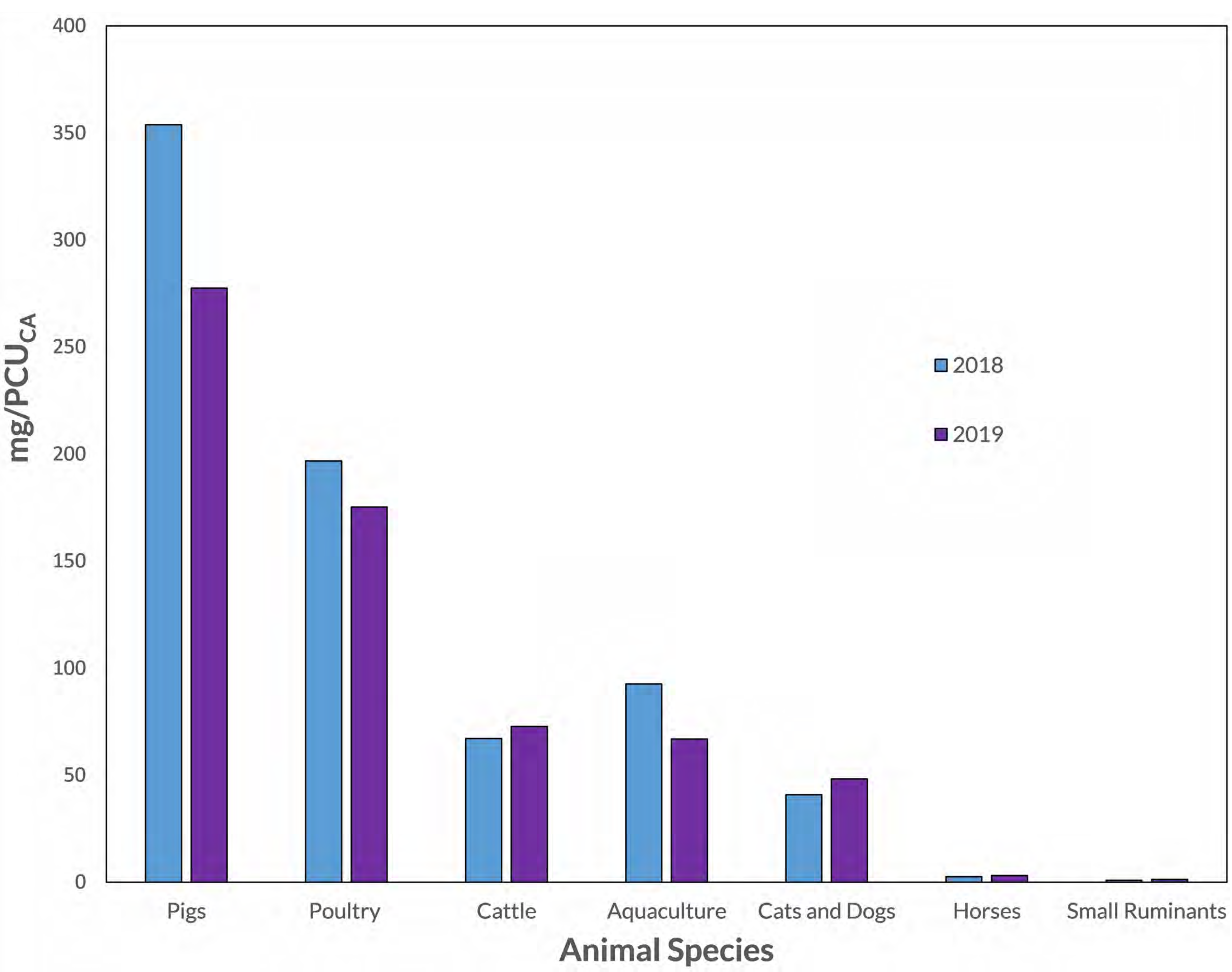


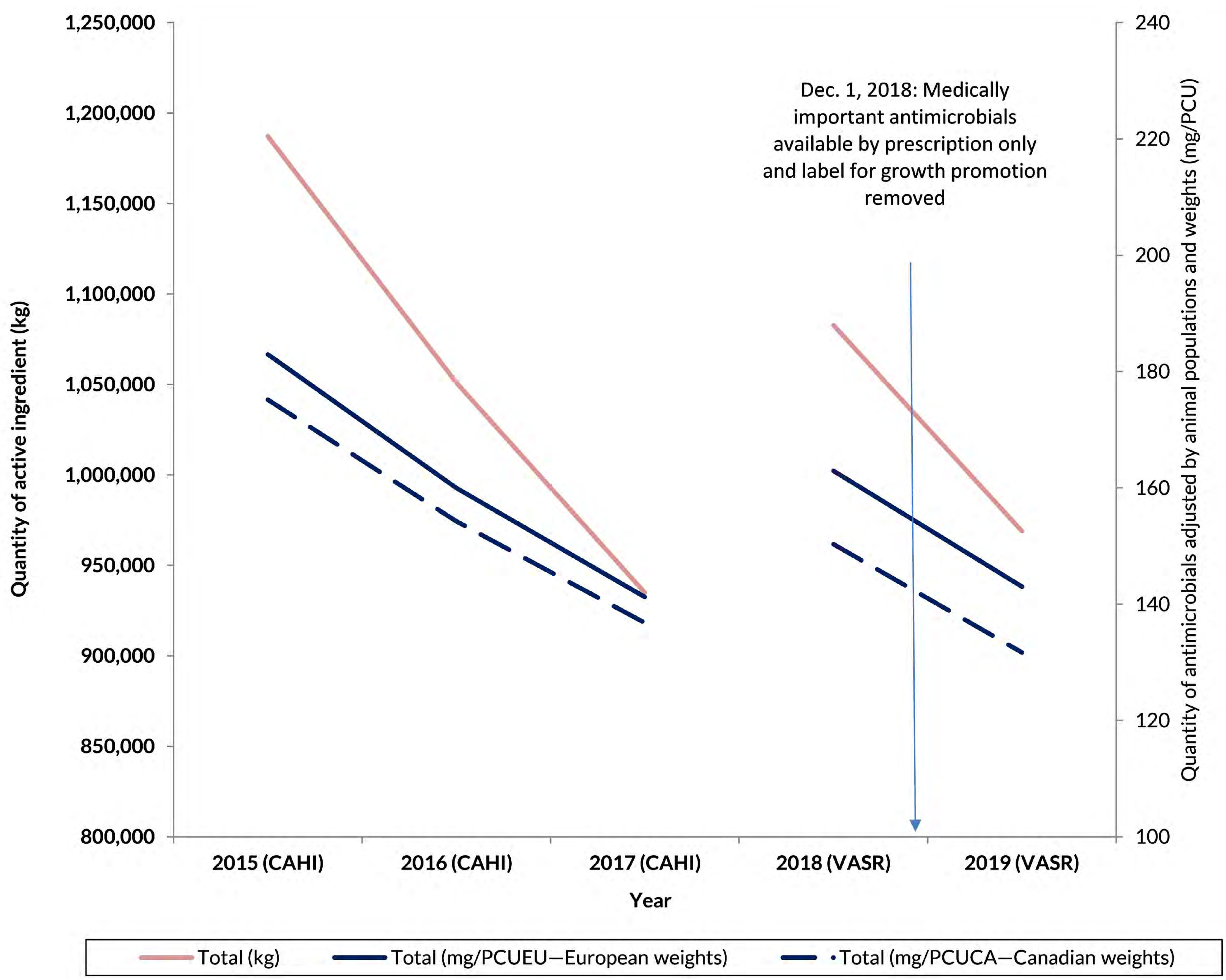
Figure 2. Quantity of antimicrobials sold adjusted by biomass (mg/PCU_{CA})



Adjusting for the number of animals and their weights (i.e., mg/PCU where 1 PCU=1kg animal), the majority of sales in 2019 were intended for use in pigs, poultry, cattle, and aquaculture.

The total quantities of antimicrobials sold by manufacturers and importers for use in **production animals** decreased by 11% between 2018 and 2019. When the total quantities were adjusted for biomass (mg/PCU), the decrease was 12% compared to 2018.

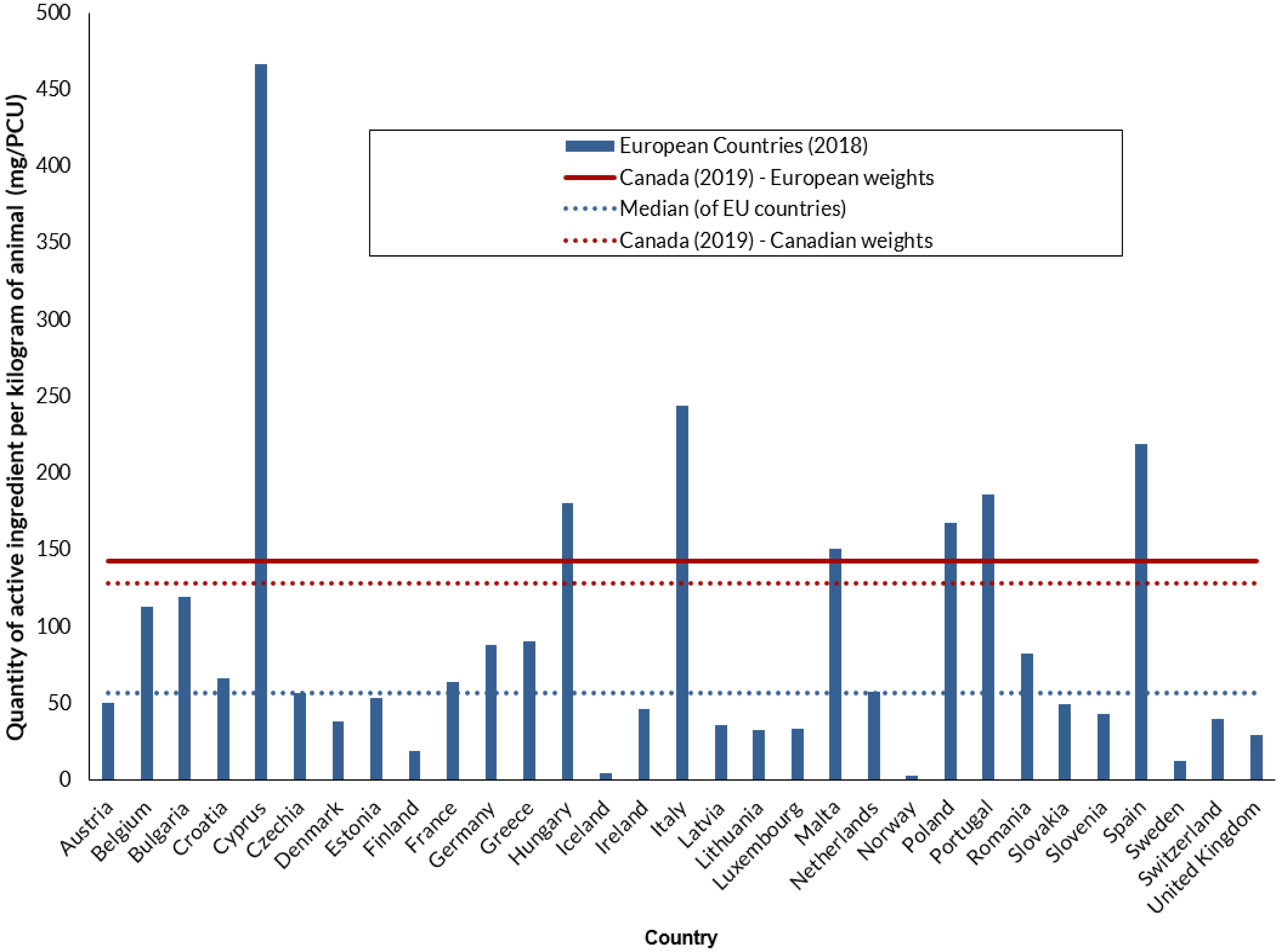
Figure 3. Quantities of antimicrobials sold by manufacturers and importers for use in production animals



The data for 2015 to 2017 were provided voluntarily by the Canadian Animal Health Institute (CAHI) and represented information from their members. The data for 2018 and 2019 were from VASR and incorporated importers and more manufacturers than CAHI. Caution should be taken when comparing information between these two datasets.

Canada is the 8th highest country (in comparison to Europe) for quantities of antimicrobials sold (mg/PCU).

Figure 4. Quantities of antimicrobials used (mg/PCU) by Canada (2019) and countries participating in the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) network (2018)



This figure assumes that the data are comparable between countries.

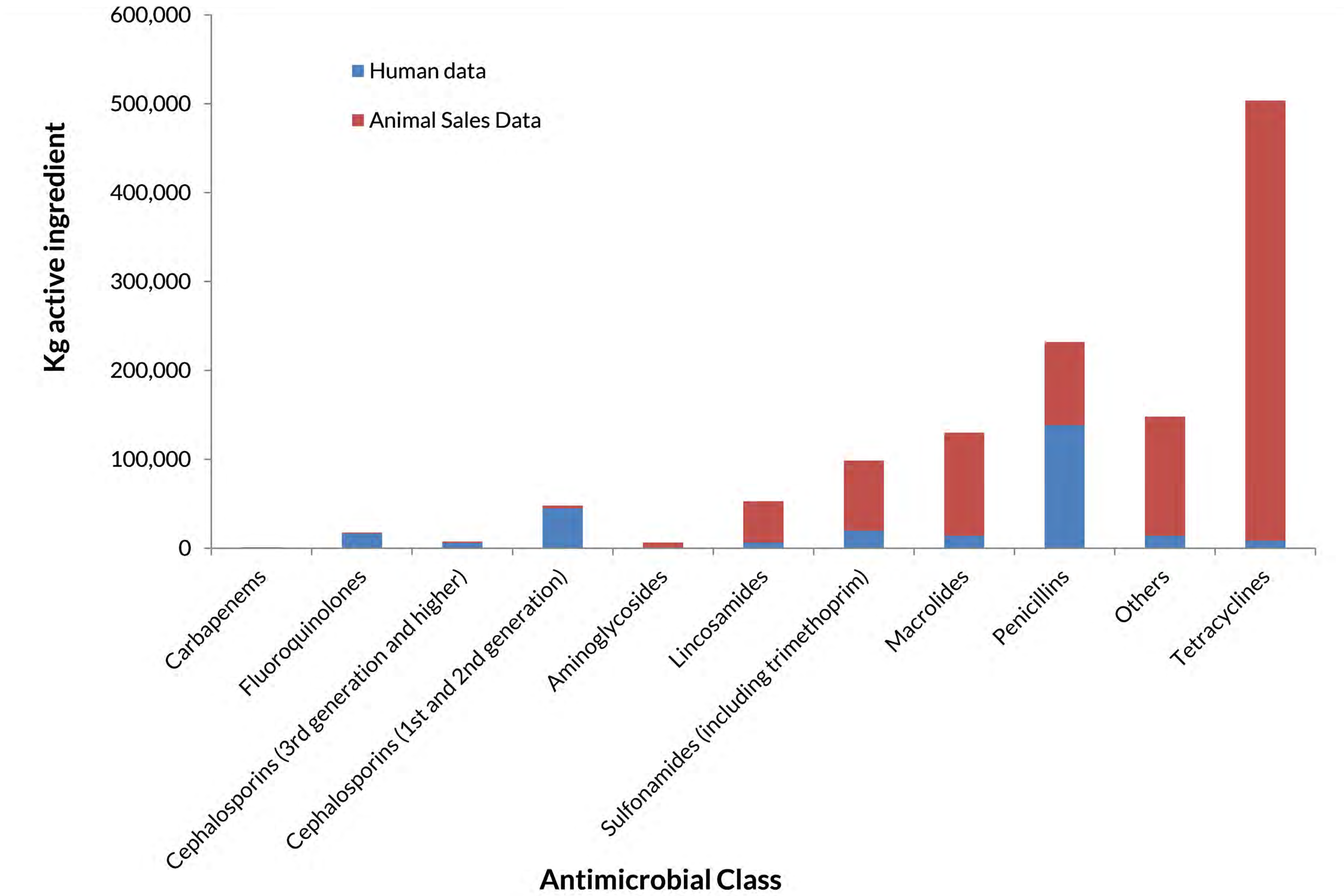
ESVAC denominator does not include beef cows, whereas in Canada beef cows are a significant population and are included.

PCU=population correction unit.

Data Sources (pages 7 to 12): Agriculture and Agri-Food Canada, Canadian Animal Health Institute (CAHI), Canadian Hatching Egg Producers, Canfax, Chicken Farmers of Canada, Egg Farmers of Canada, ESVAC, Equestrian Canada, Fisheries and Oceans Canada, Health Canada's Pest Management Regulatory Agency, human pharmacy and hospital data from IQVIA via the Canadian Antimicrobial Resistance Surveillance System, Statistics Canada, and VASR.

Similar antimicrobials were licensed for use in humans and animals; however, some antimicrobial classes were sold more for use in humans than animals and vice-versa.

Figure 5. Comparison of human and animal antimicrobial sales data



Human data include hospital and retail pharmacy data.

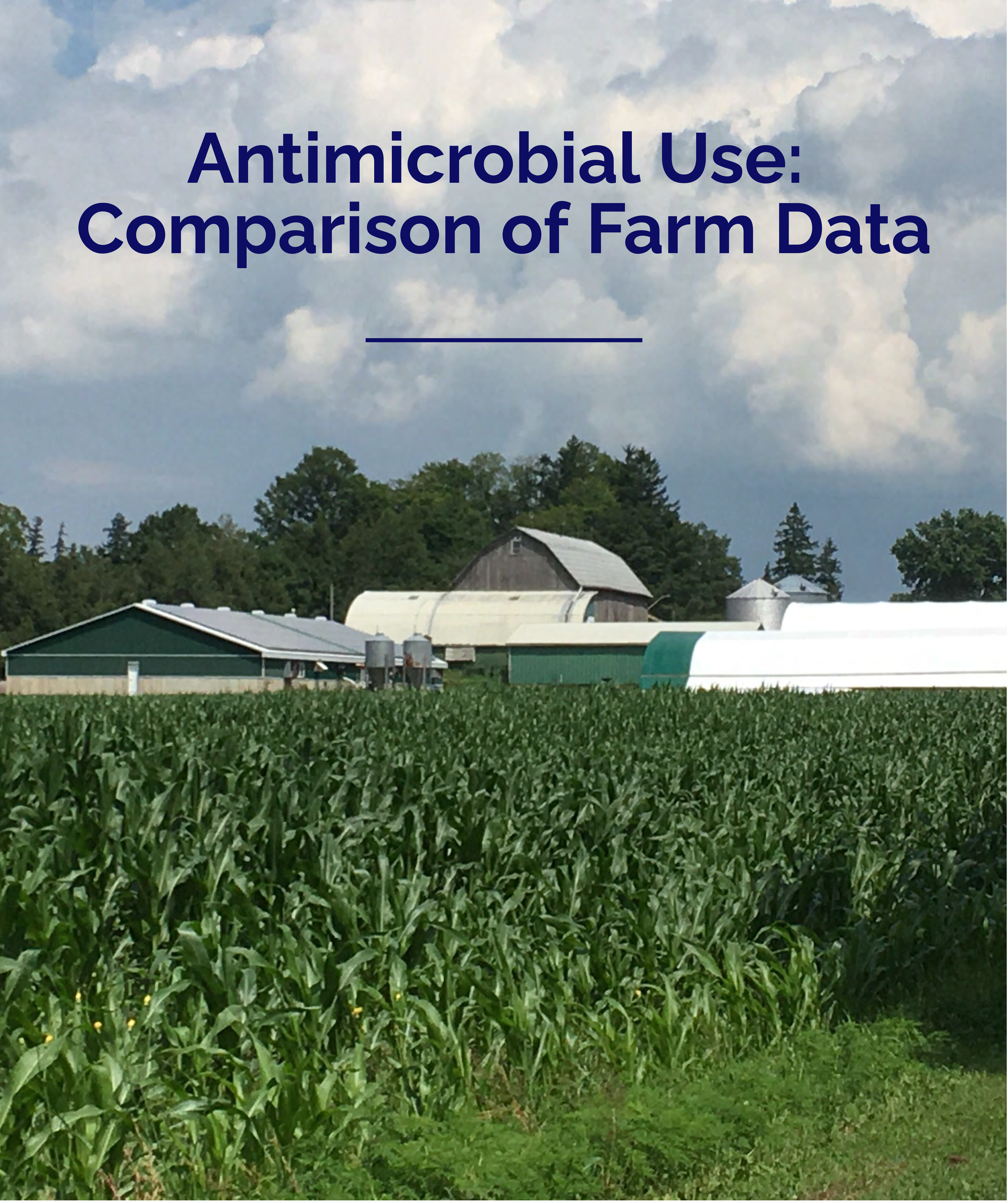
Notes:

1. Cephalosporins are β-lactam antimicrobials, but we are displaying them separately for visualization purposes.

2. Others for humans includes: bacitracin, ceftobiprole medocaril, ceftolozane-tazobactam, chloramphenicol, colistin, daptomycin, fidaxomicin, fosfomycin, fusidic acid, linezolid, metronidazole, nitrofurantoin, and vancomycin.

3. Others for animals includes: aminocoumarins, aminocyclitols, amphenicols, cyclic polypeptides, fusidic acid, glycopeptides, nitrofurantoins, nitroimidazoles, orthosomycins, phosphonic acid derivatives, pleuromutilins, polymyxins, pseudomonic acids, streptogramins, and therapeutic agents for tuberculosis.

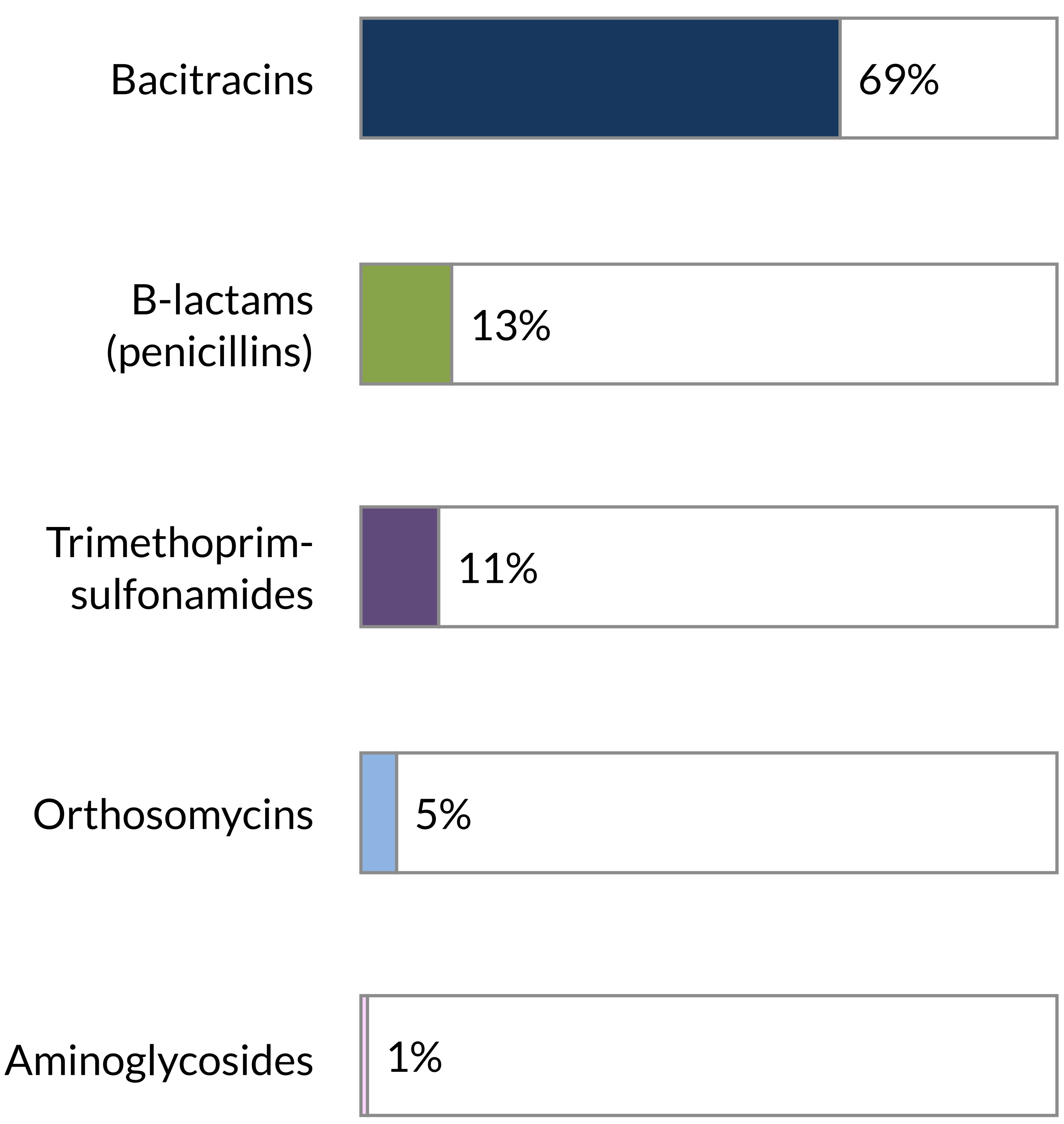
Antimicrobial Use: Comparison of Farm Data



Comparison of Antimicrobial Classes*

Figure 6.

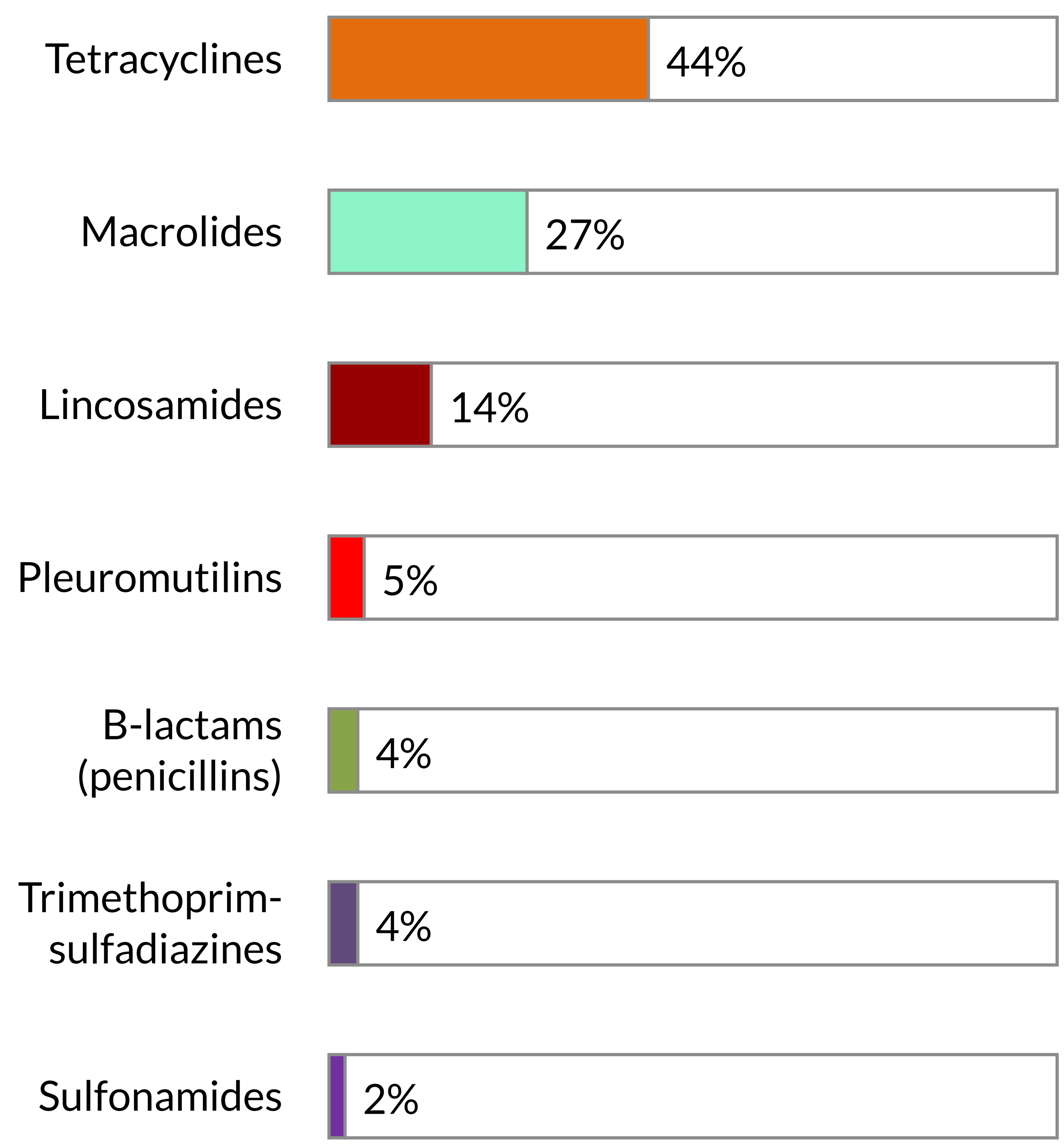
BROILER CHICKENS



Not shown: flavophospholipids (<1%), lincosamides-aminocyclitols (<1%), steptogramins (1%).

Figure 7.

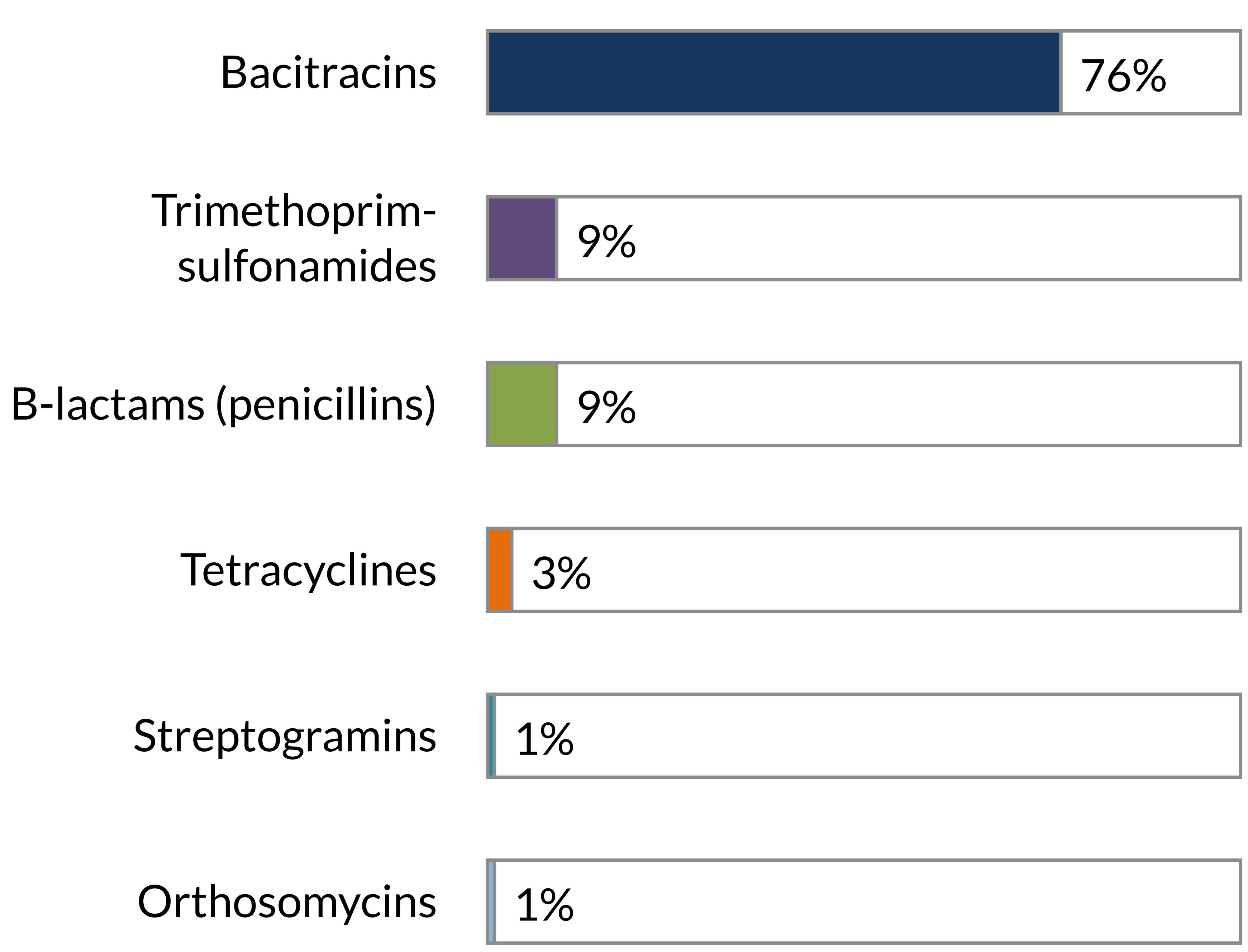
GROWER-FINISHER PIGS



Not shown: 3rd generation cephalosporins (<1%), streptogramins (1%), flavophospholipids (<1%).

Figure 8.

TURKEYS



Not shown: fluoroquinolones (<1%), aminoglycosides (<1%), flavophospholipids (<1%).

There are important differences in the types and relative quantities of antimicrobials reported for use between food animal species, which is why we need ongoing surveillance across the food animal species.

*The percentages are based on total kilograms of active ingredients intended for use in that host species.

INTEGRATED ANTIMICROBIAL USE AND RESISTANCE - FARM DATA

In this section, we highlight **farm integrated antimicrobial use and resistance stories** for 2019:

Reasons for antimicrobial use

Broiler chickens

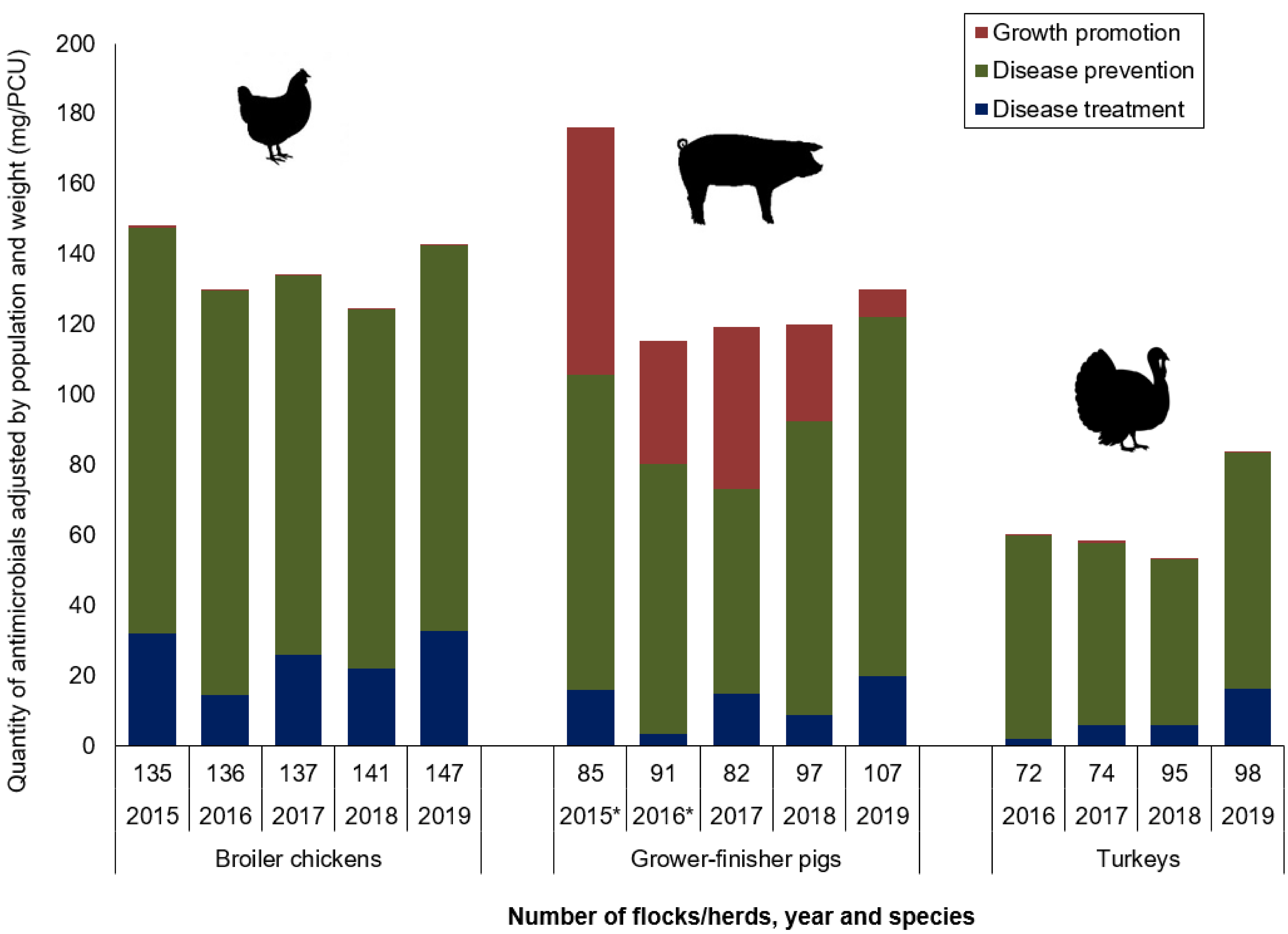
Grower-finisher pigs

Turkeys

Reasons for Antimicrobial Use

- Most antimicrobial drug use was for **disease prevention** when adjusting for either dose, or number and weight of animals (≥ 74%).
    - Across all 3 species, AMU was primarily for prevention of **enteric diseases**.
- Antimicrobials were predominantly administered in **feed** (≥ 90%).
- The proportion of antimicrobials used for **disease treatment increased** across all 3 species.
    - Poultry: this use was primarily for **diseases in young chicks/poults** and for **respiratory diseases** (feed and water).
    - Grower-finisher pigs: this use was primarily for treating **respiratory diseases** (water).
- In 2019, bambermycins were used for the prevention of **necrotic enteritis** in 4% to 5% of sentinel poultry flocks. The reported inclusion rate in feed was stable and similar to label claims for growth promotion.
- Grower-finisher pigs: continued reported use of medically-important antimicrobials for **growth promotion;** however, the quantity of use markedly decreased compared to 2018 (1 farm).

Figure 9. Quantity of antimicrobials used (mg/PCU) by species; CIPARS Farm 2015 to 2019



*Grower-finisher pigs: 2015 and 2016 data were for antimicrobial use in feed only.

Broiler Chickens

- Nationally, antimicrobial use (AMU)* **decreased** in 2019** compared with 2018.
- Notable **increase** in *Salmonella* isolates resistant to ≥1 antimicrobial classes tested.
- No remarkable changes in antimicrobial resistance (AMR) to ceftriaxone, nalidixic acid, though an increase in ciprofloxacin resistance.
- Resistance to ≥3 antimicrobial classes varied.
- AMU **decreased** and AMR varied; however, flock mortality was unchanged.

Figure 10. Antimicrobial use and resistance in broiler chickens

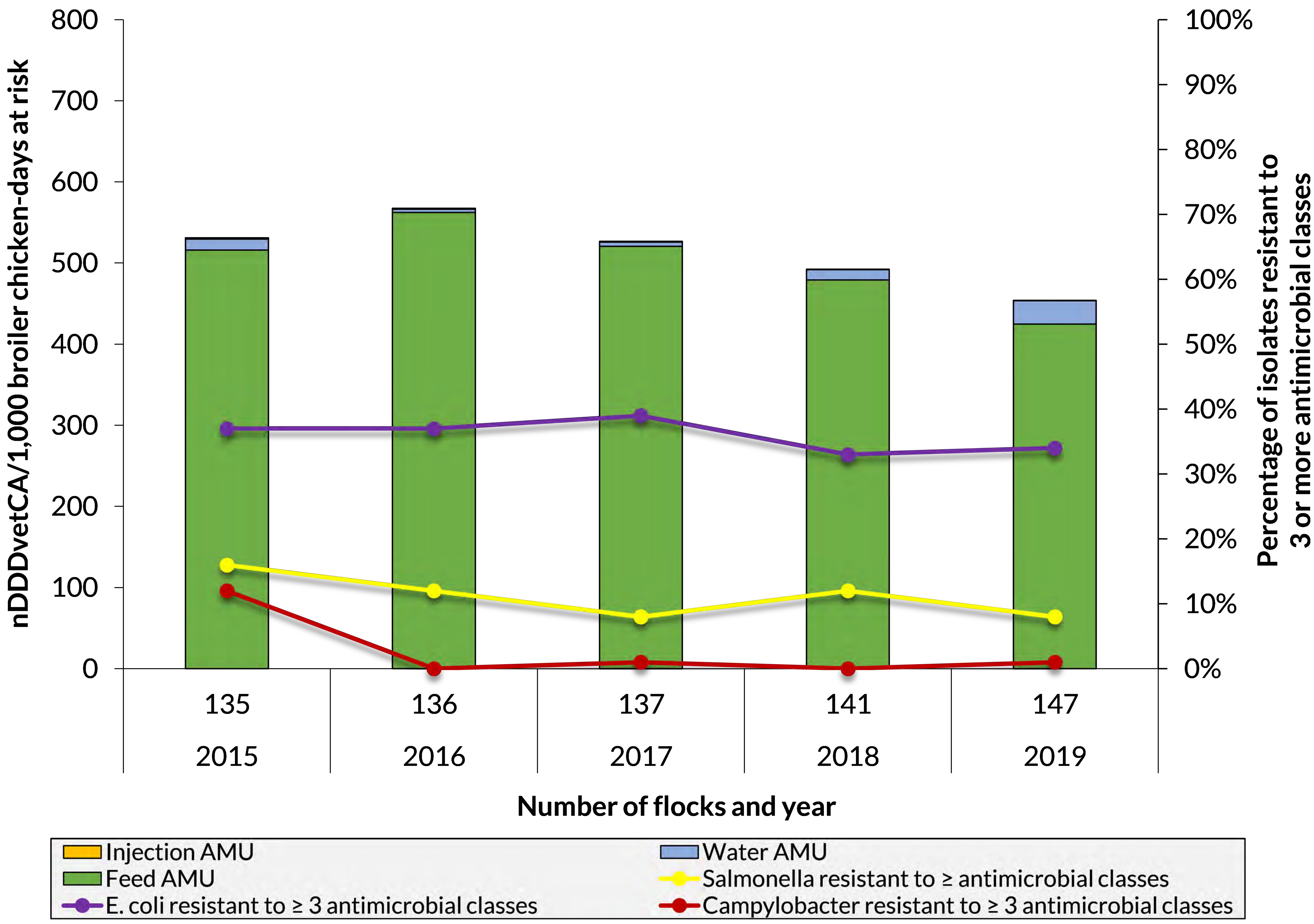


Table 1. Temporal variations in resistance and broiler chicken flock mortality

		2017	2018	2019	Comparing 2018 to 2019
Salmonella	Number of isolates	263	282	314	
	Cefriaxone	4%	13%	8%	-5%
	Nalidixic acid/ciprofloxacin	0%/0%	3%/0%	1%/0%	-3%/0%
	Resistant to ≥1 classes	43%	49%	63%	+14%
E. coli	Number of isolates	539	547	547	
	Cefriaxone	10%	7%	7%	0%
	Nalidixic acid/ciprofoxacin	5%/1%	10%/<1%	8%/<1%	-2%/-<1%
	Resistant to ≥1 classes	72%	68%	69%	+1%
Campylobacter	Number of isolates	122	122	142	
	Ciprofloxacin	18%	12%	24%	**+12%**
	Resistant to ≥1 classes	48%	30%	36%	+6%
Flock health	Mortality	3.5%	4.1%	4.2%	<1%

Bold numbers are statistically significant.
*Adjusted for daily doses.
**First year of the implementation of the broiler chicken sector's antimicrobial use reduction strategy (step 2).

Grower-Finisher Pigs

- Nationally, antimicrobial use (AMU)* **remained stable** in 2019** compared with 2018.
- Proportion of isolates resistant to ≥1 antimicrobials classes is **stable** or **increased** slightly.
- Nalidixic acid/ciprofloxacin-resistance is **stable** or **increased** slightly.
- Resistance to ≥3 antimicrobial classes **increased** in *Salmonella* but **decreased** in *E. coli* and *Campylobacter*.
- AMU remained **unchanged,** AMR generally **decreased** and herd mortality was **unchanged**.

Figure 11. Antimicrobial use and resistance in grower-finisher pigs

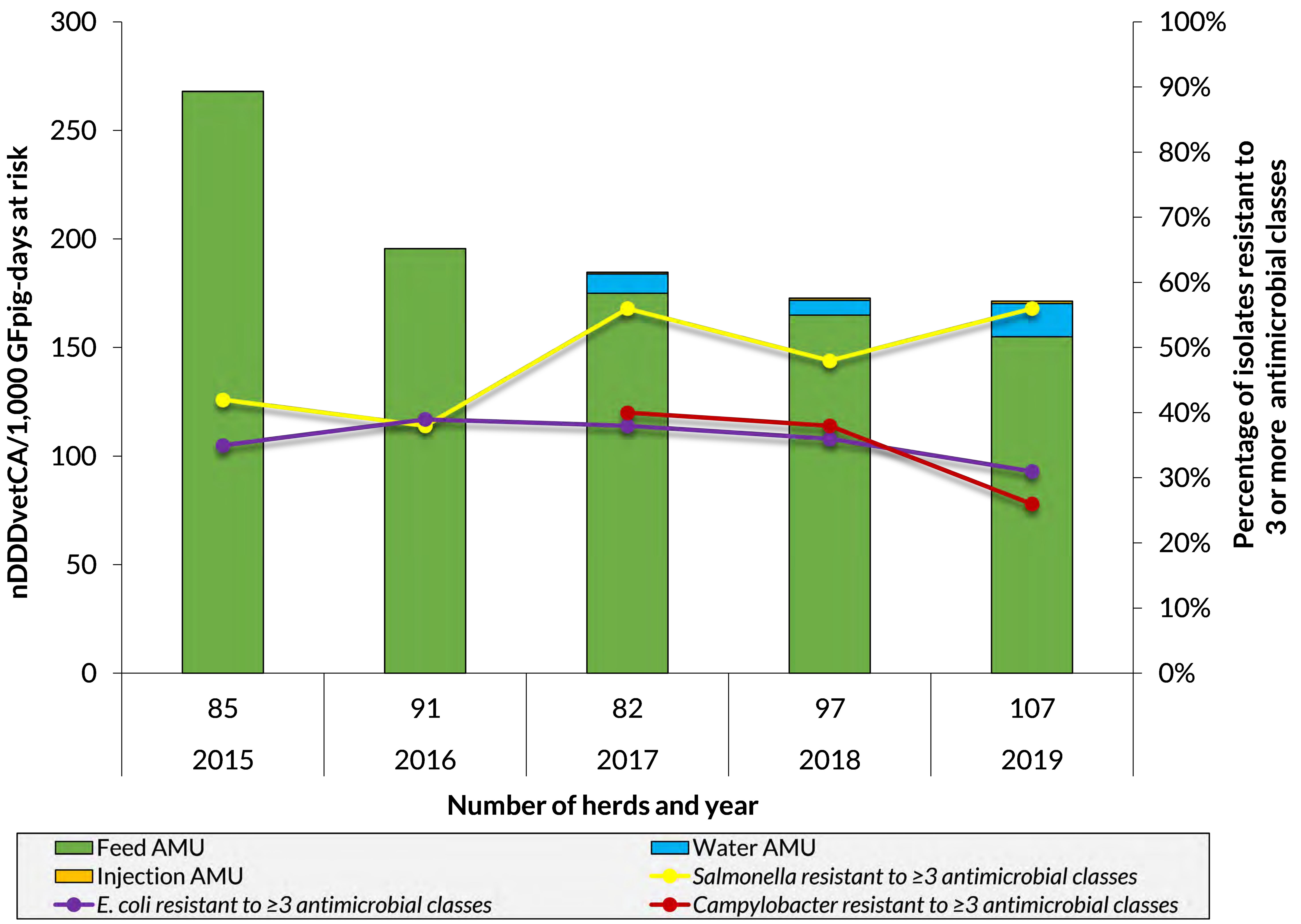


Table 2. Temporal variations in resistance and grower-finisher herd mortality

		2017	2018	2019	Comparing 2018 to 2019
Salmonella	Number of isolates	117	139	165	
	Cefriaxone	5%	8%	6%	-2%
	Nalidixic acid/ciprofloxacin	0%/0%	0%/0%	0%/0%	0%
	Resistant to ≥1 classes	65%	65%	72%	+7%
E. coli	Number of isolates	484	585	628	
	Cefriaxone	0%	2%	2%	0%
	Nalidixic acid/ciprofloxacin	<1%/0%	1%/<1%	1%/0%	0%/0%
	Resistant to ≥1 classes	77%	78%	78%	0%
Campylobacter	Number of isolates	369	483	447	
	Ciprofloxacin	8%	11%	12%	+1%
	Resistant to ≥1 classes	78%	74%	78%	+4%
Herd health	Mortality	2.1%	2.3%	2.6%	<1%

*Adjusted for daily doses.
**First year of implementation of the regulatory changes in veterinary antimicrobial use in Canada.

Turkeys

- Nationally, antimicrobial use* **decreased** in 2019** compared with 2018.
- Notable **decrease** in *Campylobacter* isolates resistant to ≥1 antimicrobial classes tested and *Salmonella* resistant to ≥3 antimicrobial classes tested.
- No remarkable changes in AMR to ceftriaxone, nalidixic acid, or ciprofloxacin.
- Resistance to ≥3 classes of antimicrobials was stable or slightly increased in *E. coli* and *Campylobacter*.
- AMU **decreased** and AMR **varied**; however, flock mortality was **unchanged.**

Figure 12. Antimicrobial use and resistance in turkeys

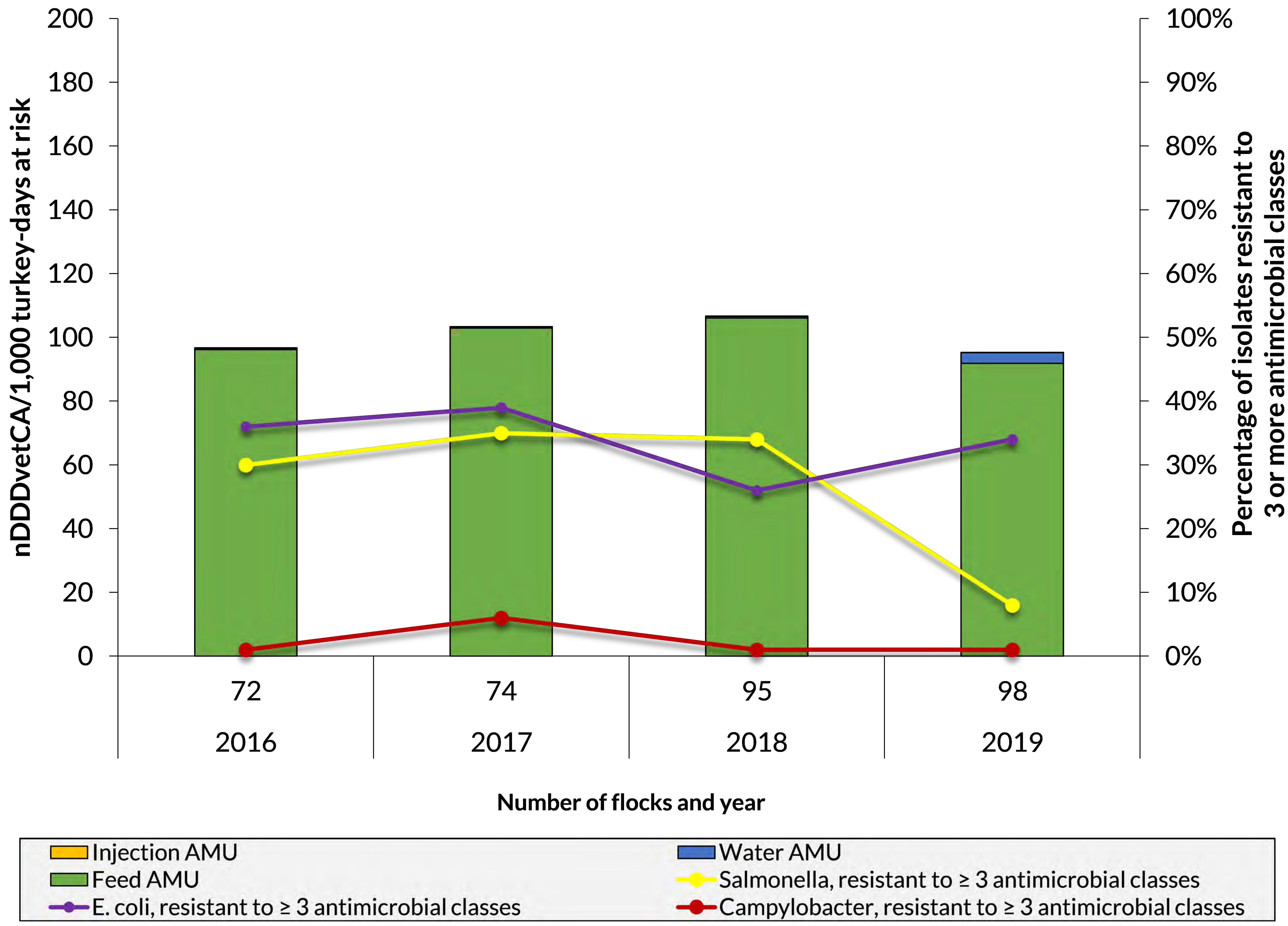


Table 3. Temporal variations in resistance and turkey flock mortality

		2017	2018	2019	Comparing 2018 to 2019
Salmonella	Number of isolates	161	239	301	
	Cefriaxone	0%	0%	2%	+2%
	Nalidixic acid/ciprofloxacin	0%/0%	0%/0%	3%/1%	+3%/+1%
	Resistant to ≥1 classes	67%	55%	63%	+8%
E. coli	Number of isolates	287	367	393	
	Cefriaxone	1%	1%	2%	+1%
	Nalidixic acid/ciprofloxacin	2%/0%	1%/1%	2%/<1%	+1%/-<1%
	Resistant to ≥1 classes	75%	69%	69%	0%
Campylobacter	Number of isolates	157	191	214	
	Ciprofloxacin	30%	38%	37%	-2%
	Resistant to ≥1 classes	67%	66%	36%	-30%
Flock health	Mortality	6.4%	6.9%	6.0%	-1%

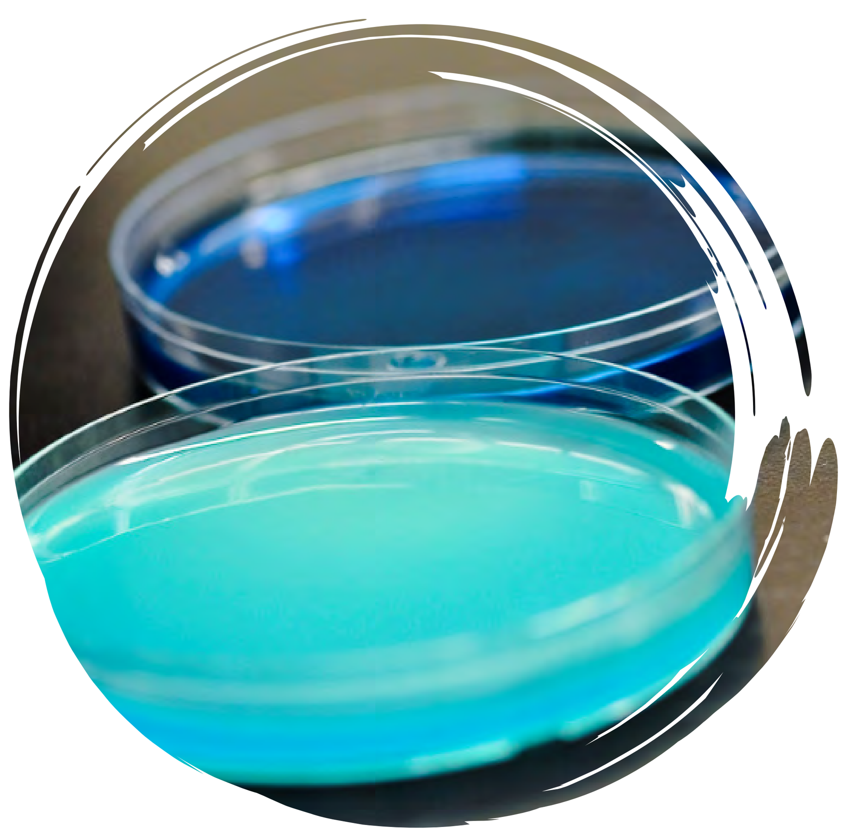
*adjusted for daily doses.
**first year of the implementation of the turkey sector's antimicrobial use reduction strategy (step 2).

INTEGRATED ANTIMICROBIAL RESISTANCE

In this section, we highlight 4 **resistance stories** for 2019:

Nalidixic acid-resistant *Salmonella* Enteritidis in humans and associated travel.

The detection of quinolone-resistant *Salmonella* Enteritidis from chicken(s).



Salmonella resistant to 6 or 7 antimicrobial classes with an increase in *Salmonella* from human and agri-food sources.

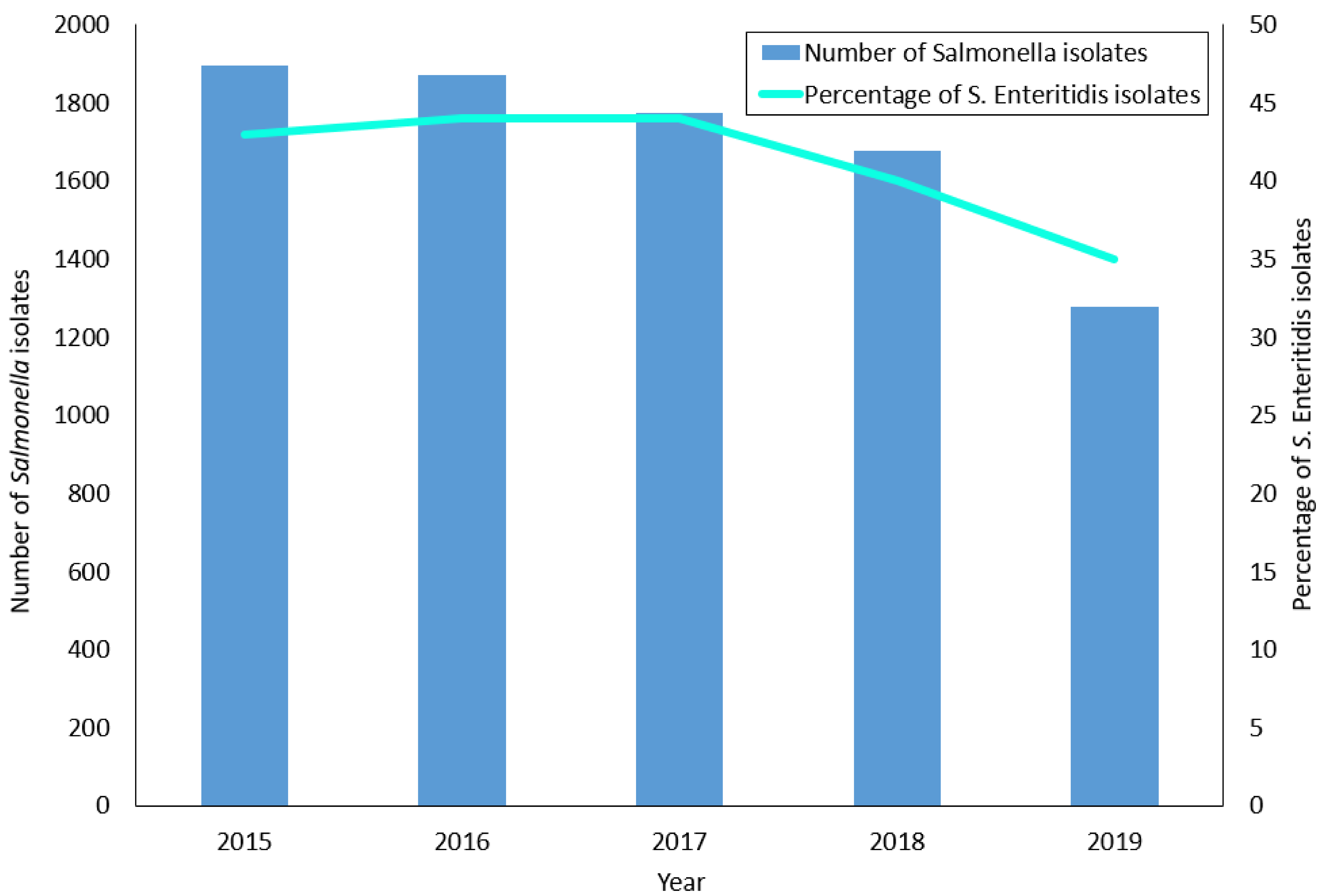
The detection of *Salmonella* Heidelberg from healthy cattle.

Salmonella Enteritidis and Quinolone Resistance in Humans

- Salmonellosis is a nationally notifiable disease in all provinces and territories.
- *S.* Enteritis is the most common serovar identified in people with salmonellosis.
- Most *S.* Enteritidis infections are located in the intestines, but can cause serious disease if it moves to the blood stream, other organs or joints.

In 2018 and 2019, *S.* Enteritidis detection **decreased** resulting in an overall reduction in cases of salmonellosis.

Figure 13. Trends in human *Salmonella* and *S.* Enteritidis isolates



Resistance is uncommon in *S.* Enteritidis.

For antimicrobials other than nalidixic acid, generally **<5%** of isolates are resistant to specific individual antimicrobials.

Except for resistance to nalidixic acid; a quinolone and Category II antimicrobial.

Salmonella Enteritidis and Quinolone Resistance in Humans

Resistance to nalidixic acid in human *S.* Enteritidis isolates has been **increasing** since 2010.

Figure 14. Nalidixic acid resistance in human *S.* Enteritidis isolates

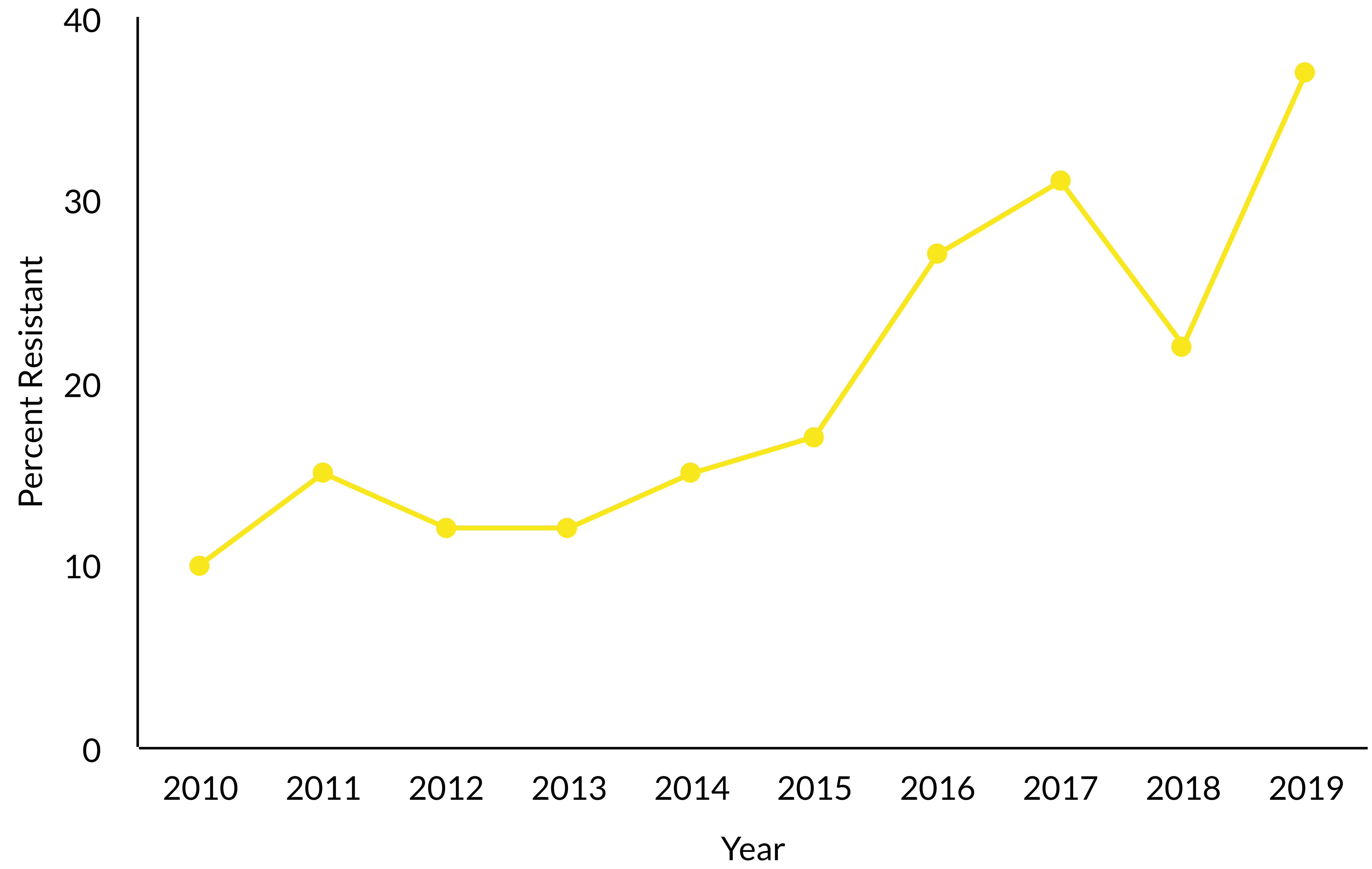
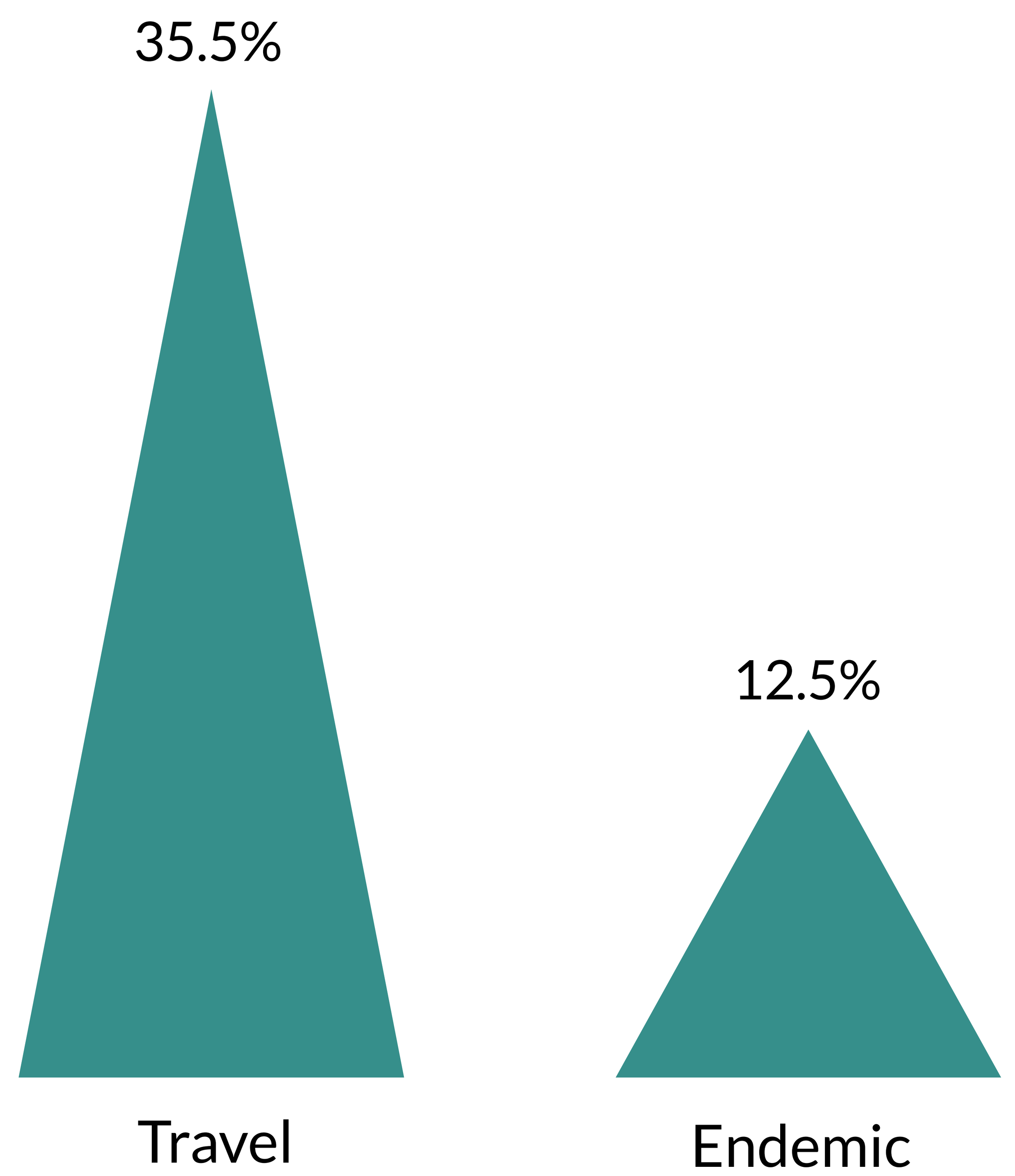


Figure 15. Nalidixic acid resistance in human travel-associated and endemic *S.* Enteritidis isolates



*FoodNet Canada data

Data* indicate that nalidixic acid resistance in *S.* Enteritidis is **more common** in cases with a history of **travel** outside of Canada compared to cases without a history of travel outside of Canada (endemic cases).

Ongoing genetic analyses will help to further explain the potential relationship of travel outside Canada and nalidixic acid-resistant *S.* Enteritidis infections.

Detection of Quinolone Resistance in *Salmonella* Enteritidis from Chicken(s)

In 2018, a clear increase (although small in numbers) in the detection of nalidixic acid-resistant *S.* Enteritidis across several surveillance components from multiple provinces was noted. In 2019, this pattern of detection continued.

RETAIL

1 isolate from Alberta (FoodNet Canada)

RETAIL

1 isolate from Québec

ABATTOIR

2 isolates from Nova Scotia and Prince Edward Island

The **majority** of *S.* Enteritidis from animal and food sources were susceptible to all antimicrobials tested.

In 2019, in addition to meat and abattoir isolates, nalidixic acid-resistance was detected in **8** clinical isolates from broiler chickens (sick chicken do not enter the food chain).

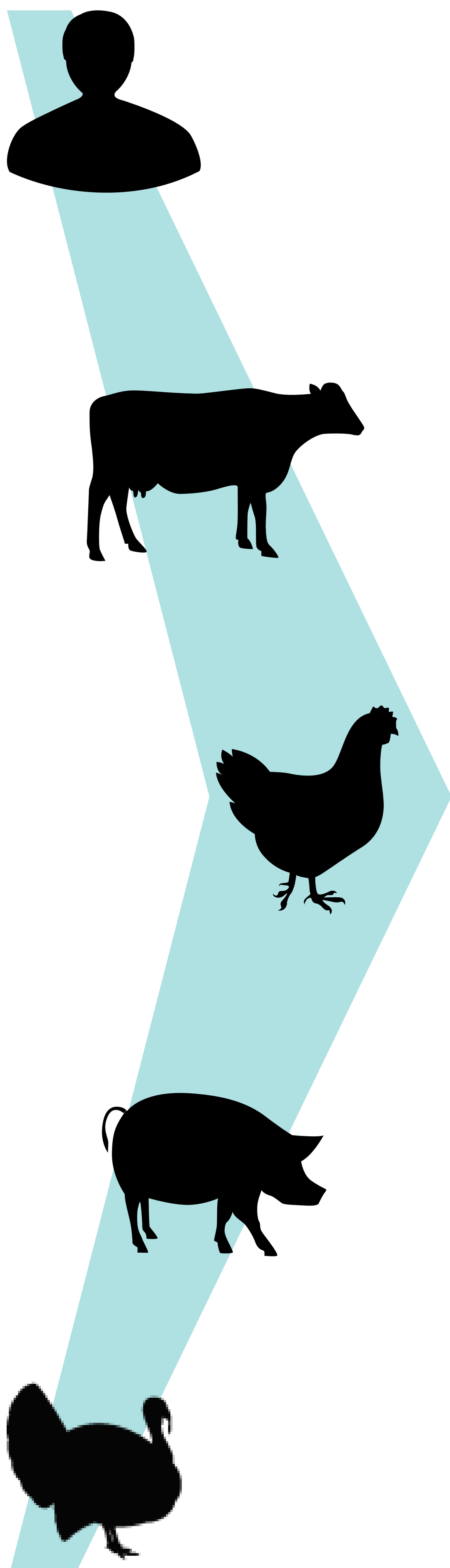
Reasons for the detection of novel resistance may differ between isolates found along the agri-food chain and clinical isolates.

Noting the number of detected isolates are small, CIPARS will continue to monitor whether domestic chicken could be a new possible source of human exposure to nalidixic-resistant *S.* Enteritidis.

Salmonella Resistant to 6 or 7 Antimicrobial Classes

- The number of *Salmonella* isolates resistant to 6 or 7 of the 7 antimicrobial classes tested continued to **increase** (from both human and animal sources).
- There was also **new** detection of *Salmonella* Heidelberg on cattle farms resistant to 6 or 7 antimicrobial classes.

In 2019, 159 *Salmonella* isolates were identified as highly drug-resistant from the following sources:



Human

- Only clinical isolates tested.
- Most isolates were *S.* Newport, Infantis, and Typhimurium.

Cattle

- First detection of highly drug-resistant *Salmonella* from cattle farms (n = 2).
- All these isolates from healthy cattle were *Salmonella* Heidelberg.
- However, most isolates were from sick cattle with resistance to 6 or7 antimicrobial classes were *S.* Dublin.

Chicken

- There was continued detection of highly drug resistant *S.* Infantis.
- It was detected in a retail sample from Ontario.

Note: Sick animals do not enter the food chain

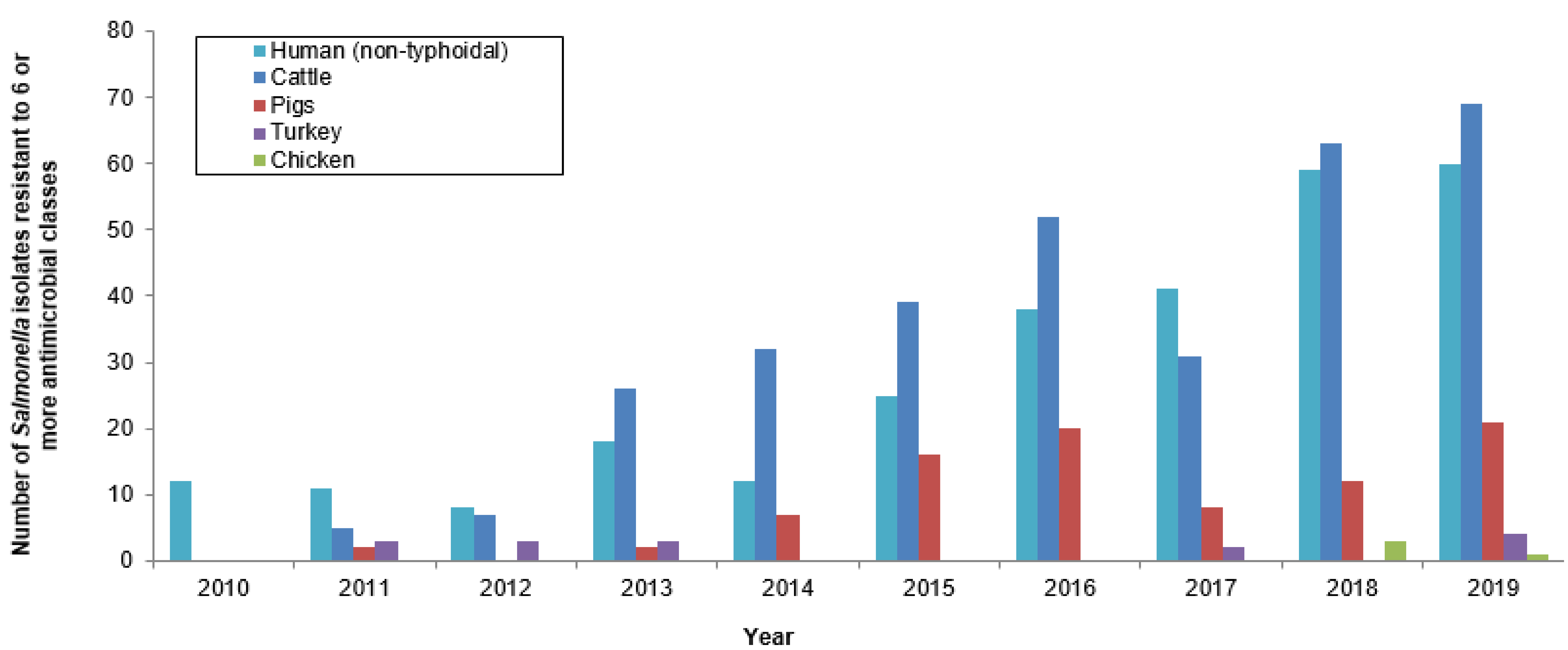
Swine

- Resistance to 6 or 7 antimicrobial classes was detected in 8 serovars.
- Most were from sick pigs (clinical samples) (n = 18).
- 4, [5], 12:i:- was the predominant serovar (n = 8).
- One 4, [5], 12:i:- isolate was resistant to all 7 classes (clinical sample).

Turkey

- All isolates were *S.* Infantis.
- Most isolates (n = 3) were from Ontario farms.

Figure 16. Number of *Salmonella* isolates resistant to 6 or 7 antimicrobial classes from 2010 to 2019

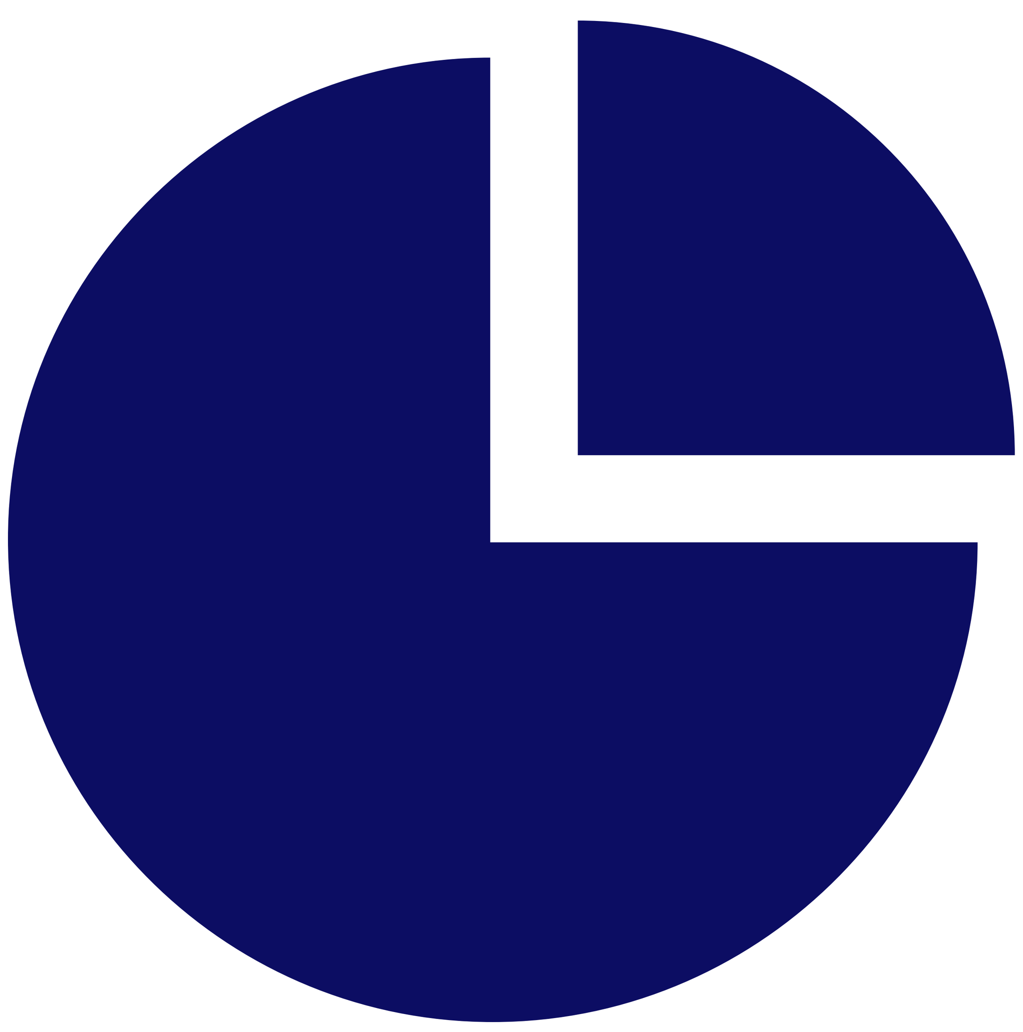


Note: information from sick animals (which do not enter the food chain) is combined with information from healthy animals and meat. These represent different levels of exposure concern to people.

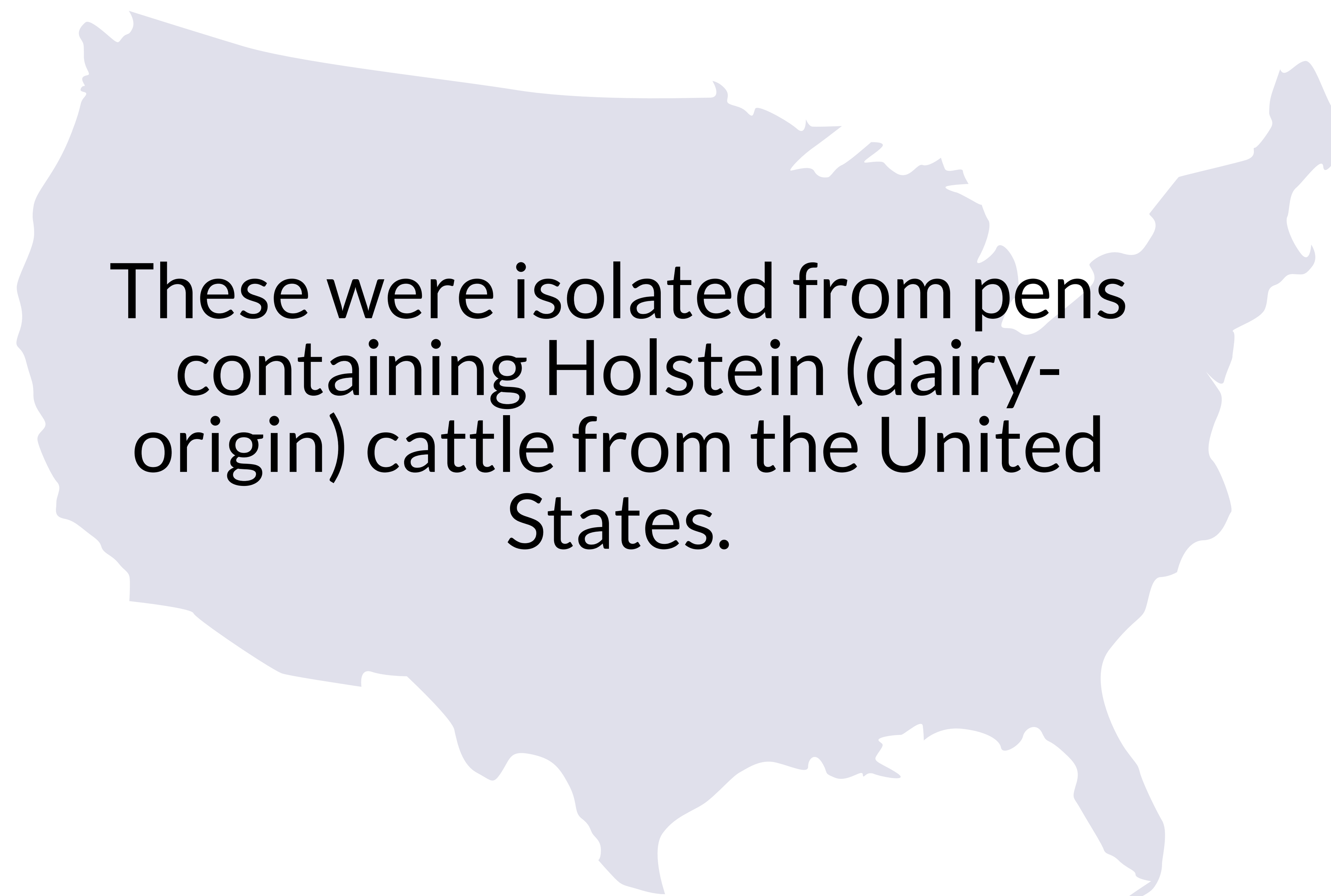
Salmonella Heidelberg from Cattle

- In 2019, *Salmonella* Heidelberg isolates with resistance to 6 antimicrobial classes were identified from healthy cattle on Alberta feedlots.

~25% (approximately)



There were 6 isolates resistant to 6 classes, with an additional isolate resistant to 5 classes.



These were isolated from pens containing Holstein (dairy-origin) cattle from the United States.

Previously, *Salmonella* from cattle with resistance to 6 or 7 antimicrobial classes was only identified in sick animals (mostly *S.* Typhimurium and *S.* Dublin).

The prevalence of *Salmonella* from healthy Canadian feedlot cattle in the past (research and historic CIPARS Feedlot AMR data) has been **very low** (1 to 2%) and resistance to the antimicrobials tested was not found in these *Salmonella* isolates.

Salmonella Heidelberg in Cattle

CIPARS does not test for *Salmonella* from beef cattle in other surveillance components related to the food-chain (abattoir, retail) due to very low recovery rates.

The finishing of Holstein cattle from the United States in Canada is a new practice in Western Canada and has become an important part of the feedlot industry.

Whole genome sequencing indicated there is no relation between these *S.* Heidelberg isolates found in cattle with any human isolates.

Glossary

Antimicrobial class: Antimicrobials are grouped into the same class if they have a common chemical structure and method to kill or stop the growth of bacteria. CIPARS uses the Clinical and Laboratory Standards Institute to define antimicrobial class.

Biomass and Population Correction Unit (PCU): The PCU accounts for the size of the population. It includes both the number and weight (biomass) of animals or people in the population. CIPARS uses the PCU to interpret the antimicrobial use and sales data, using the same approach as the European Surveillance of Veterinary Antimicrobial Consumption Project.

DDDvet: This is an acronym for the "Defined Daily Dose for animals". The amount of antimicrobials given during a treatment (dose) will vary depending on the antimicrobial, how the antimicrobial is given (e.g. by injection, through water or feed) and the population treated (cattle, chickens, pigs). CIPARS uses this metric to adjust for this variation and help interpret antimicrobial use data.

Grower-finisher pig: A pig that is approximately 25 kilograms to market weight.

Highly Drug-Resistant (HDR): Resistance to 6 or 7 classes of antimicrobials. No formal international standards exist for defining highly resistant isolates.

Medically important antimicrobials: Antimicrobials deemed to be of very high importance (**Category I**), high importance (**Category II**), or medium importance (**Category III**) in human medicine.

mg/PCU: An antimicrobial use metric that adjusts the quantity (milligram/mg) of antimicrobial used, consumed or distributed by the size of the population.

nDDDvet/1000 animal-days: An antimicrobial use metric that adjusts for both variation in the amount of antimicrobial given during a treatment (DDDvet), and the length of time that an animal or group of animals are treated to help interpret antimicrobial use data.

Susceptible: Susceptible to all tested antimicrobial classes. In 2019, CIPARS tested for resistance to 7 antimicrobial classes.

CIPARS analysts are working to develop new ways of identifying emerging issues and integrating data across various host species, bacterial species, and across regions.

CIPARS will continue to monitor and communicate the impact of changing antimicrobial use practices on the occurrence of antimicrobial resistance to preserve the effectiveness of antimicrobials in animals and humans.

CIPARS Canadian Integrated Program for Antimicrobial Resistance Surveillance

Programme intégré canadien de surveillance de la résistance aux antimicrobiens PICRA

Government of Canada Gouvernement du Canada