# Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

# 2018 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.

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To obtain additional information, please contact:

Dolly Kambo
Executive Assistant
Public Health Agency of Canada
370 Speedvale Avenue West, Guelph, ON N1H 7M7
Telephone: 519-826-2174
Fax: 519-826-2255
E-mail: phac.cipars-picra.aspc@canada.ca

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## QUESTIONS?

phac.cipars-picra.aspc@canada.ca

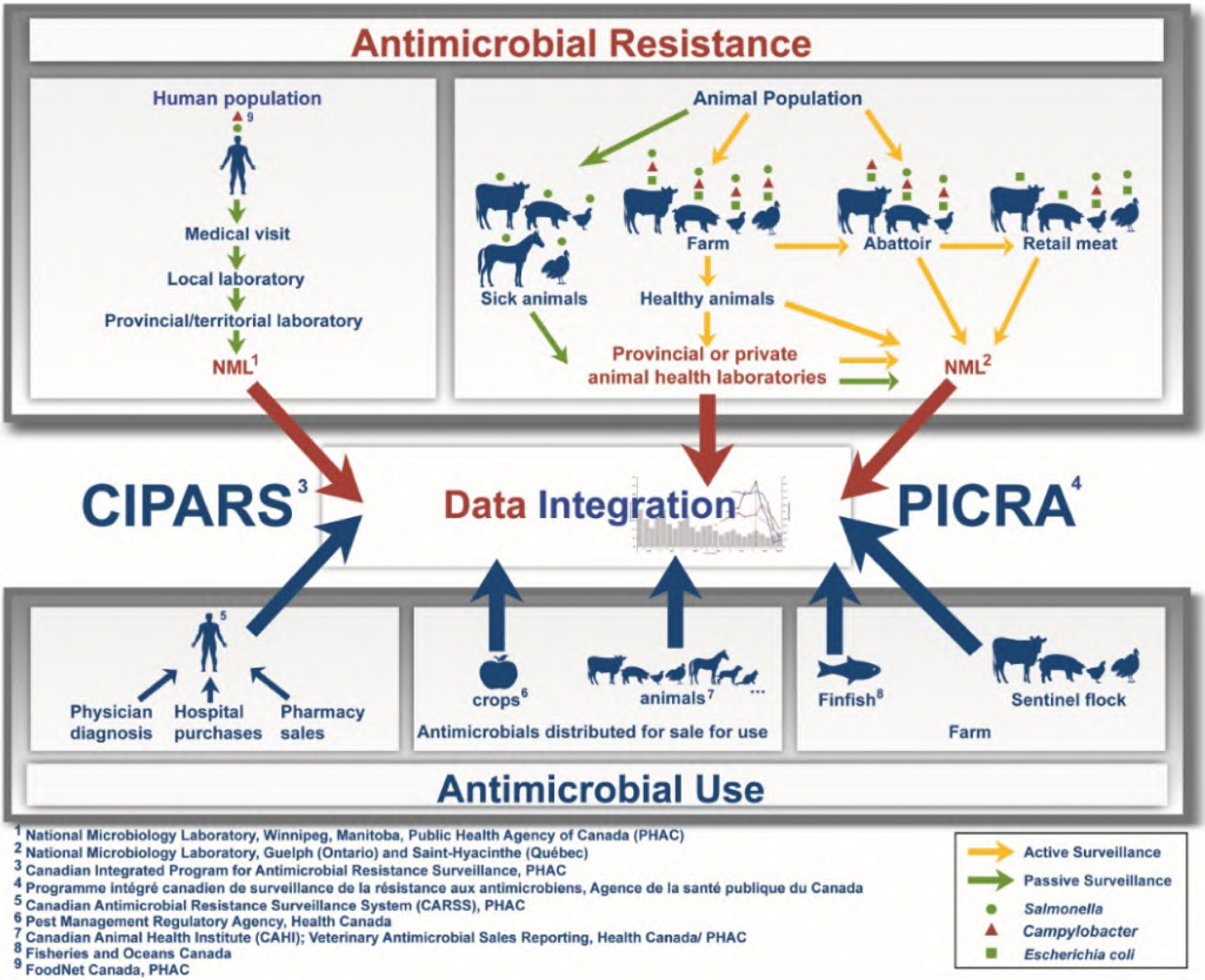
https://www.canada.ca/en/public-health/services/surveillance/canadian-integrated-program-antimicrobial-resistance-surveillance-cipars/cipars-reports.html

CIPARS Figures & Tables 2018

CIPARS Methodology

# Overview of CIPARS Activities

## CIPARS brings together diverse sources of data in a robust and sound manner.



# 2018 Key Findings

## 01 | ANTIMICROBIAL USE

- Antimicrobial sales **increased** between 2017 and 2018.
- For broiler chickens, farm surveillance showed a **reduction of use** in 2018 compared to 2017 data, with some provincial variations.
- For pigs, AMU has significantly **decreased** overall and substantially in some provinces.
- For turkeys, AMU has **increased** overall with some provincial variations.

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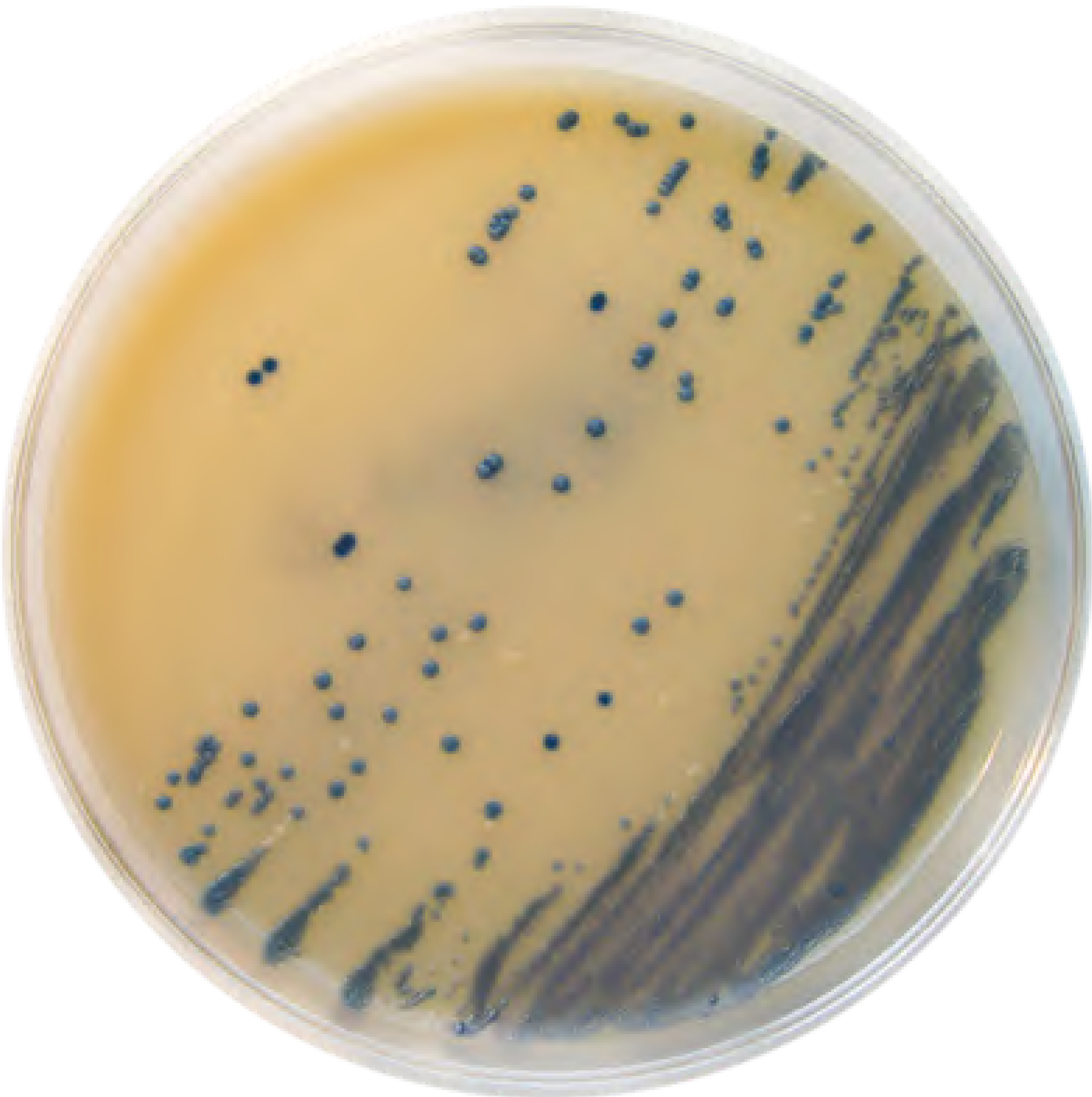
## 02 | ANTIMICROBIAL RESISTANCE

### QUINOLONE-RESISTANT *SALMONELLA* ENTERITIDIS (pg. 18)

Quinolone (nalidixic acid) resistance in *S*. Enteritidis from agri-food sources is **extremely rare**, especially from chicken(s).

In 2018, nalidixic acid resistance in *S*. Enteritidis from chickens and chicken meat was detected at **levels never observed before by CIPARS.**

## HIGHLY DRUG RESISTANT *SALMONELLA* (pg. 19)



We observed the **highest number** of highly-resistant *Salmonella* isolates to-date across all human, animal, and food sources in 2018.

Additionally, we isolated highly-resistant *Salmonella* (serovar Infantis) from a chicken source for the **first time**.

# 03 | INTEGRATED ANTIMICROBIAL USE AND RESISTANCE DATA

## CHICKEN AND PEOPLE

The poultry industry initiative to eliminate the use of **Category I** antimicrobials (including the 3rd generation cephalosporins and fluoroquinolones) for disease prevention appears to reduce antimicrobial resistance in most scenarios.

### Ceftiofur Use and Ceftriaxone Resistance (pg. 22-23)

- There has been no reported ceftiofur use in broiler chickens since 2015.
- In most scenarios, there has been a reduction in ceftriaxone (a 3rd generation cephalosporin) resistance in both *E. coli* and *Salmonella* recovered from chickens, and *Salmonella* isolates recovered from people.
- However, there was an **increase** in ceftriaxone-resistant *Salmonella* from chickens on farm.

### Fluoroquinolone-resistant *Campylobacter* (pg. 21)

- In 2018, fluoroquinolones were reported for treatment of sick chickens in a single flock in British Columbia.
- Similar to previous years, there were regional differences in the prevalence of fluoroquinolone-resistant *Campylobacter* from chicken and chicken meat.
- Resistance to ciprofloxacin (a fluoroquinolone) was more commonly identified in human *Campylobacter* isolates and retail chicken from **British Columbia** compared to Alberta and Ontario.

# Integrated Findings and Discussion

## Integrated Antimicrobial Use Data

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: cephalosporins (3rd and 4th generation), carbapenems, fluoroquinolones.

**Category II: High importance**

Examples: macrolides, penicillins.

**Category III: Medium importance**

Examples: tetracyclines.

**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.

Note: chemical coccidiostats are considered uncategorized antimicrobials.

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For reporting data on antimicrobials used in animals, we use different metrics or ways of reporting the information.

### WHY DO WE USE DIFFERENT METRICS?

- There are several different ways to collect, analyze, and report antimicrobial use data.
- No single approach is appropriate for all purposes.
    - Certain metrics are better suited to looking at trends over time, while others may be more appropriate for comparing different regions or different host species, and others may be better for understanding relationships between use and resistance.





# COMPARING HUMANS, ANIMALS, AND CROPS

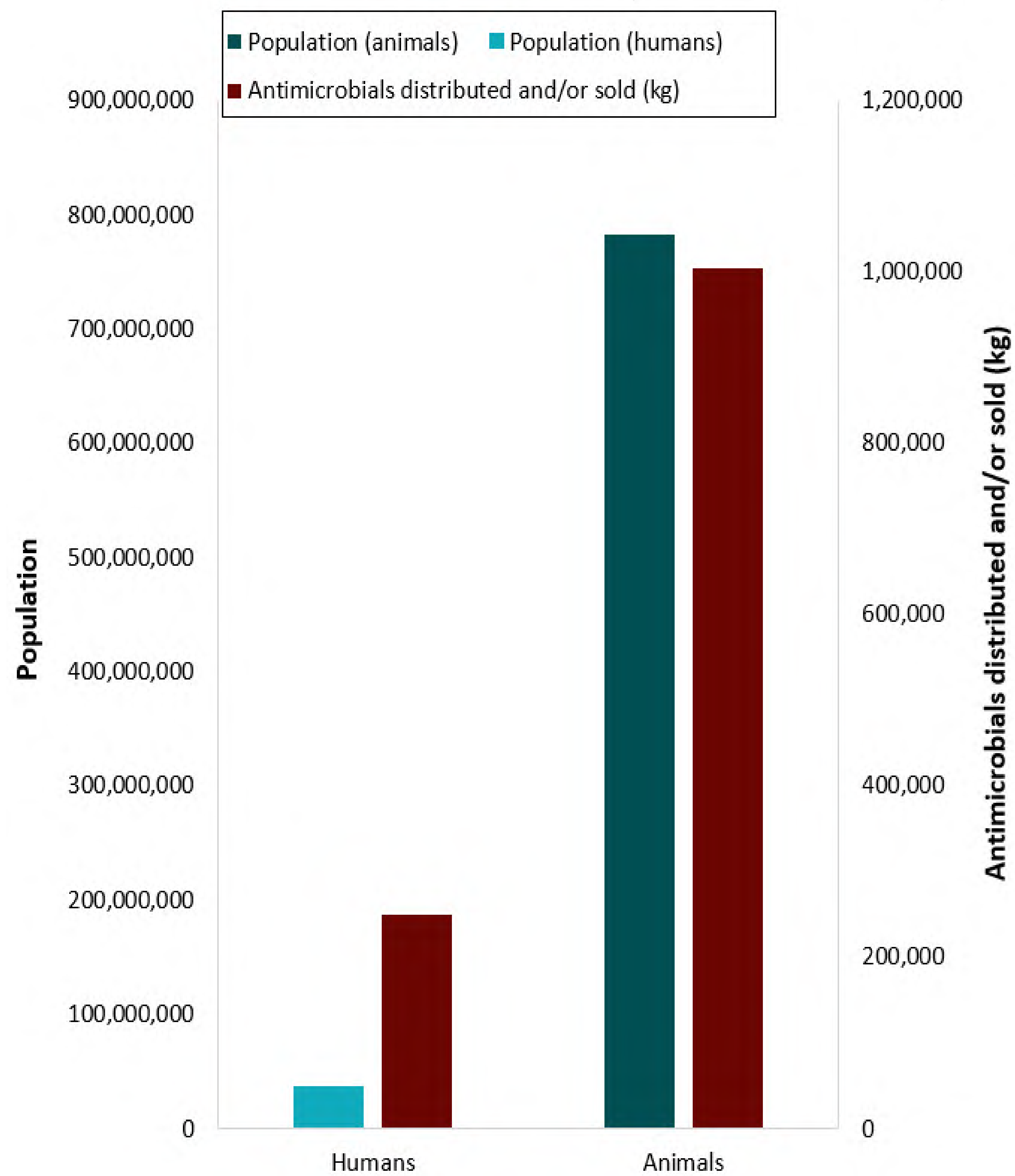
# COMPARISON OF HUMANS, ANIMALS, AND CROPS

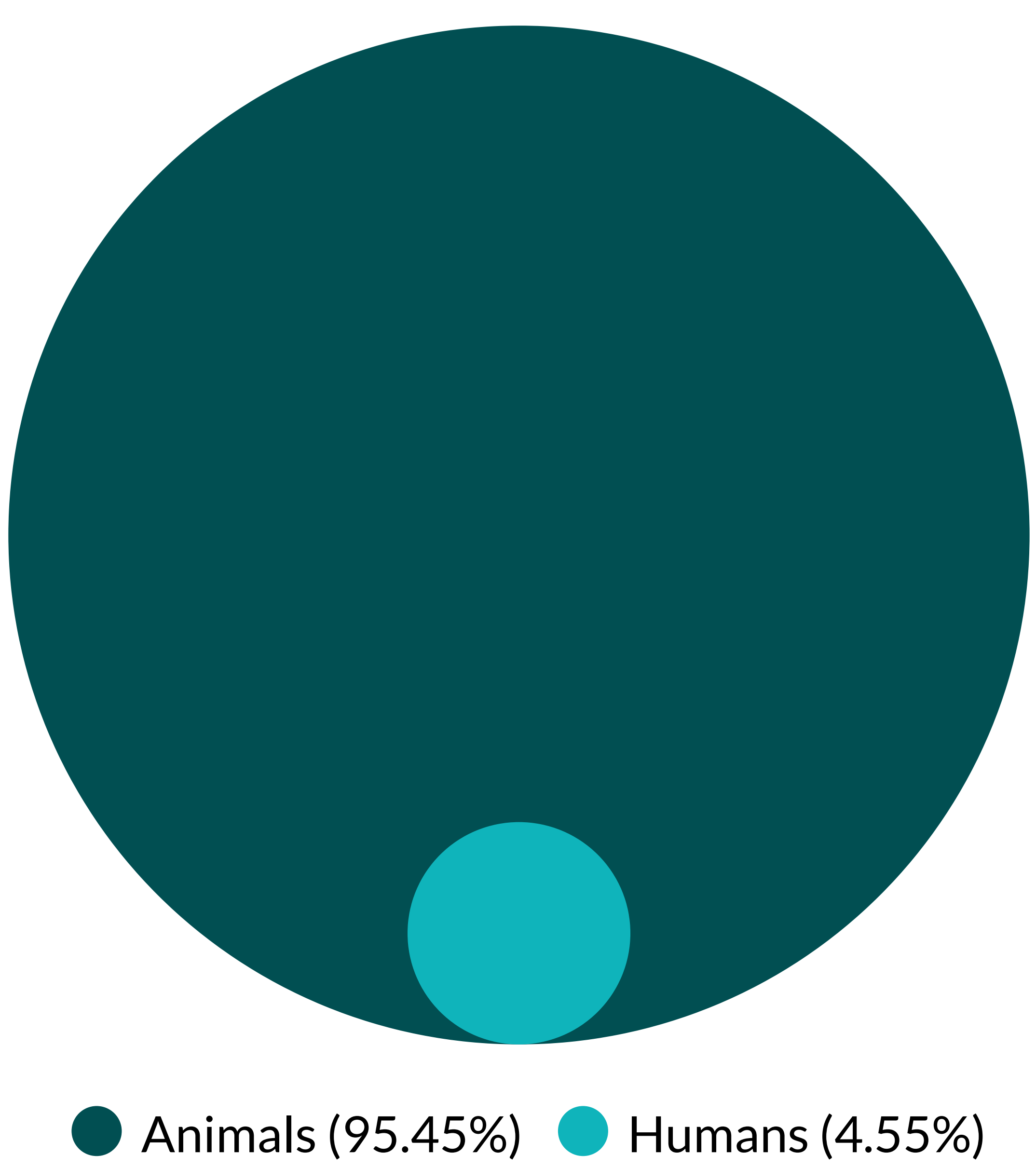
**5%**

**INCREASE IN TOTAL QUANTITY OF ANTIMICROBIALS (ADJUSTED BY BIOMASS) DISTRIBUTED FOR USE IN PRODUCTION ANIMALS SINCE 2017 AS A RESULT OF INCREASED TETRACYCLINE USE**

**~1.4x**

**MORE ANTIMICROBIALS WERE DISTRIBUTED FOR USE IN ANIMALS THAN HUMANS AFTER ADJUSTING FOR UNDERLYING BIOMASS IN 2018**

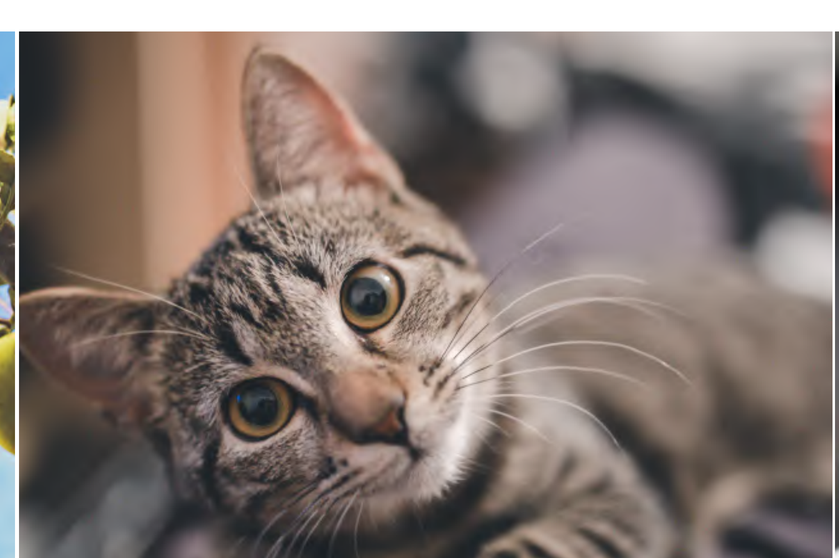



**21x**

**MORE ANIMALS THAN PEOPLE IN CANADA IN 2018**

*Note: This is an underestimation, as fish are not included in the animal estimate*



## Of the antimicrobials distributed or sold* in 2018:

78% were intended for **production animals**

21% were intended for **humans**

1% were intended for **companion animals**

<1% were intended for **crops**

*Animal distribution data currently do not account for quantities imported for own use, or as active pharmaceutical ingredients intended for further compounding; hence, these are underestimates of total quantities used.

**For both humans and animals, the β-lactams (penicillins) were one of the main antimicrobial classes distributed/sold on a per kg of antimicrobial basis.**

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

The relative quantity of cephalosporins and fluoroquinolones (Category I) intended for use in people is higher compared to animals (~7x and 25x higher for people, respectively).

Tetracyclines (Category III) are used predominantly in production animals.

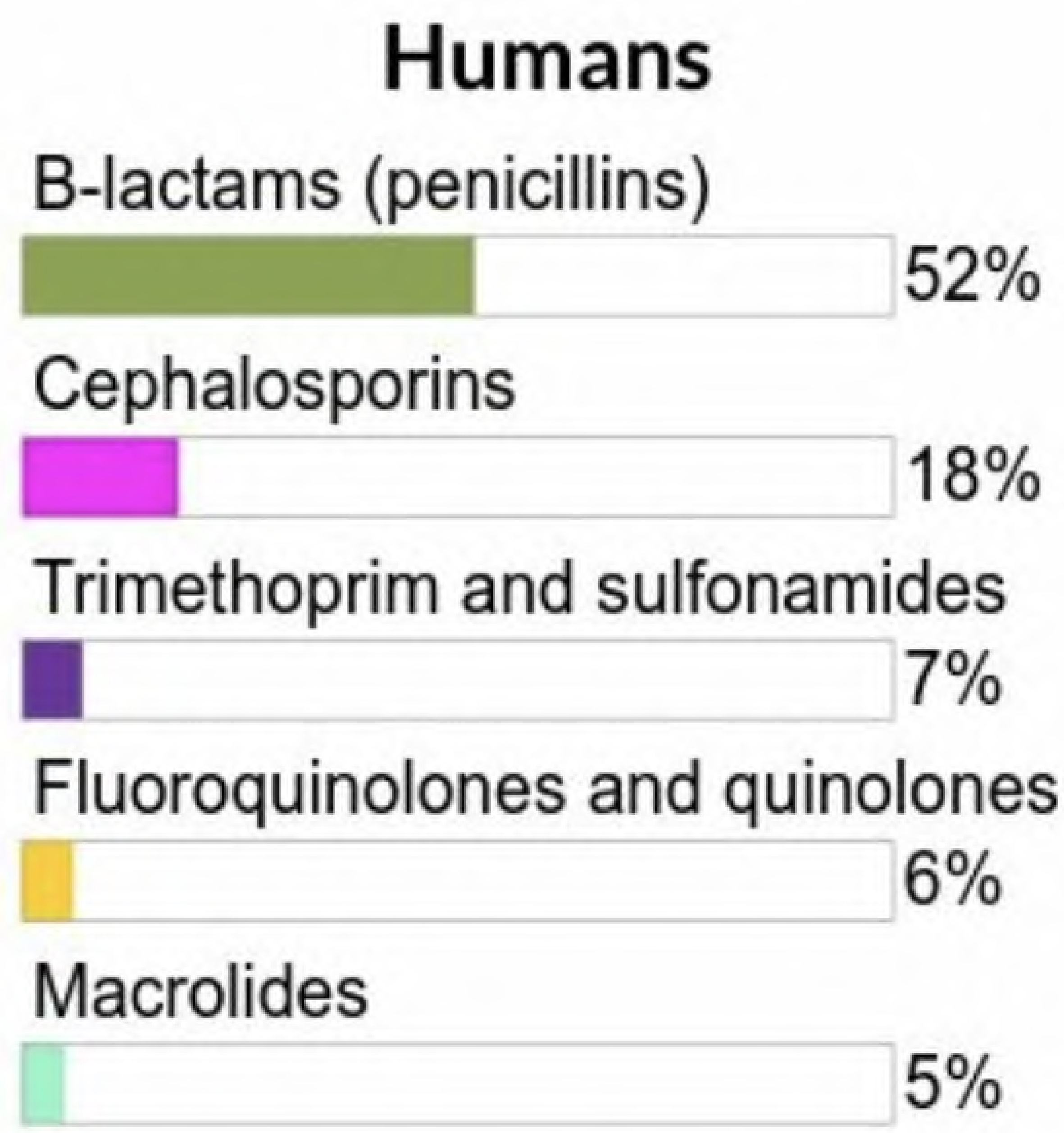
**Notes:**

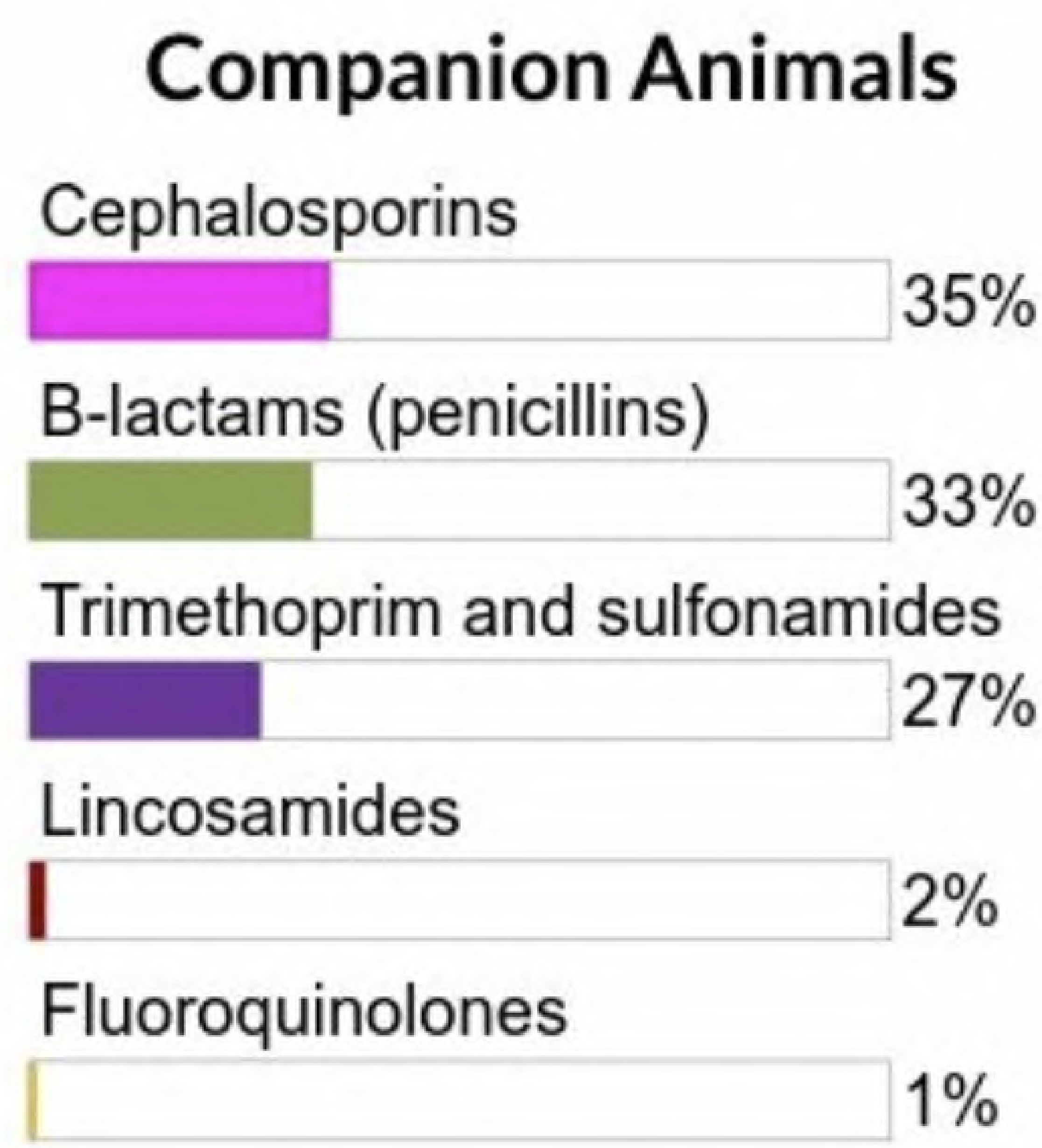
1. Cephalosporins are β-lactam antimicrobials, but we are displaying them separately for visualization purposes.

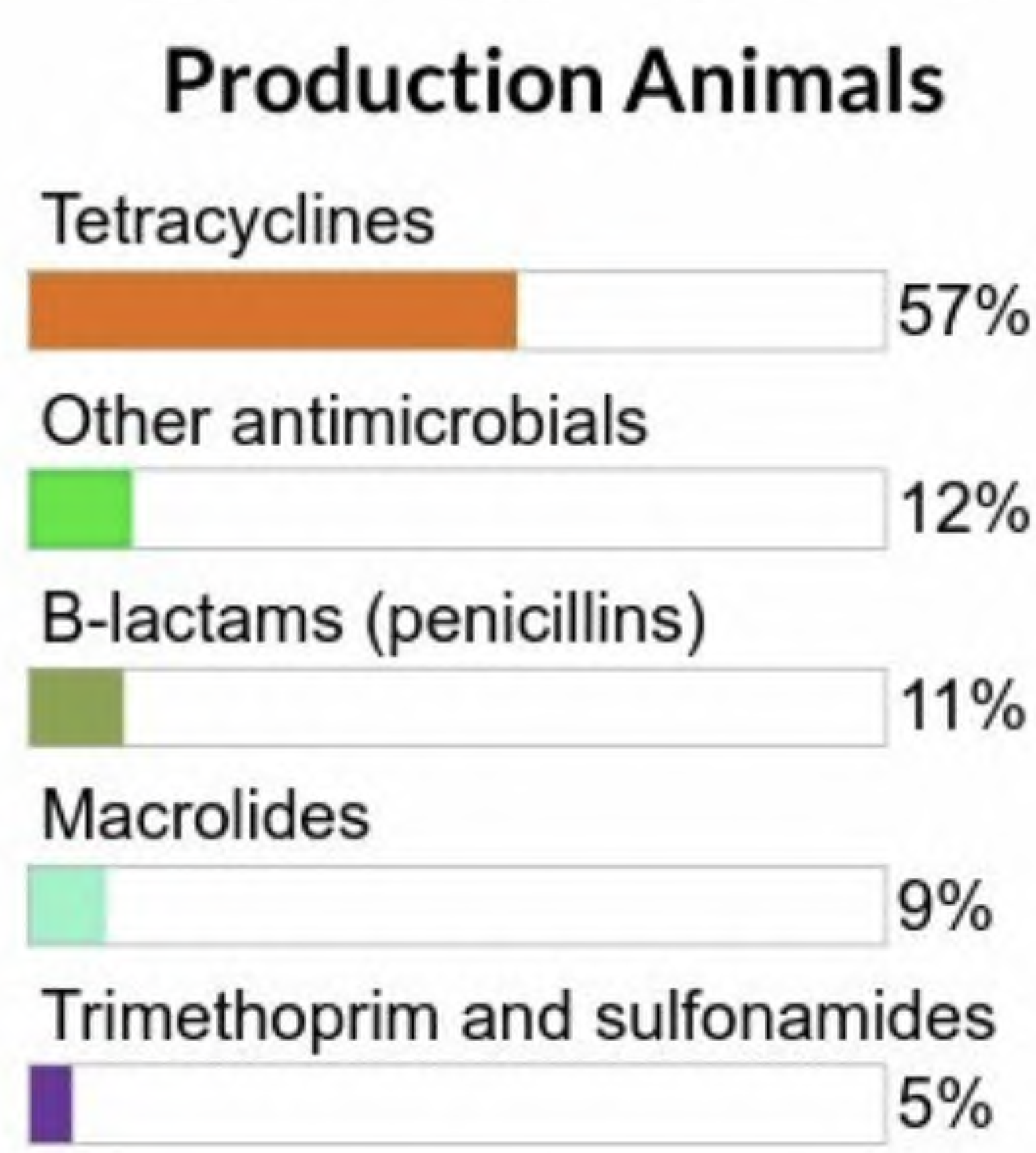
2. The percentages are based on total kilograms of active ingredients intended for use in that host species.

3. Other antimicrobials for animals: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymixin B, tiamulin, and virginiamycin.

4. Other antimicrobials for humans: bacitracin, chloramphenicol, colistimethate, colistin, daptomycin, fidaxomicin, fosfomycin, fusidic acid, linezolid, methenamine hippurate, methenamine mandelate, metronidazole, nitrofurantoin, polymyxin b, quinupristin/dalfopristin, and vancomycin.

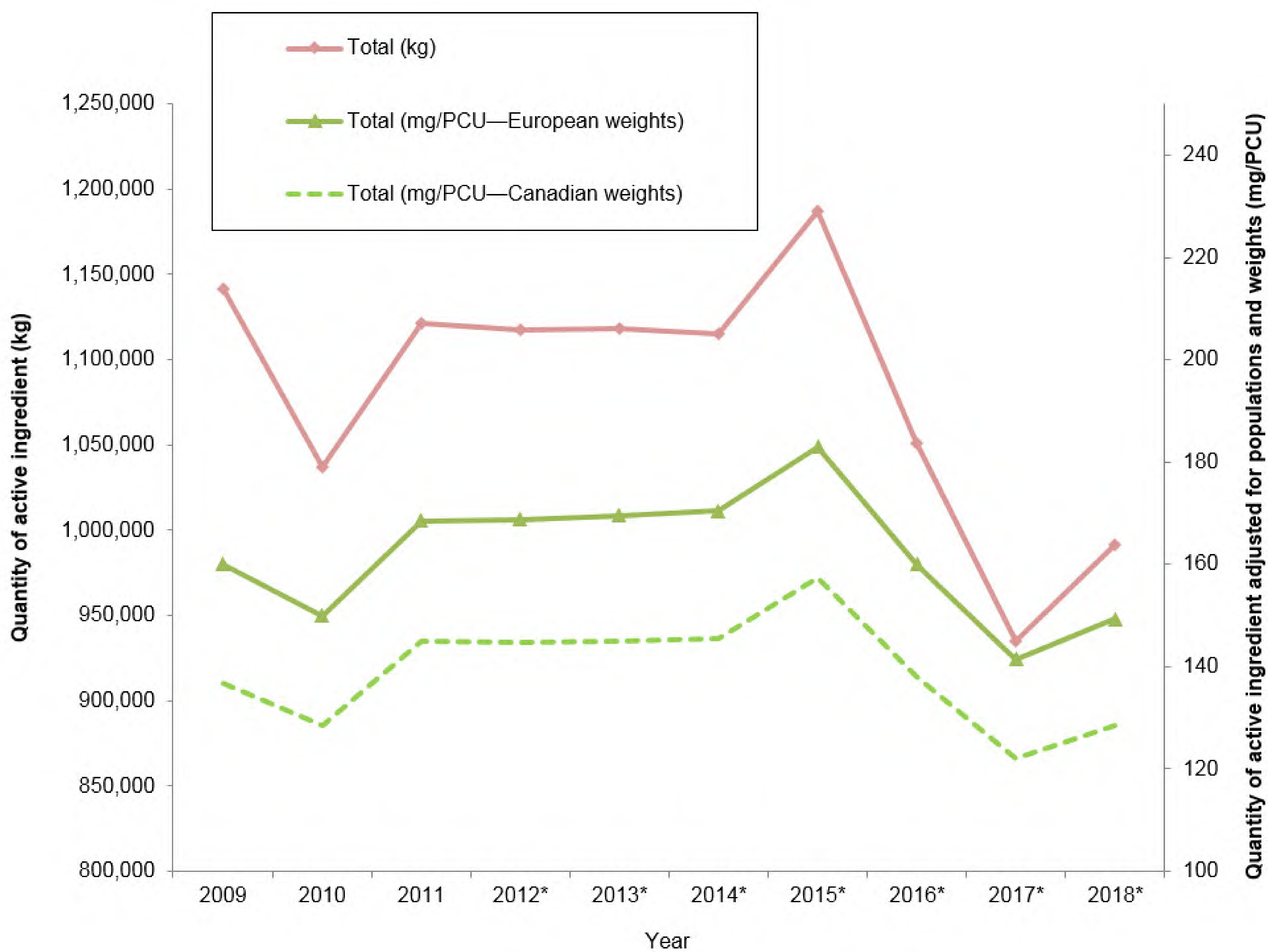


**The total quantities of antimicrobials distributed for sale for use in production animals increased. When measured in kilograms, the total quantities distributed increased by 6% compared to 2017. When total quantities were adjusted for biomass (mg/PCU), the increase was 5% compared to 2017.**

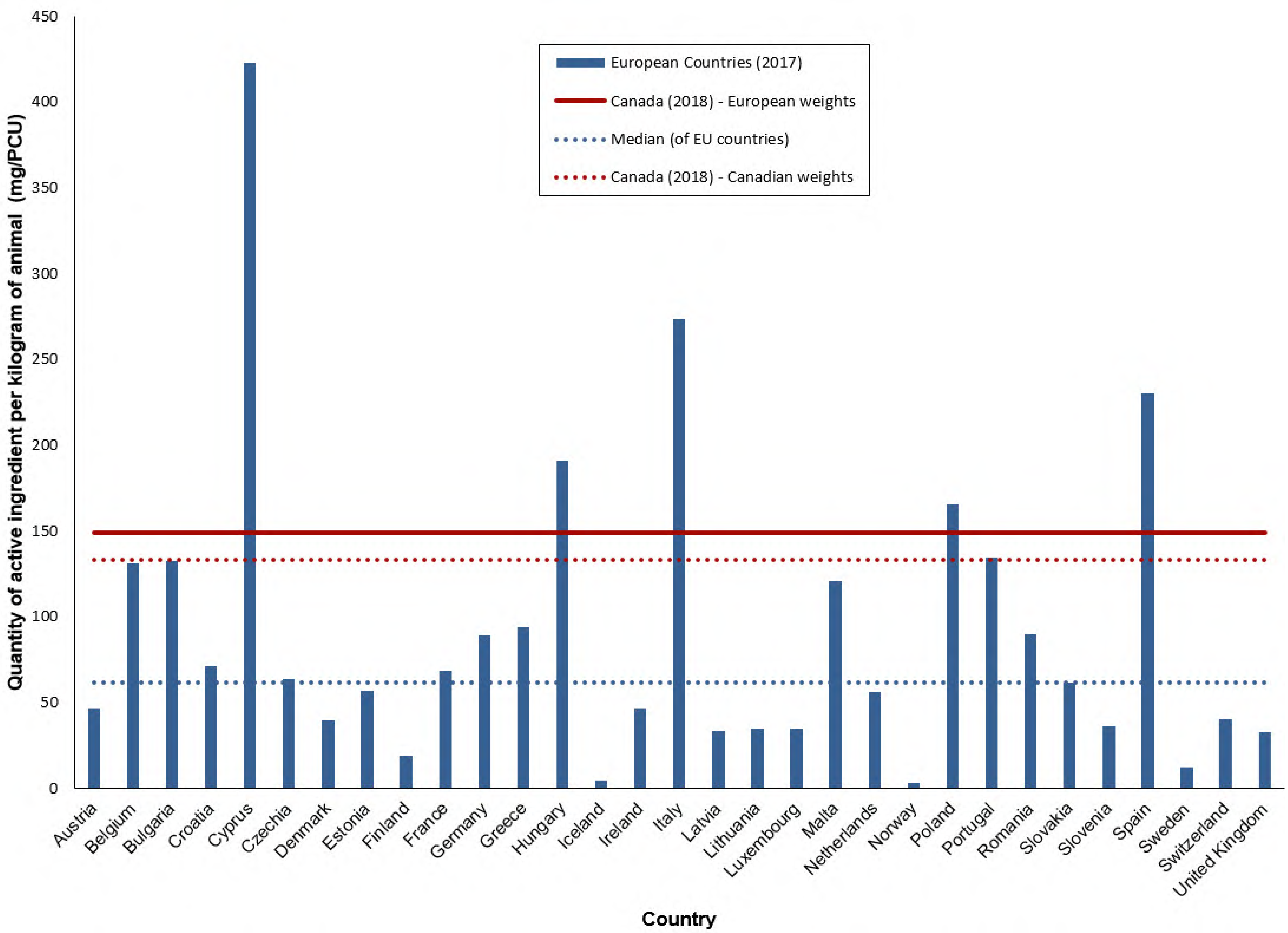
**Quantities of antimicrobials distributed for use in animals**




* Indicates years where data exclude antimicrobials sold for use in companion animals.

# Canada is the 6th highest country (in comparison to Europe) for quantities of antimicrobials sold (mg/PCU).

## Quantities of antimicrobials used (mg/PCU) by Canada (2018) and countries participating in the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) network (2017)




*Weights used in the biomass calculation are European standard weights at treatment.
**This figure makes the assumption that the data are comparable between countries.

**Data Sources (pgs. 6-10):** Canadian Animal Health Institute (CAHI), ESVAC, 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, Agriculture and Agri-Food Canada, and Equine Canada.

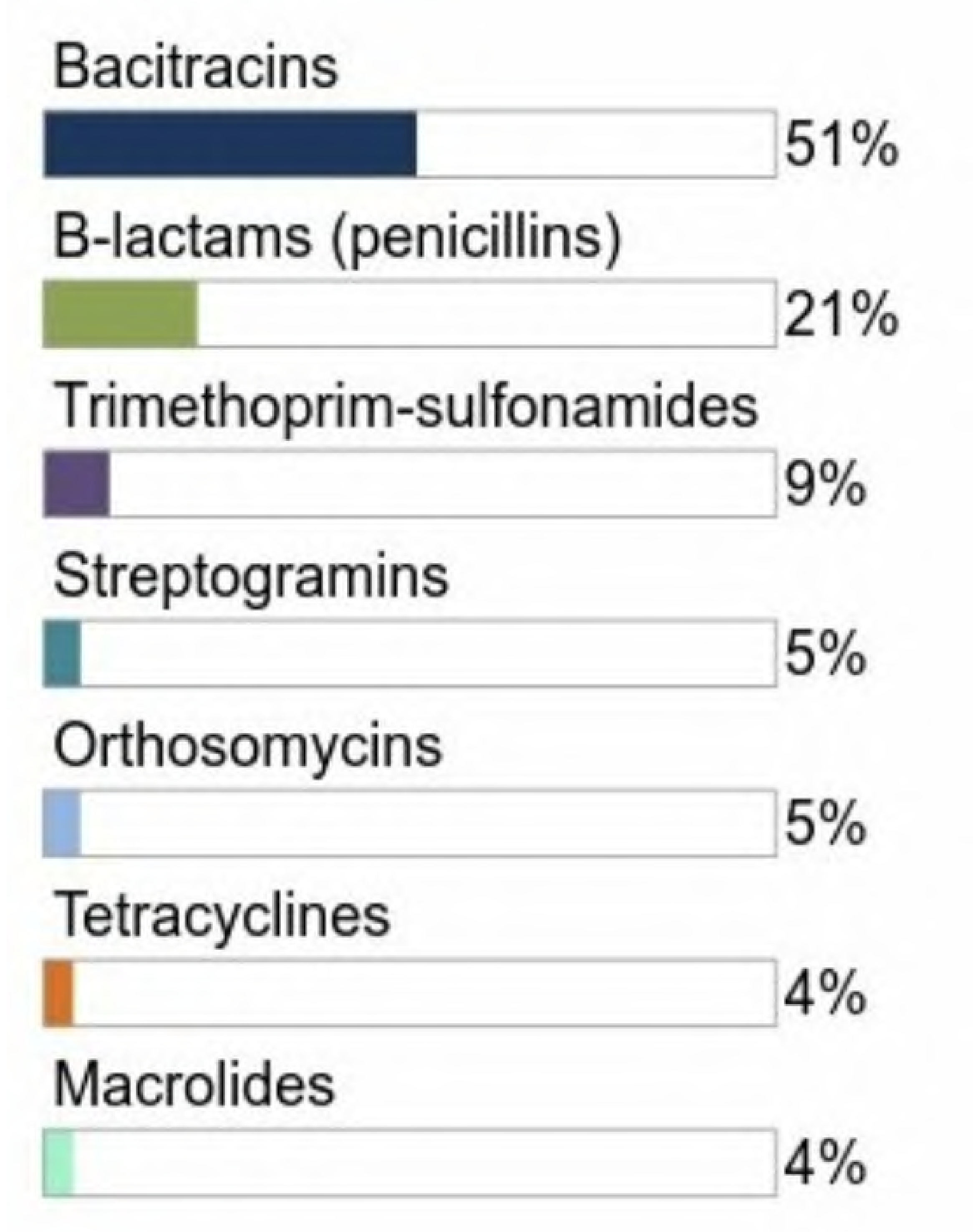




# COMPARING FARM ANTIMICROBIAL USE DATA

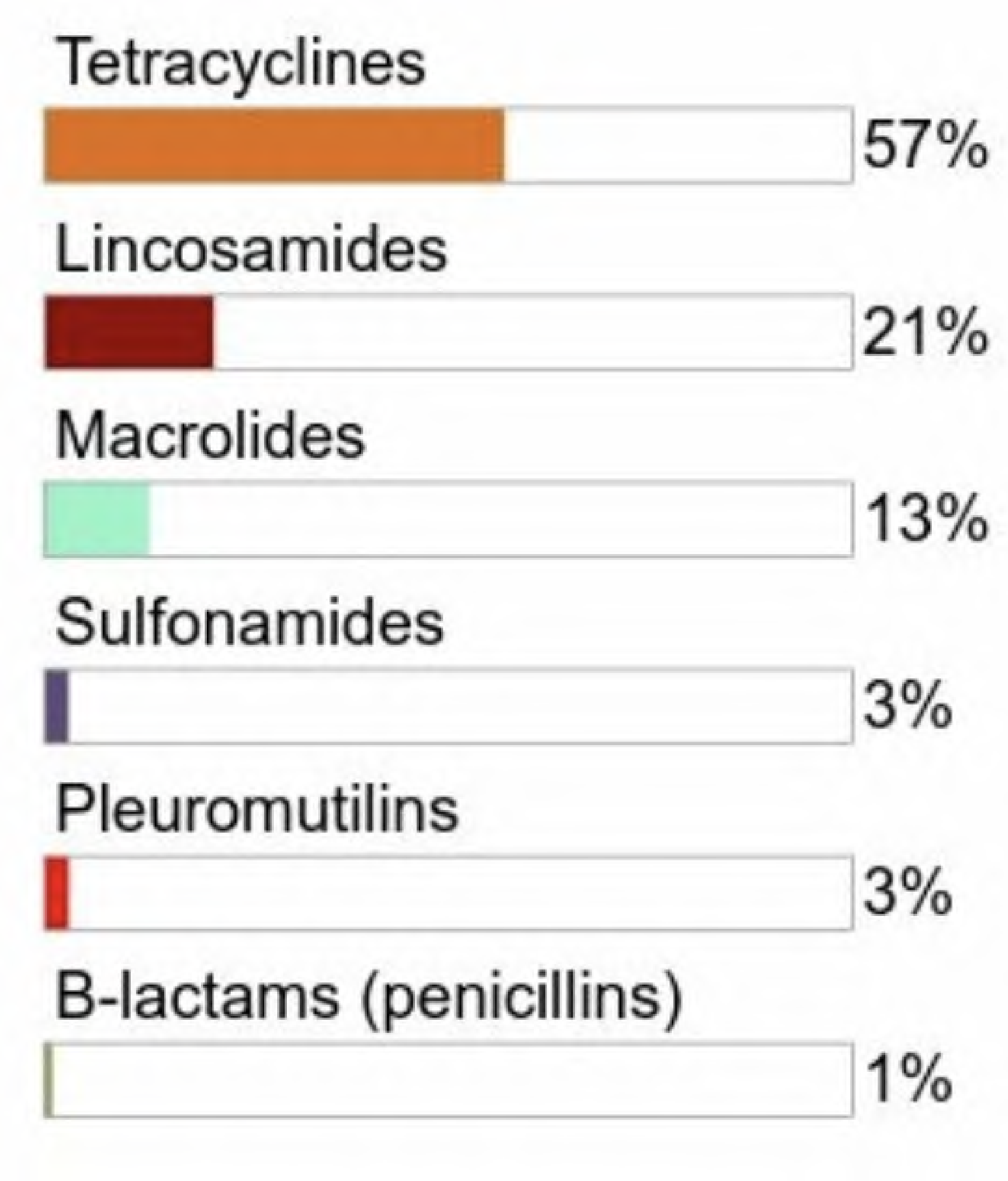
# COMPARISON OF ANTIMICROBIAL CLASSES*

## BROILER CHICKENS



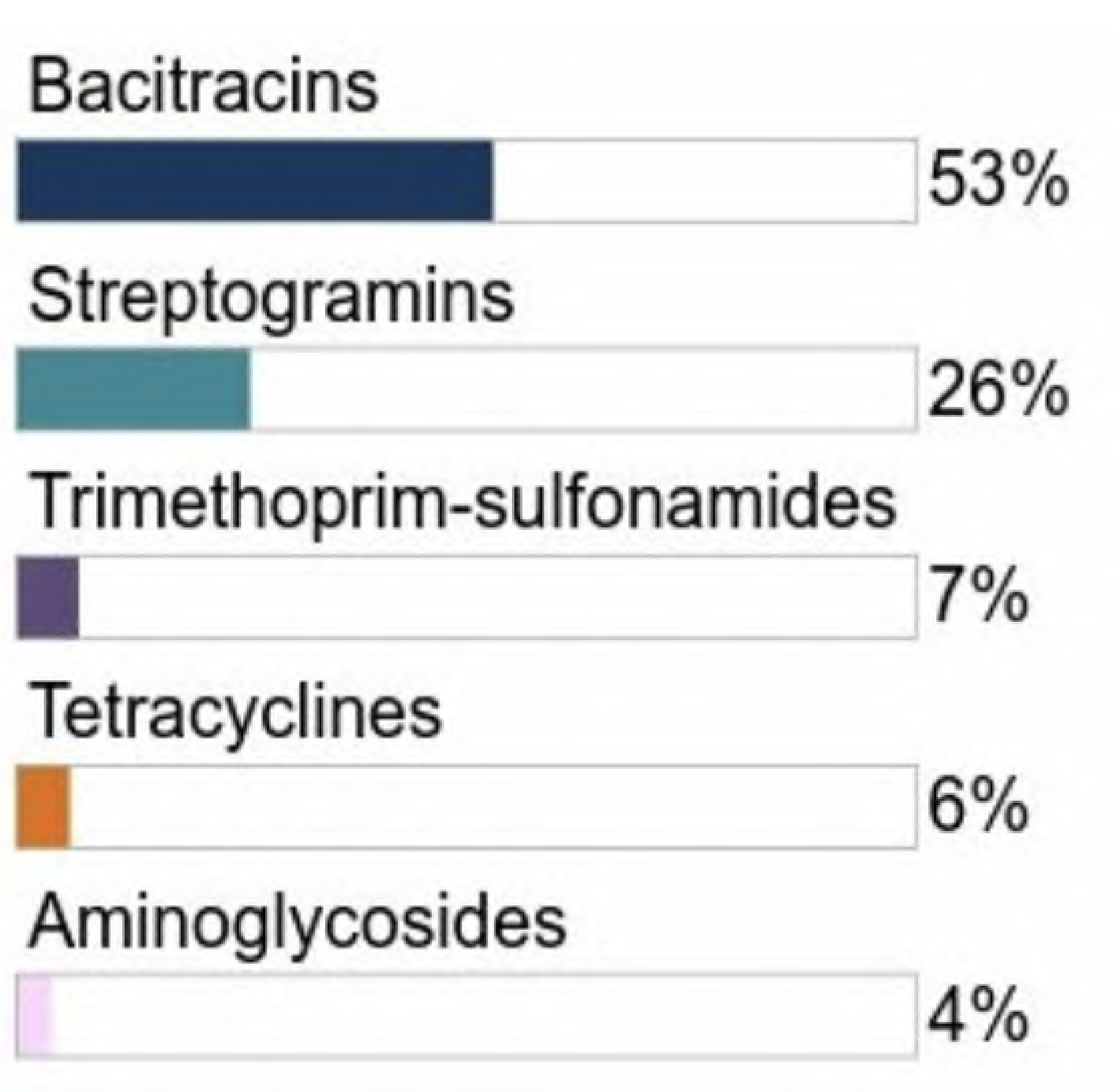

**Not shown:** aminoglycosides (1%), lincosamides-aminocyclitols (<1%).

## GROWER-FINISHER PIGS**




**Not shown:** streptogramins (1%)
**used in feed only.

## TURKEYS




**Not shown:** B-lactams (penicillins) (3%), orthomycins (1%), fluoroquinolones (<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.

# TEMPORAL TRENDS IN AMU

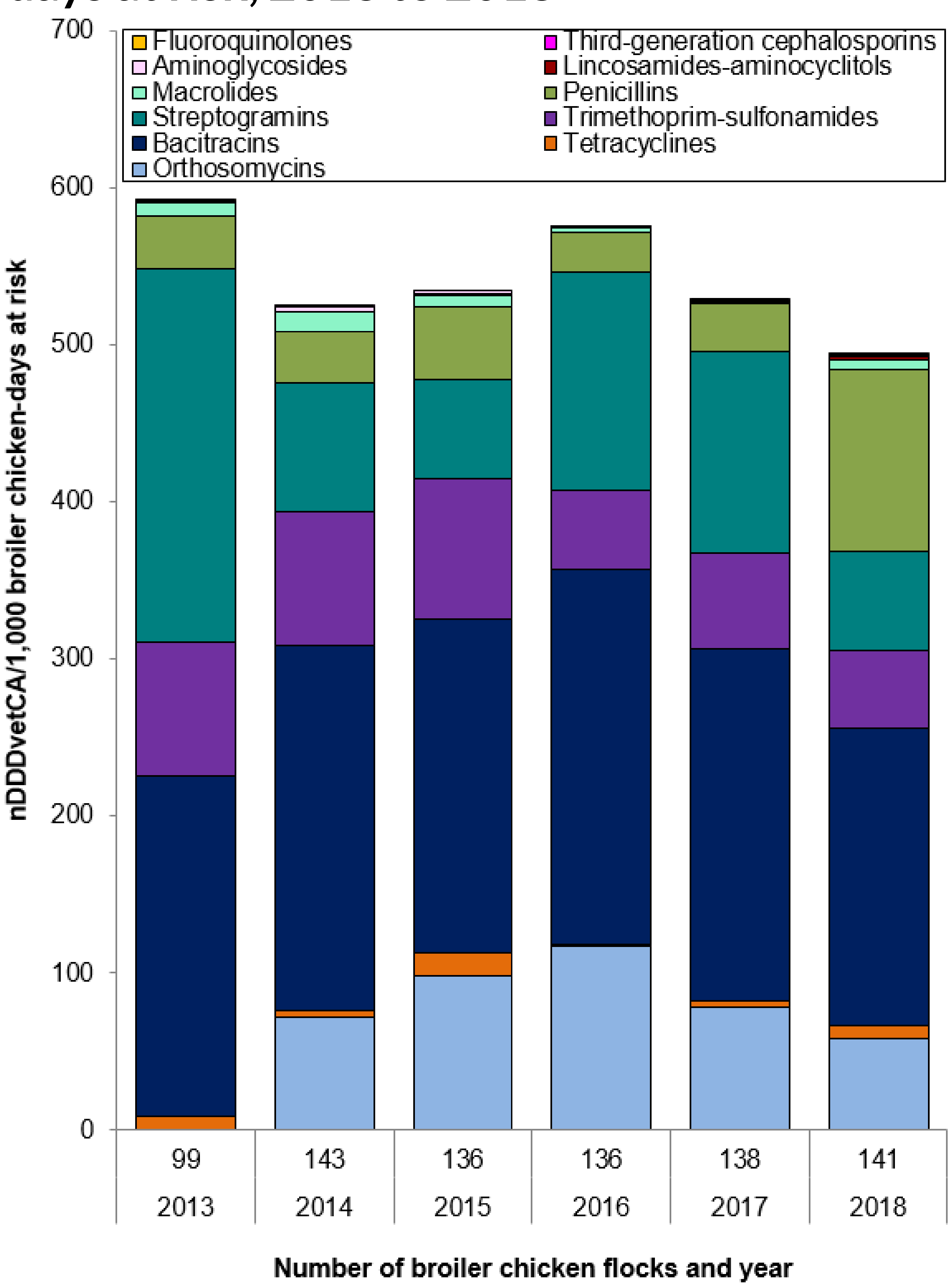
## BROILER CHICKENS

Overall (nationally), farm surveillance showed a **reduction in antimicrobial use** in 2018 compared with 2017 data in broiler chickens. The two most commonly reported classes of antimicrobials used in broilers were bacitracins (**Category III**) and penicillins (**Category II**).

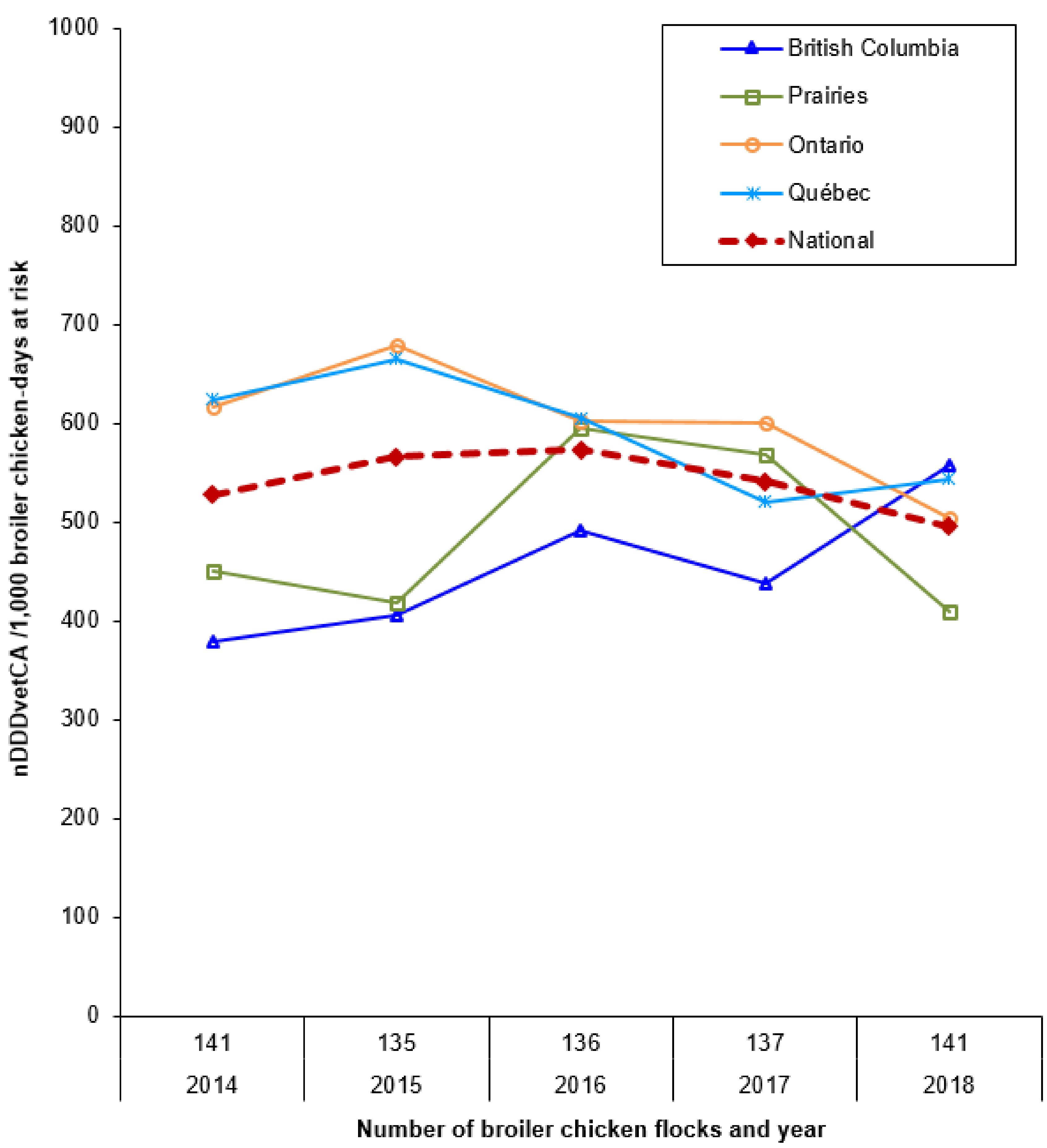
There were regional differences in the number of doses of antimicrobials administered. Compared to 2017:

- The Prairies and Ontario **decreased** their overall AMU.
- There was an **increase** in overall AMU in flocks from British Columbia and Québec.

**Temporal trends in nDDDvetCA/1000 chicken-days at risk, 2013 to 2018**




**Temporal trends in nDDDvetCA/1000 chicken-days at risk, by province/region, 2014 to 2018**



# TEMPORAL TRENDS IN ANTIMICROBIAL USE

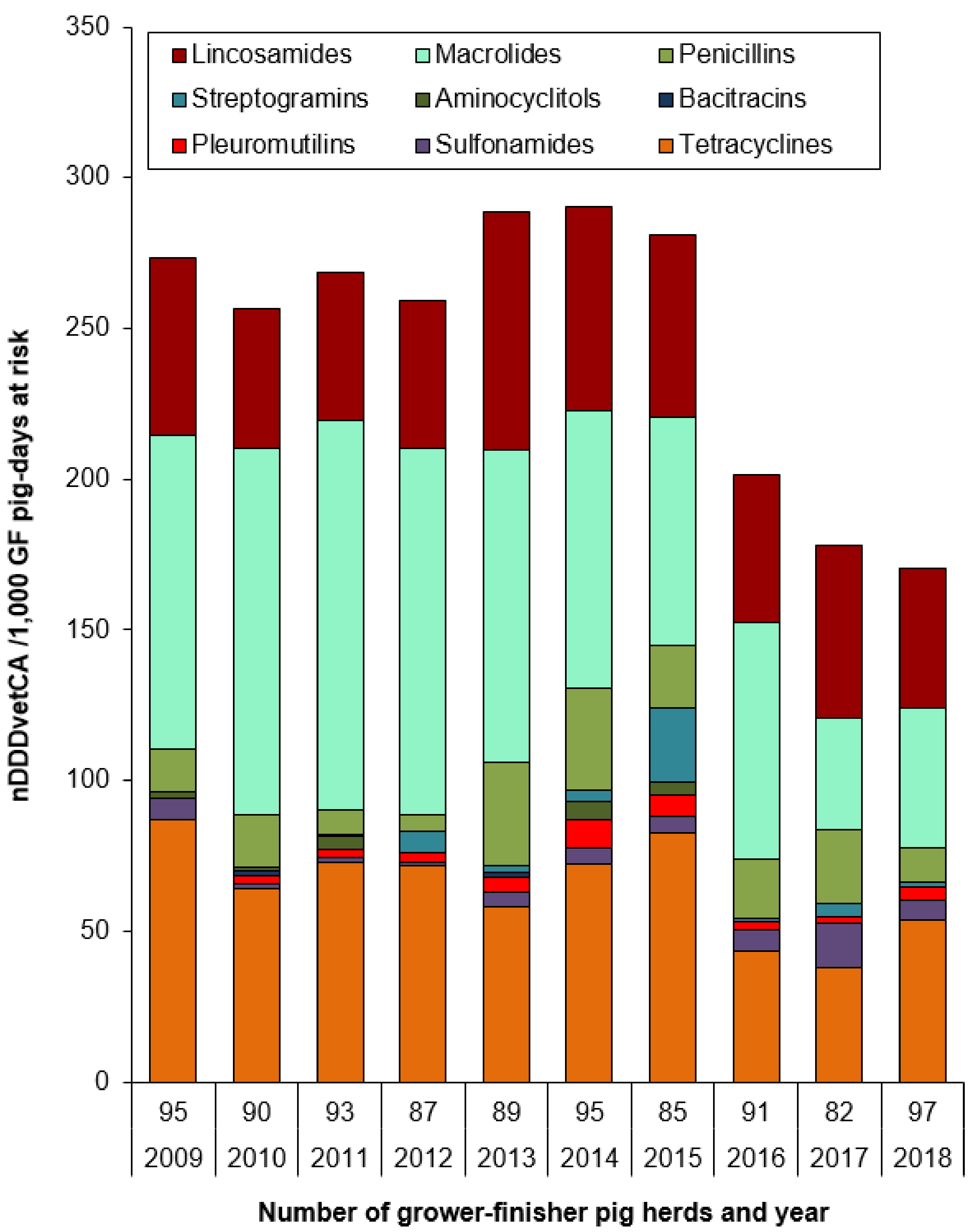
## GROWER-FINISHER PIGS

Farm surveillance showed a **decrease** in antimicrobials used in feed (nDDDvetCA/1000 grower-finisher pig-days at risk) between 2014 and 2018. The most commonly reported classes of antimicrobials used in pigs included tetracyclines (**Category III**) , lincosamides (**Category II**), and macrolides (**Category II**).

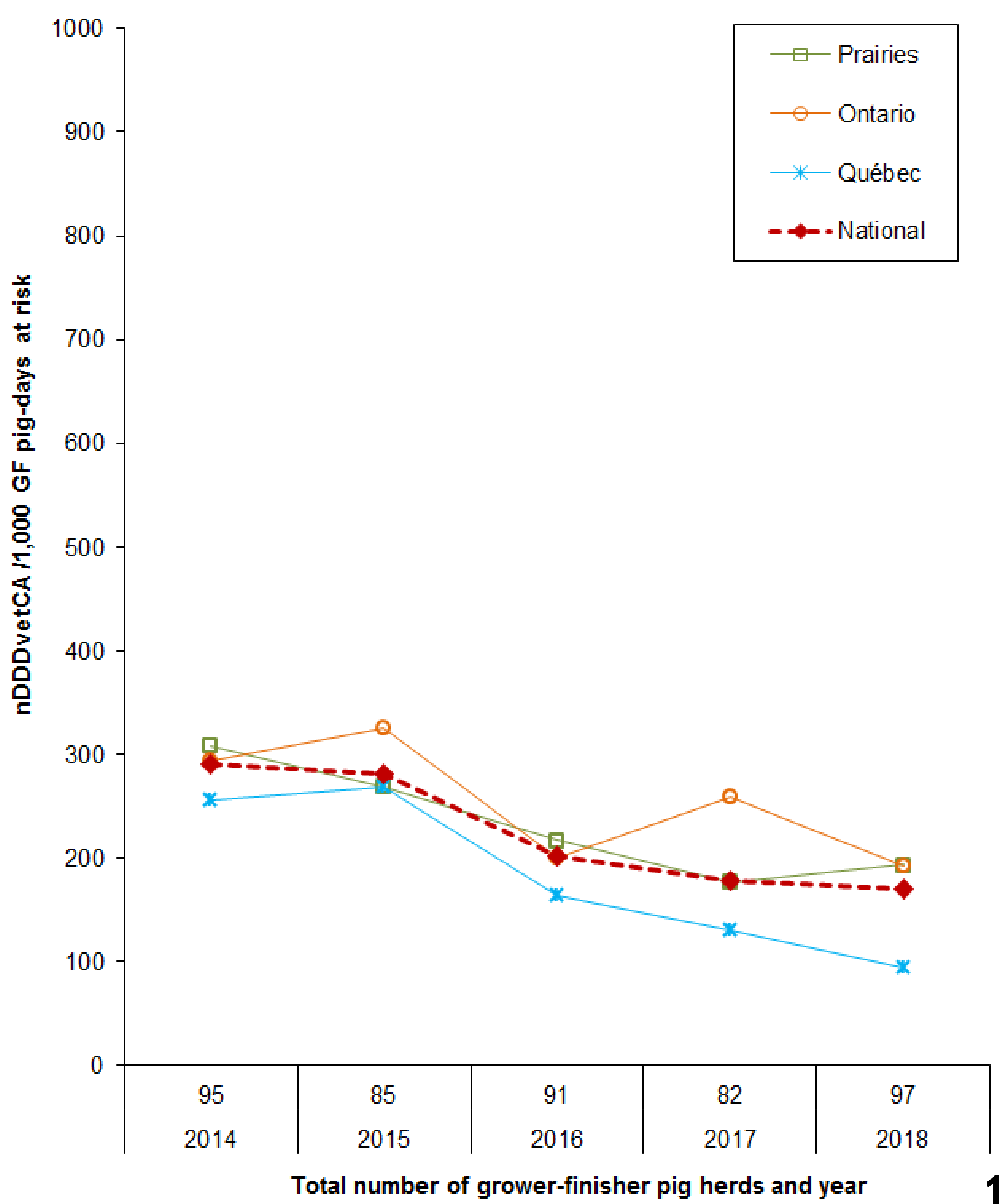
There were regional differences in the quantity and the number of doses of antimicrobials administered through feed over a grower-finisher feeding period. Compared to 2017:

- Québec and Ontario herds **decreased** their overall AMU in feed.
- There was an **increase** in overall AMU in feed in herds from the Prairies.

**Temporal trends in nDDDvetCA/1000 GF pig-days at risk, 2009 to 2018**




**Temporal trends in nDDDvetCA/1000 GF pig-days at risk for antimicrobials administered in feed, 2014 to 2018**



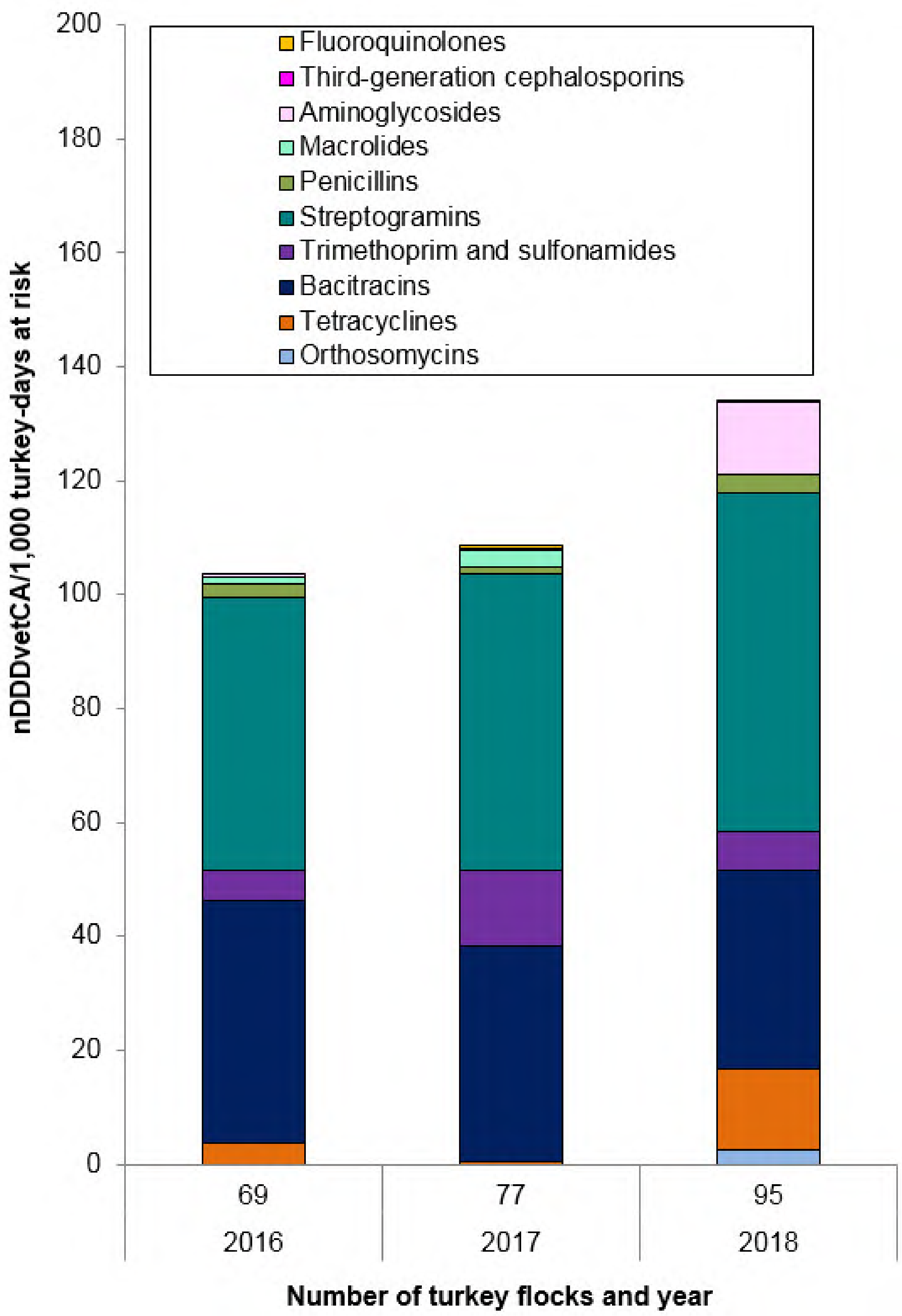
# TEMPORAL TRENDS IN ANTIMICROBIAL USE

## TURKEYS

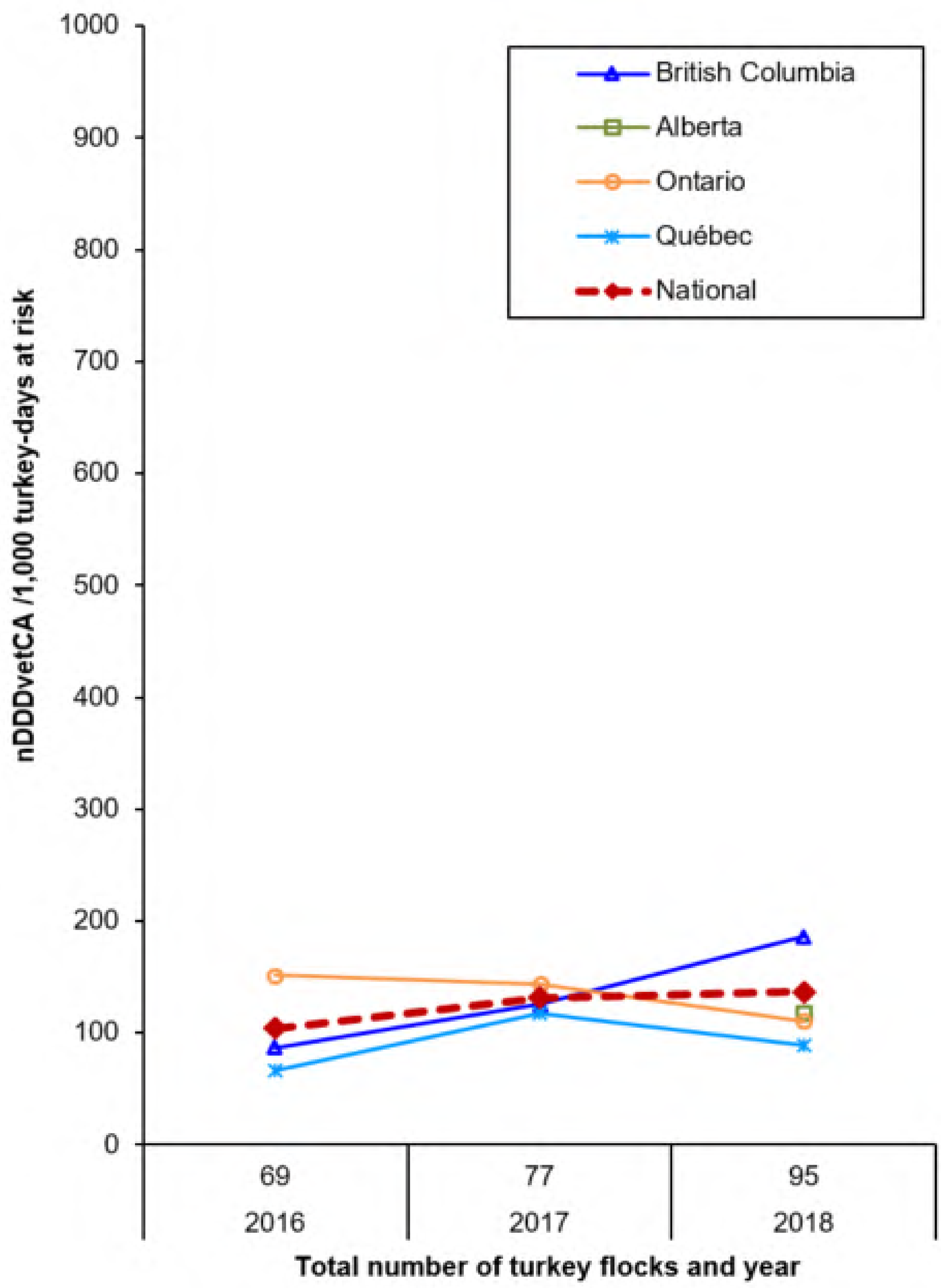
In 2018, the overall reported antimicrobial use in turkeys **increased**. The top reported classes of antimicrobials used in turkeys included streptogramins (**Category II**) and bacitracins (**Category III**). Compared to 2017:

- Ontario and Québec flocks **decreased** their overall AMU.
- There was an **increase** in overall AMU in flocks from the British Columbia.

**Temporal trends in nDDDvet per 1000 turkey-days at risk in Canada, 2016 to 2018**



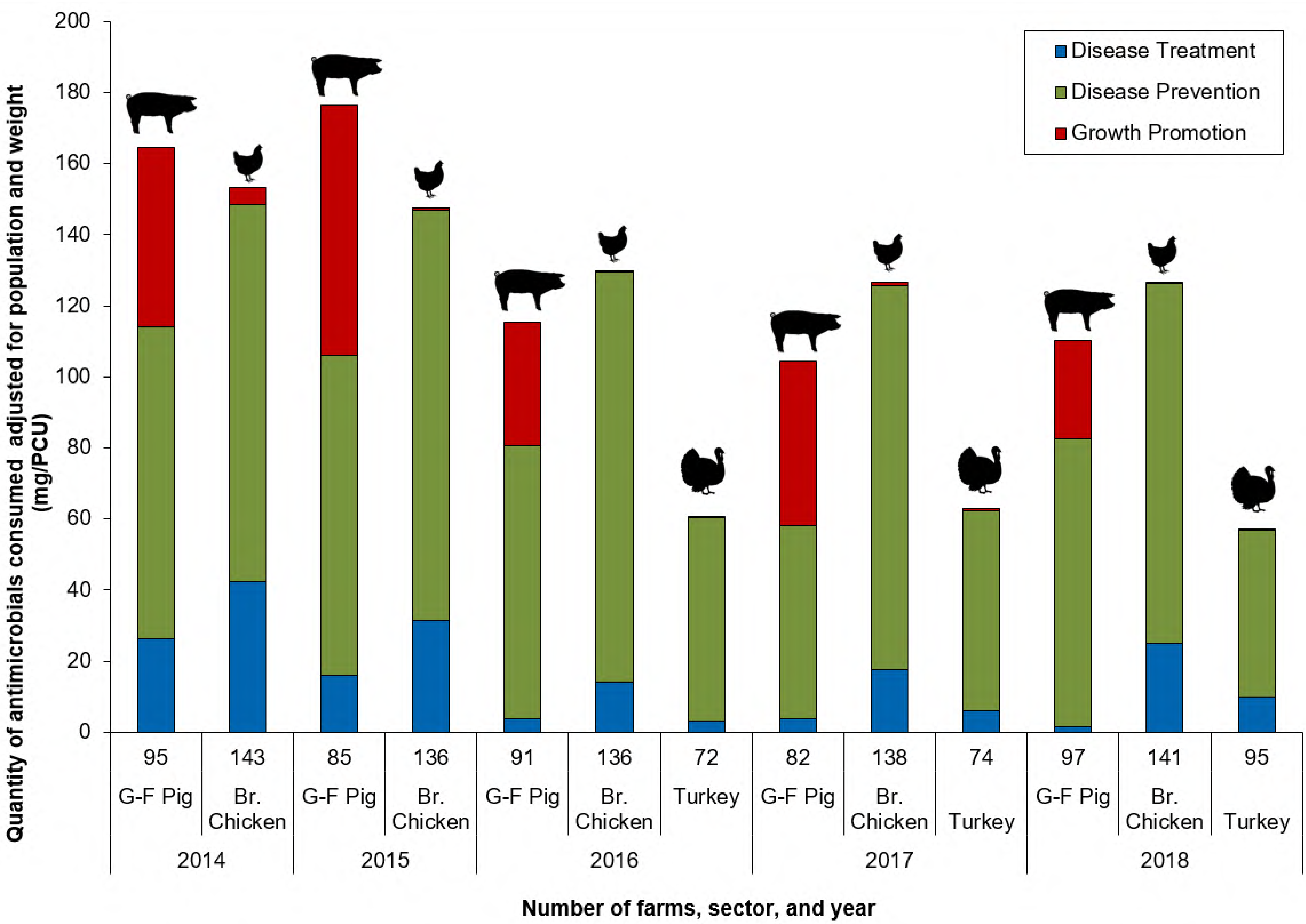

**Temporal trends in nDDDvet per 1000 turkey-days at risk in Canada, by province/region, 2016 to 2018**



# REASONS FOR ANTIMICROBIAL USE

- In broiler chickens (Br. Chicken), turkeys, and grower-finisher pigs (G-F Pig), the predominant reason for administering antimicrobials was for **disease prevention**.
- In grower-finisher pigs, there continues to be reported use of antimicrobials for growth promotion.

**Quantity of antimicrobials used (mg/PCU) by reason for use; CIPARS Farm 2014 to 2018**

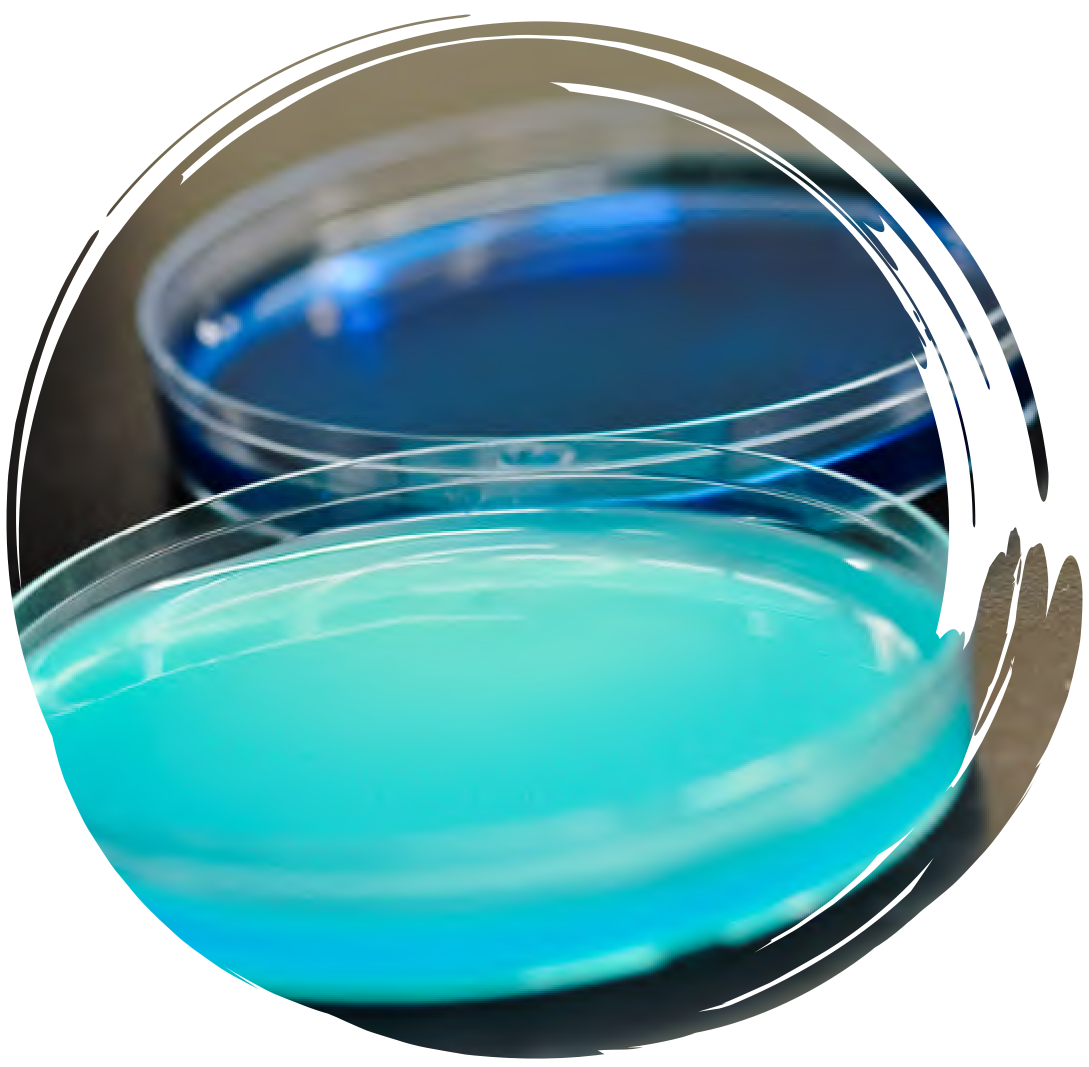



Note: Swine data are for antimicrobial use in feed only; chicken and turkey data include all routes of administration.

# Integrated Antimicrobial Resistance Data

In this section, we highlight **two resistance stories** for 2018:

1. The detection of quinolone-resistant *Salmonella* Enteritidis from chicken.



2. The increase in highly drug-resistant *Salmonella* from human and agri-food sources.

In 2018, CIPARS tested for resistance to **7 classes of antimicrobials.**

Although there is no international standard for defining highly resistant isolates, CIPARS considers isolates which have resistance to 6 or more classes of antimicrobials to be **highly drug resistant.**

# DETECTION OF QUINOLONE RESISTANCE IN *SALMONELLA* ENTERITIDIS FROM CHICKEN

In 2018, a clear **increase** in nalidixic acid (a quinolone) resistance among *S.* Enteritidis from chickens occurred across **several surveillance components from multiple provinces.**

## RETAIL

1 isolate from a chicken burger in British Columbia (FoodNet Canada)

## RETAIL

1 isolate from Alberta

***Not previously observed***

## ABATTOIR

2 isolates from Ontario and Québec

***Not previously observed***

## CLINICAL CASES

2 isolates from Ontario (sick chicken)

*Previously observed in a single isolate in Manitoba (2010)*

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

From 2003 to 2018, nalidixic acid resistance was only observed in a **single isolate** from a sick chicken (clinical isolate) from Manitoba in 2010.

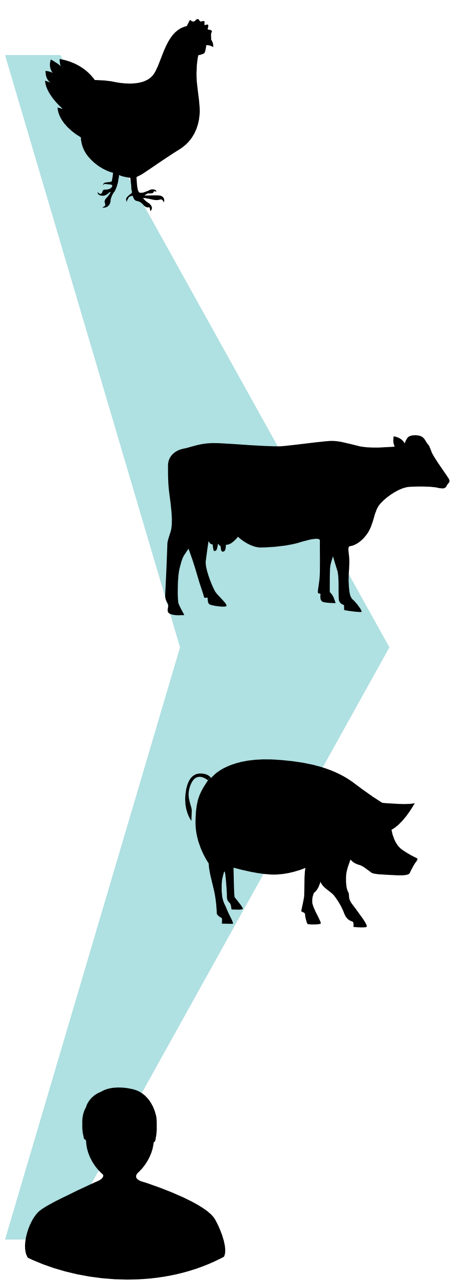
Most *S.* Enteritidis from people were susceptible to all antimicrobials tested. When resistance did occur, it was most commonly to **nalidixic acid** and these human cases may be related to travel outside of Canada.

**This may be a new source of human exposure to nalidixic acid-resistant *S.* Enteritidis in Canada. This unprecedented and sudden increase in chickens and chicken meat will be monitored closely by CIPARS.**

# HIGHLY DRUG-RESISTANT *SALMONELLA*

- The number of highly resistant *Salmonella* isolates have **increased** substantially since 2008 in both human and animal sources.
- 2018 was the **first time** where highly resistant *Salmonella* were isolated from a chicken source.
- Despite a slight decrease in 2017, a substantial increase in the number of highly resistant *Salmonella* occurred in 2018 to levels not previously observed by CIPARS.

## In 2018, 132 *Salmonella* isolates were identified as highly drug resistant from the following sources:



**Chicken**

- All highly resistant isolates from chicken were from retail samples (from chicken burgers) from British Columbia, the Prairies, and Ontario.
- All isolates were ***S.* Infantis.**

**Cattle**

- Sick cattle (clinical isolates).
- Most isolates were ***S.* Dublin**.

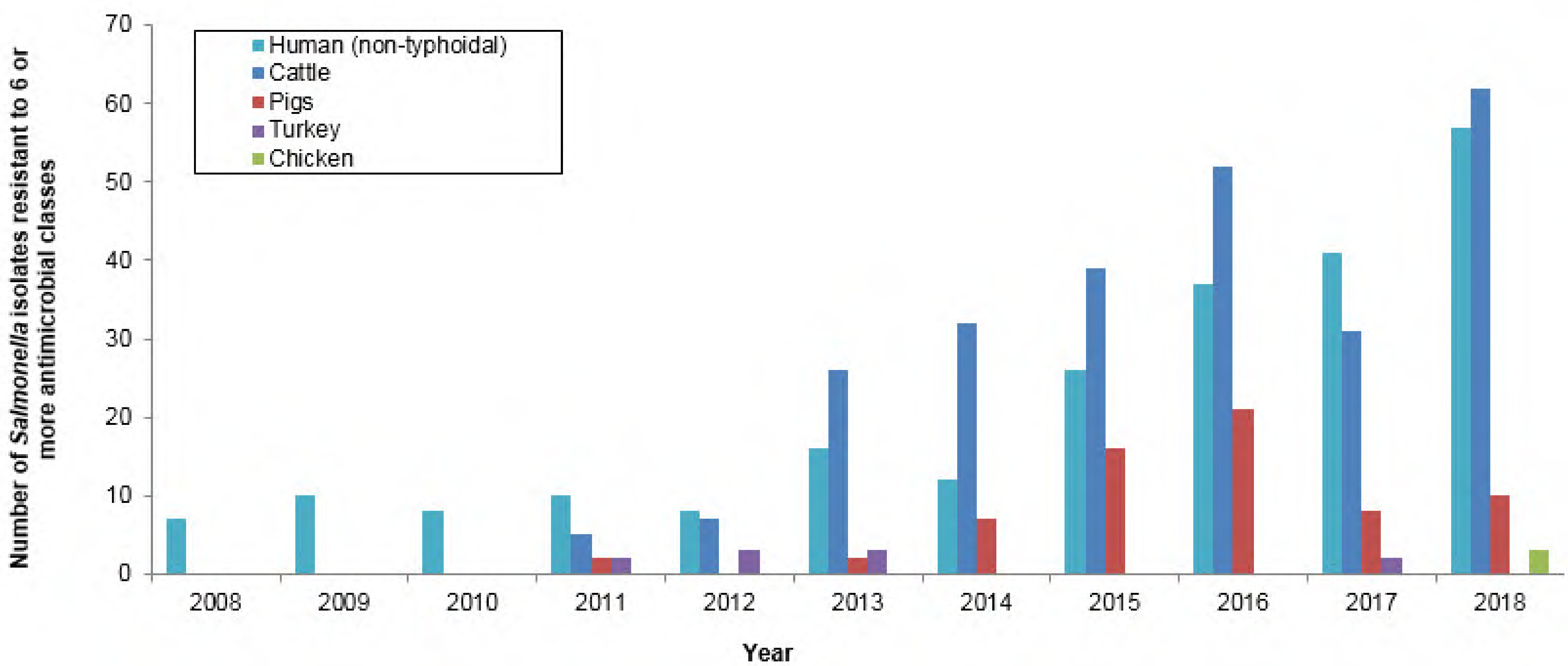
**Swine**

- Sick pigs (clinical isolates).
- Some isolates demonstrate resistance to **all 7 classes** of antimicrobials tested.
- Four serovars were detected.

**Human**

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

**Number of *Salmonella* isolates resistant to 6 or more antimicrobial classes from 2008 to 2018**



# Integrated Antimicrobial Use and Resistance Data

In this section, we highlight **two integrated antimicrobial use and resistance stories** for 2018:

1. Fluoroquinolone-resistant *Campylobacter*

2. Ceftriaxone resistance in non-typhoidal *Salmonella* and generic *E. coli*

# FLUOROQUINOLONE-RESISTANT *CAMPYLOBACTER*

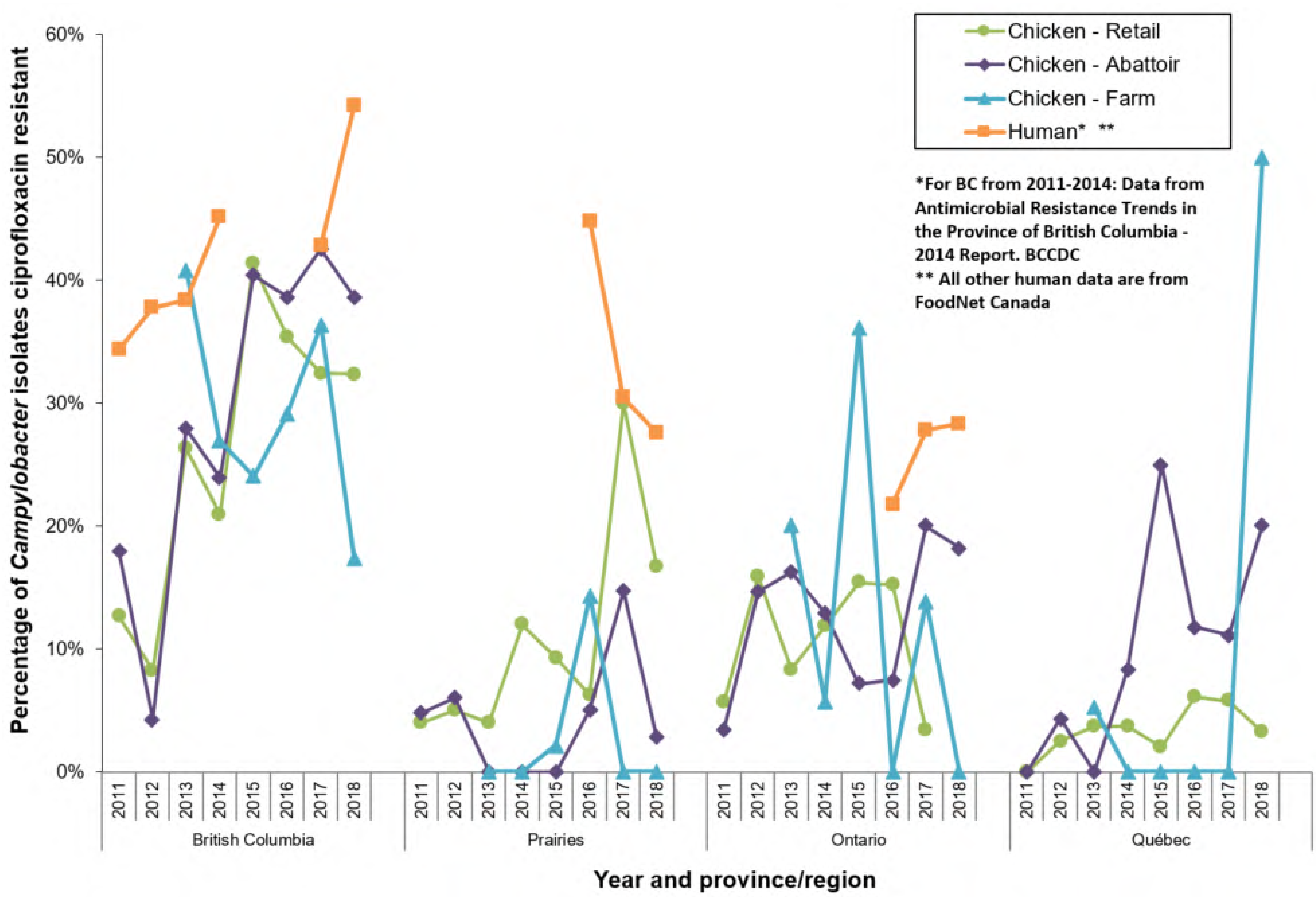
- In 2018, **one flock** from **British Columbia reported using a fluoroquinolone for disease treatment**. Since 2014, there was no reported fluoroquinolone use on sentinel broiler chicken farms.

- In general, the highest proportion of ciprofloxacin-resistant *Campylobacter* continued to be from British Columbia. However, resistance from chicken(s) continued to vary over time and across regions.

In British Columbia, ciprofloxacin-resistant *Campylobacter* from chickens on farm **decreased** to 17% (8 out of 46 isolates were resistant).

In Québec, ciprofloxacin-resistant *Campylobacter* from chickens on farm **increased** to 50% (8 out of 16 isolates were resistant).

**Ciprofloxacin resistance in *Campylobacter* isolates over time and between regions; CIPARS 2011 to 2018**



# CEFTRIAXONE RESISTANCE IN NON-TYPHOIDAL *SALMONELLA* AND GENERIC *E. COLI*

Since 2015, there has been **no reported ceftiofur use** in sentinel broiler chicken flocks, as well as **reduced ceftriaxone resistance** in both *E. coli* and *Salmonella* from chickens and chicken meat in most scenarios.

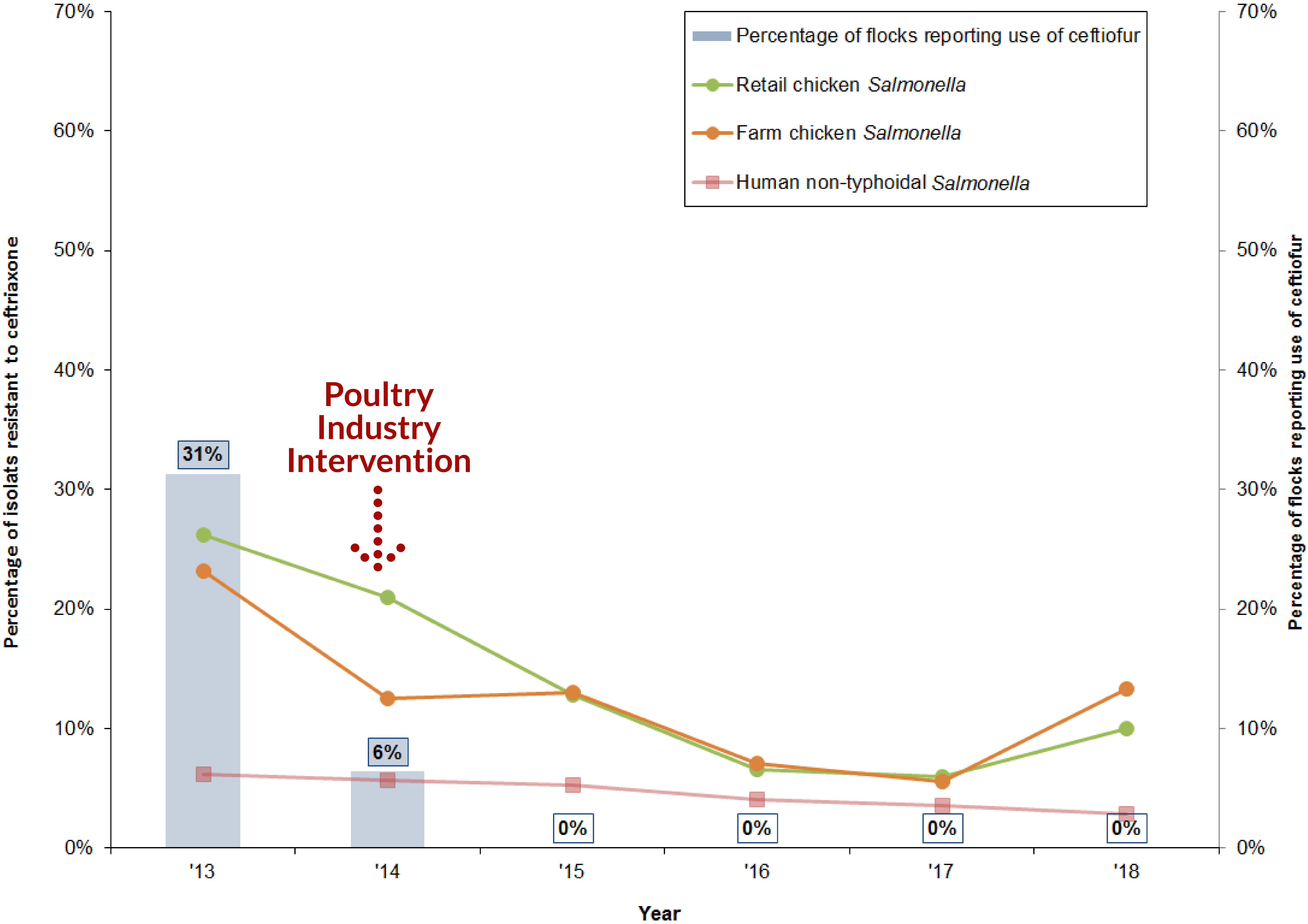
Previously, ceftriaxone-resistant *Salmonella* in humans were primarily serovar Heidelberg isolates. However, in 2018, the majority of resistant isolates were serovar Infantis, followed by serovar Heidelberg.

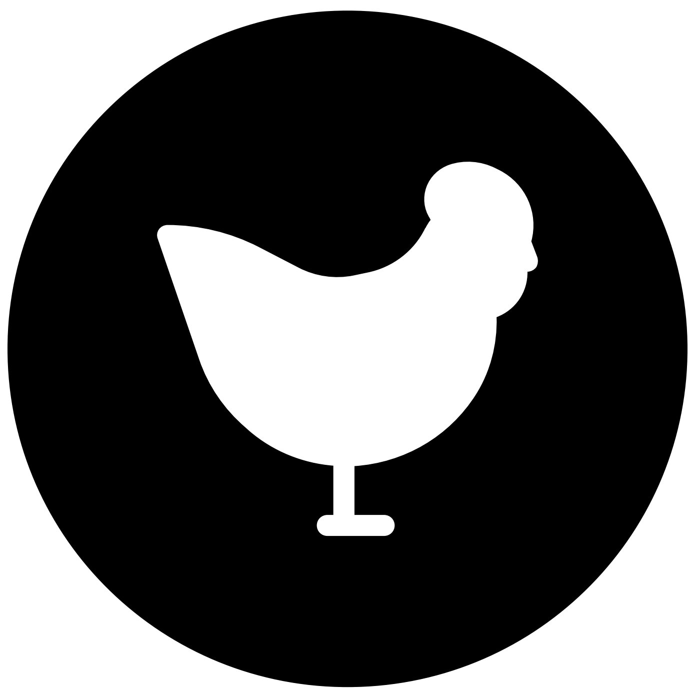
In 2018, ceftriaxone resistance in *S.* Infantis **decreased** to 15%, compared to 17% in 2017. Ceftriaxone resistance in *S.* Heidelberg also **decreased** to 7% compared to 12% in 2017.

Overall, ceftriaxone resistance in *Salmonella* and *E. coli* isolates from chicken sources remained relatively stable or decreased after the 2014 initiative to eliminate the use of **Category I** antimicrobials for disease prevention. Most *Salmonella* isolates were *S.* Kentucky, followed by *S.* Heidelberg and *S.* Infantis.

However, there were some increases in ceftriaxone resistance in 2018 compared to 2017 data. This is most notable in *Salmonella* isolated from **chickens at the farm level**.

**Reduction in reported use of ceftiofur on sentinel farms and changing resistance to ceftriaxone in non-typhoidal *Salmonella* from humans and chicken sources between 2013 and 2018**



The reduction in ceftiofur use and associated decrease in ceftriaxone resistance compared to pre-2014 data in chickens and humans is a good example of a successful intervention to limit antimicrobial resistance.

# What's New for CIPARS in 2018

We are modernizing how we share our information with different audiences and are transitioning to new communication tools and formats. In the meantime, CIPARS will continue to deliver the same information, but in a modified manner.

For the 2018 data, we will be releasing 4 documents:

- Executive Summary
- Figures and Tables (summarized information with little accompanying text)
- Design and Methods
- Integrated Findings

## ANTIMICROBIAL USE

- Data collected under legislation by Health Canada from veterinary pharmaceutical manufacturers, importers, and compounders for 2018 is currently being analyzed. Results will be released as a separate report in Spring of 2020.

- In 2018, grower-finisher pig quantitative antimicrobial use metrics were reported for the first time for antimicrobial use in water and injectables.

- As of 2018, the antimicrobial use metric nDDDvet/PCU  was no longer be reported.

## ANTIMICROBIAL RESISTANCE

- There was no placement broiler chicken sampling conducted in 2018.

- For farm surveillance, sampling in turkeys was initiated in Alberta.

- Only a partial year of retail sampling was conducted in Ontario and the Prairies, and no sampling occurred in the Atlantic region; therefore, no temporal retail data from these regions are presented in 2018.

In addition to the changes described above, we launched two sentinel farm surveillance activities in **feedlot and dairy cattle** with our stakeholders.


**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 consumption 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.

**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.

**Non-typhoidal *Salmonella*:** All *Salmonella s*erovars, excluding *S.* Typhi, and Paratyphi A and B.

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

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