Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

2017 Integrated Findings

CIPARS Canadian Integrated Program for Antimicrobial Resistance Surveillance

Programme intégré canadien de surveillance de la résistance aux antimicrobiens PICRA

Gouvernement du Canada Government of 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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QUESTIONS?

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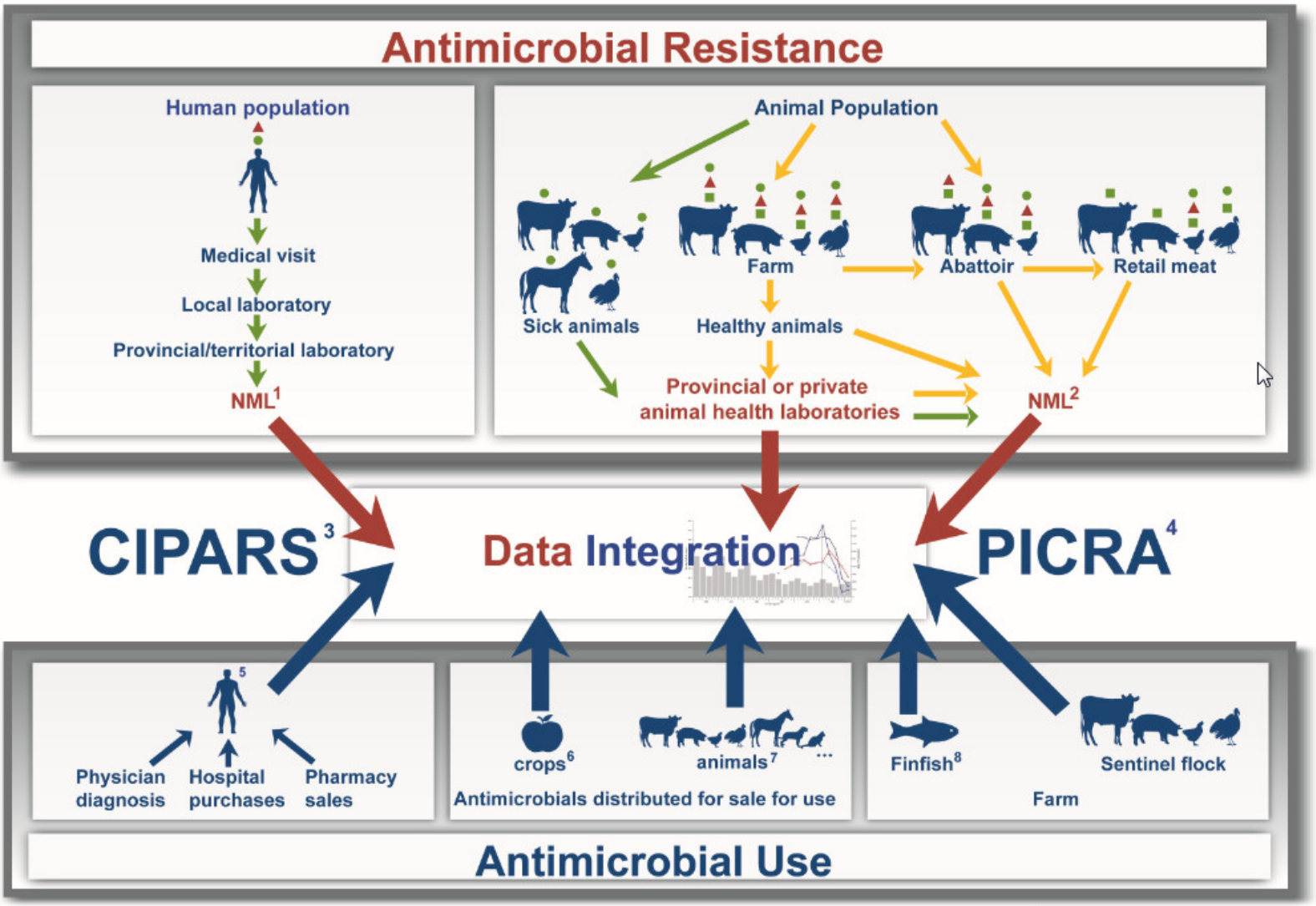
https://www.canada.ca/en/public-health/services/surveillance/canadian-integrated-program-antimicrobial-resistance-surveillance-cipars.html

CIPARS Figures & Tables 2017 (link pending)

CIPARS Methodology (link pending)

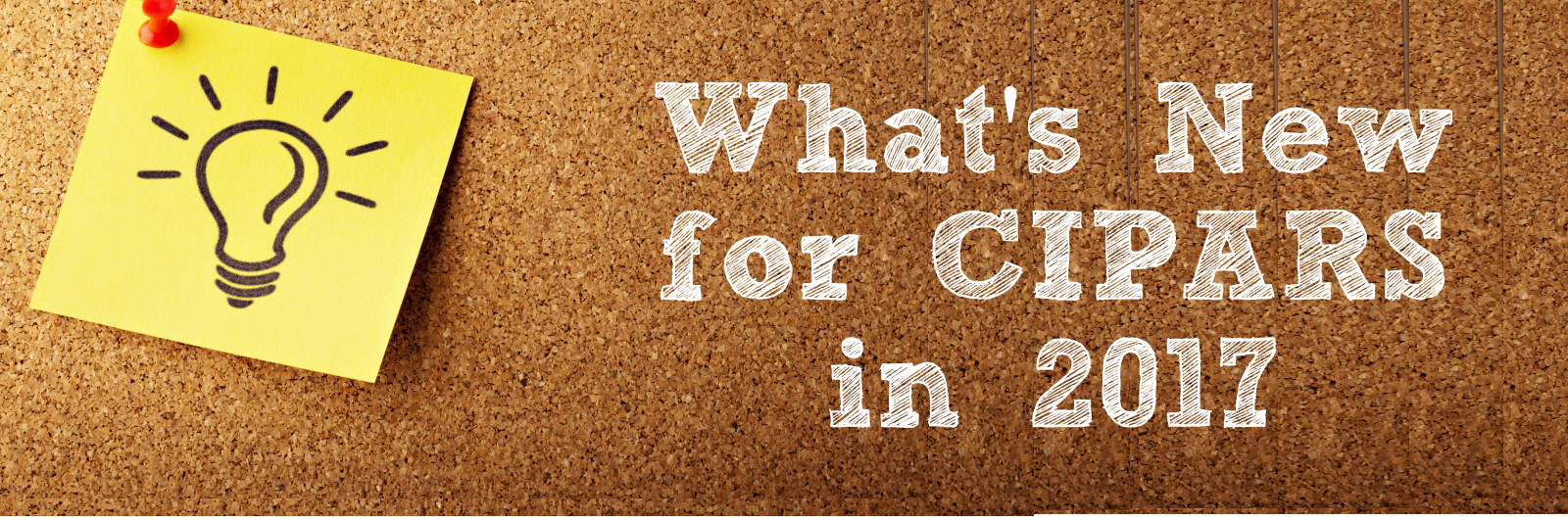
The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

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 Saint-Hyacinthe (Québec)
3 Canadian Integrated Program for Antimicrobial Resistance Surveillance, PHAC
4 Programme intégré canadien de surveillance de la résistance aux antimicrobiens, Agence de la santé publique du Canada
5 Canadian Antimicrobial Resistance Surveillance System (CARSS), PHAC
6 Pest Management Regulatory Agency, Health Canada
7 Canadian Animal Health Institute (CAHI); Veterinary Antimicrobial Sales Reporting, Health Canada/ PHAC
8 Fisheries and Oceans Canada

Active Surveillance
Passive Surveillance
Salmonella
Campylobacter
Escherichia coli



What's New for CIPARS in 2017

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 2017 data, we will be releasing 4 documents:

- 2017 Executive Summary
- 2017 Figures and Tables (summarized information with little accompanying text)
- 2017 Design and Methods
- 2017 Integrated Findings

Details about the innovative communication products will be discussed with stakeholders in the Fall of 2019.

ANTIMICROBIAL RESISTANCE

- Only a partial year of retail sampling was conducted in Ontario and the Prairies, and no sampling occurred in the Atlantic region.
- Sampling for *Campylobacter spp.* from retail ground turkey was discontinued due to low recovery.

ANTIMICROBIAL USE

- Fisheries and Oceans Canada provided data on antimicrobial use in marine and freshwater finfish aquaculture.

2017 Key Findings

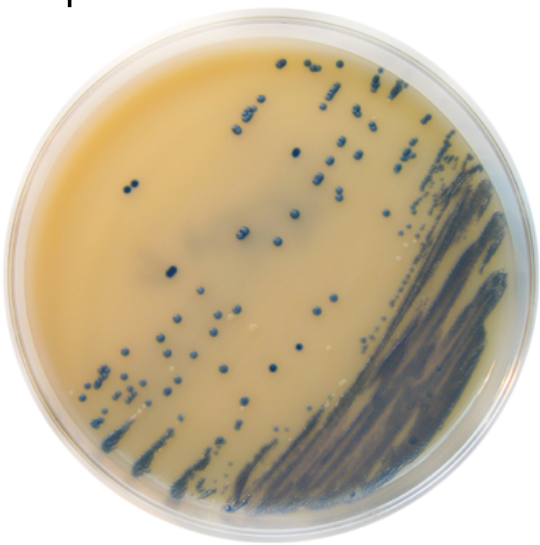
01 ANTIMICROBIAL USE (AMU)

- Antimicrobial sales decreased between 2016 and 2017
- For broiler chicken and pig farms participating in CIPARS surveillance, the overall reported quantity of antimicrobials used declined. For turkey farms participating, there was a small increase in the overall reported use
- The types of antimicrobials used varied by animal species
- Based on sentinel farm data, antimicrobial use in turkeys was generally lower than antimicrobial use in broiler chickens

In 2017, fewer farms participating in CIPARS surveillance reported using antimicrobials.

The reductions in antimicrobial use on broiler chicken and pig farms may be in response to new policy regulations for medically important antimicrobials (eliminating use for growth promotion and available by prescription only).

02 ANTIMICROBIAL RESISTANCE (AMR)



Since 2011, we have observed an increasing number of human and agri-food isolates resistant to more than 5 antimicrobial classes.

03 INTEGRATED AMU AND AMR DATA
CHICKEN AND PEOPLE

Ceftiofur Use in Poultry

The poultry industry initiative to eliminate use of Category I antimicrobials (including the 3rd generation cephalosporin **ceftiofur**) for disease prevention appears to have had the desired effect to reduce AMR.

- There has been no reported ceftiofur use in broiler chickens since 2015.
- There has been a reduction in resistance in both *E. coli* and *Salmonella* recovered from chickens on farm, at slaughter, and in chicken purchased at grocery stores.
- Importantly, in *Salmonella* isolates recovered from people, resistance to the third generation cephalosporin **ceftriaxone** also declined.

Campylobacter

There are currently regional differences in the prevalence of fluoroquinolone-resistant *Campylobacter* from chicken and chicken meat.

In 2017, resistance to ciprofloxacin was more commonly identified in human *Campylobacter* isolates and retail chicken from British Columbia compared to Alberta and Ontario.

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:

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: aminoglycosides, tetracyclines

Category IV: Low importance

Examples: ionophores, chemical coccidiostats

Similar to 2016, 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.

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.

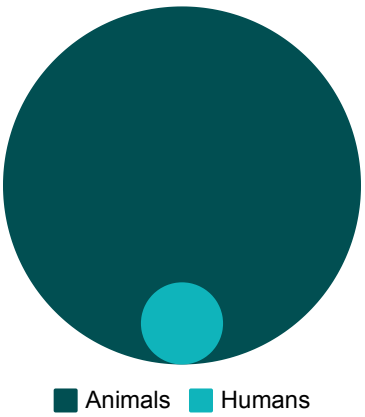



Comparing Humans, Animals, and Crops

Canada is a major producer of food animals for domestic and international markets.

~21x

MORE ANIMALS THAN PEOPLE IN CANADA IN 2017



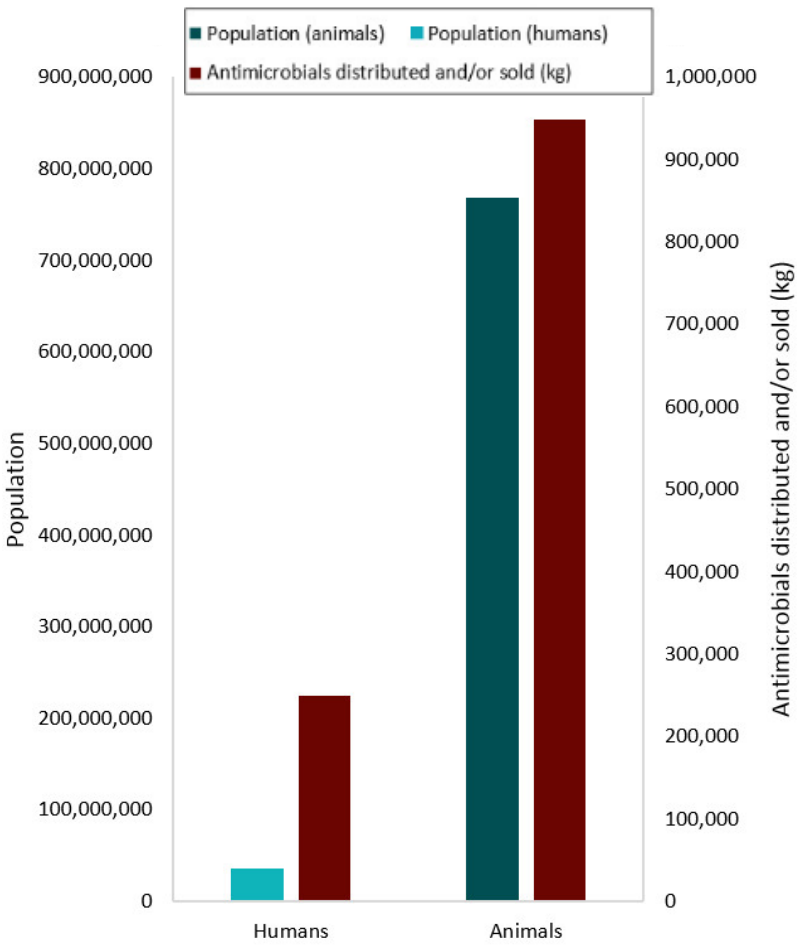
Note: This is an underestimation, as fish are not included in the animal estimate.

11%

REDUCTION IN TOTAL MG OF ANTIMICROBIALS (ADJUSTED BY BIOMASS) DISTRIBUTED FOR USE IN ANIMALS SINCE 2016.

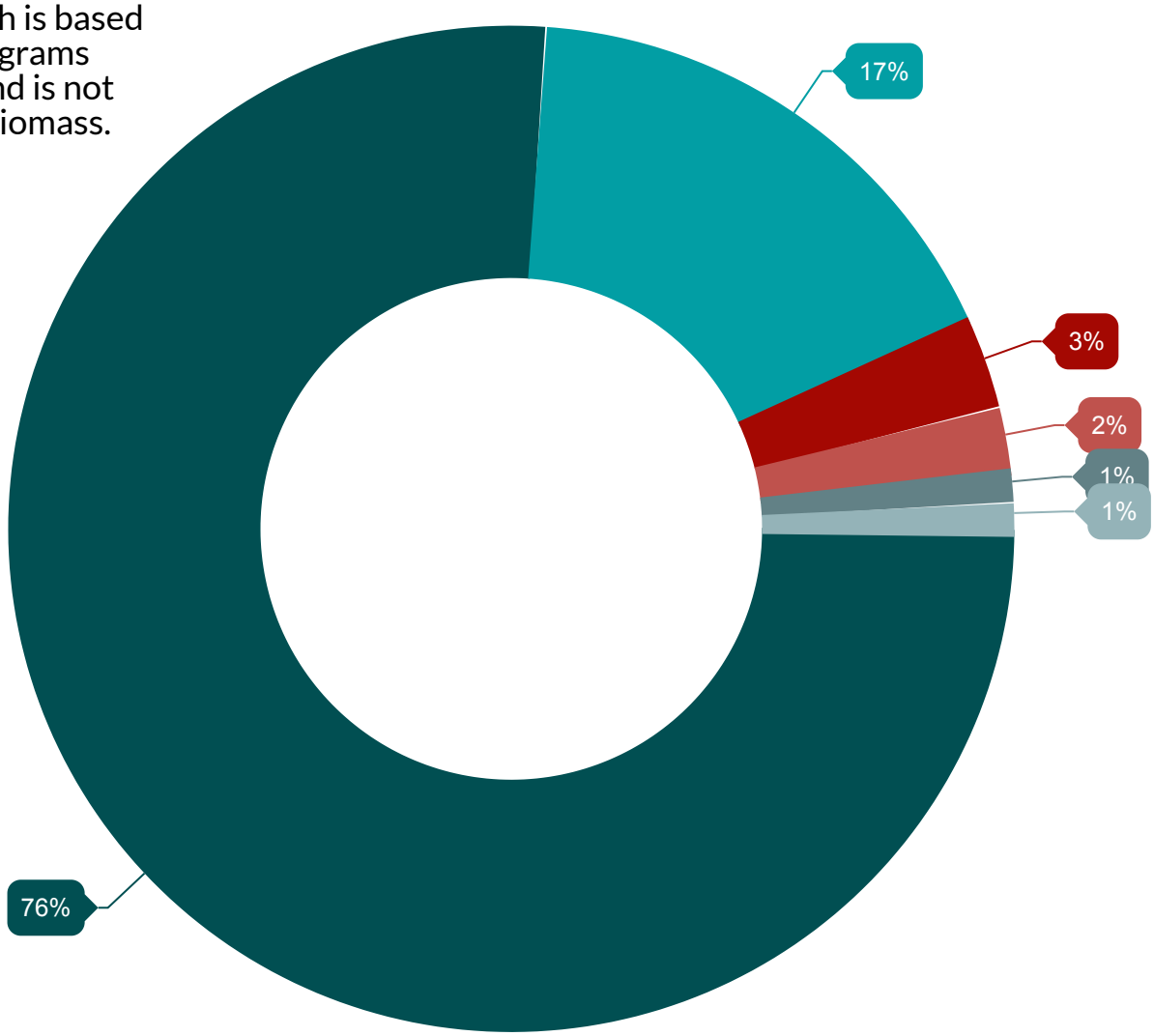
~1.5x

MORE ANTIMICROBIALS WERE DISTRIBUTED FOR USE IN ANIMALS THAN HUMANS AFTER ADJUSTING FOR UNDERLYING BIOMASS in 2017



Approximately 76% of antimicrobials distributed or sold* in 2017 were intended for production animals, 20% were for humans, 2% for crops and 1% for companion animals.

Note: This graph is based on total kilograms distributed and is not adjusted for biomass.



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

*When measured by kilograms of active ingredient

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.

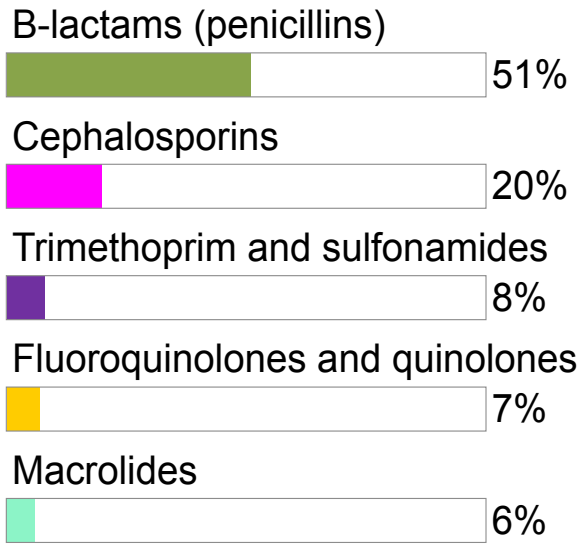
Similar antimicrobials are licensed for use in humans and animals; however, some antimicrobial classes are sold or distributed more for use in humans than animals and vice-versa.

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

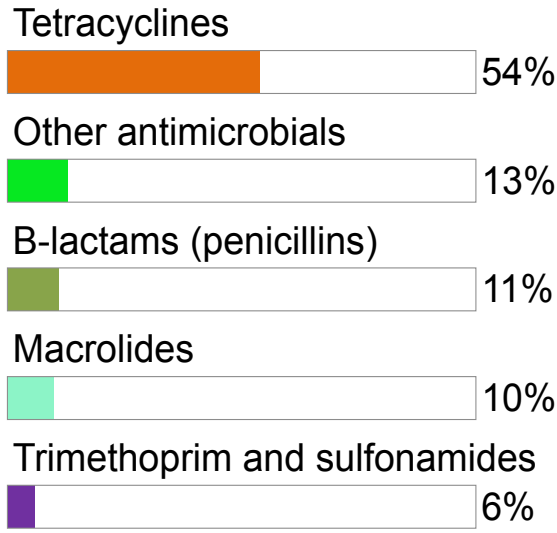
The relative quantity of cephalosporins and fluoroquinolones (Category I) intended for use in humans is higher compared to animals.

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

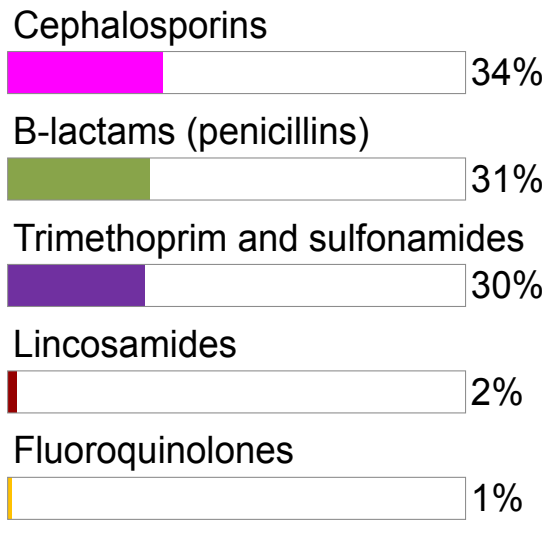
Humans



Production Animals

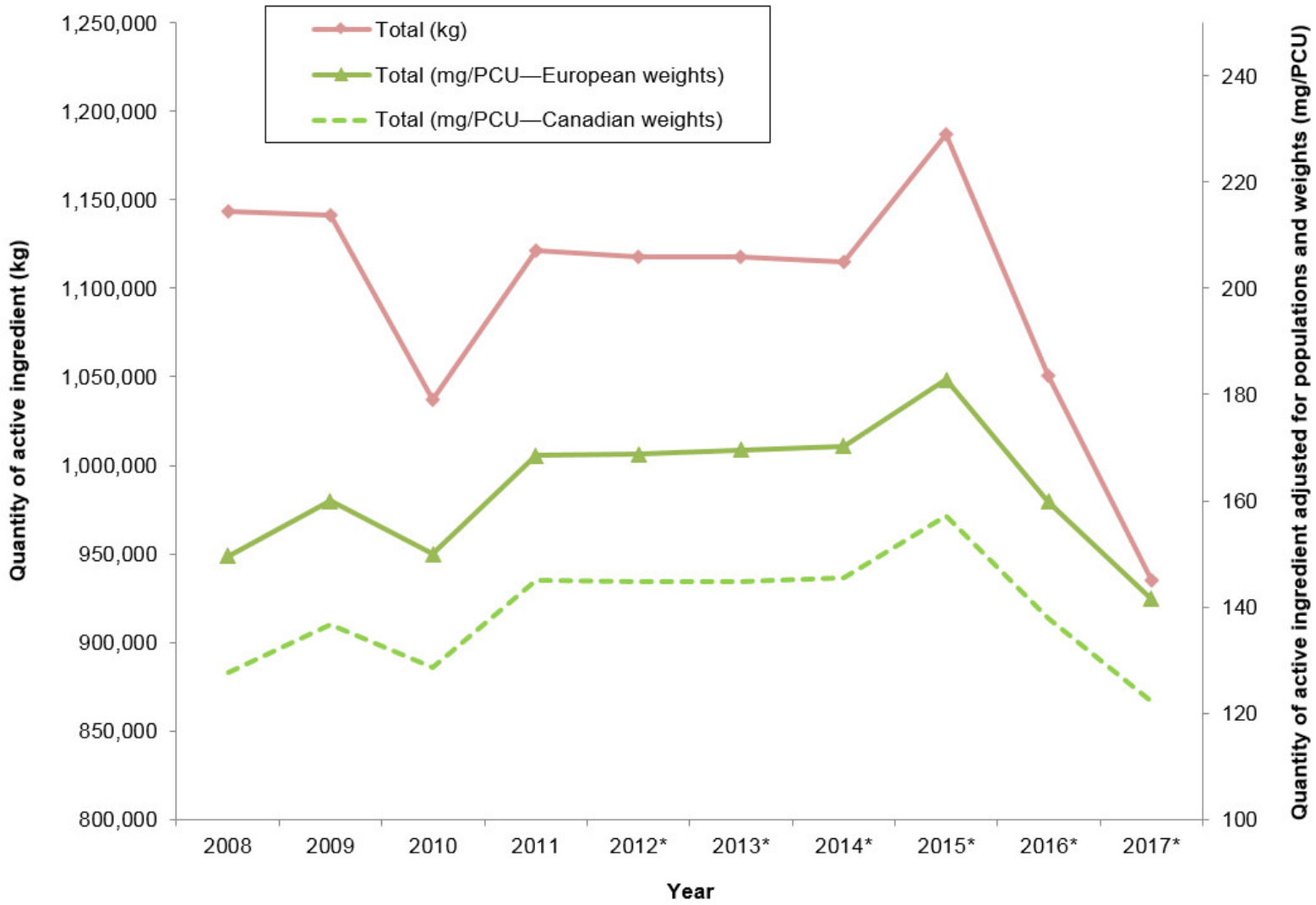


Companion Animals



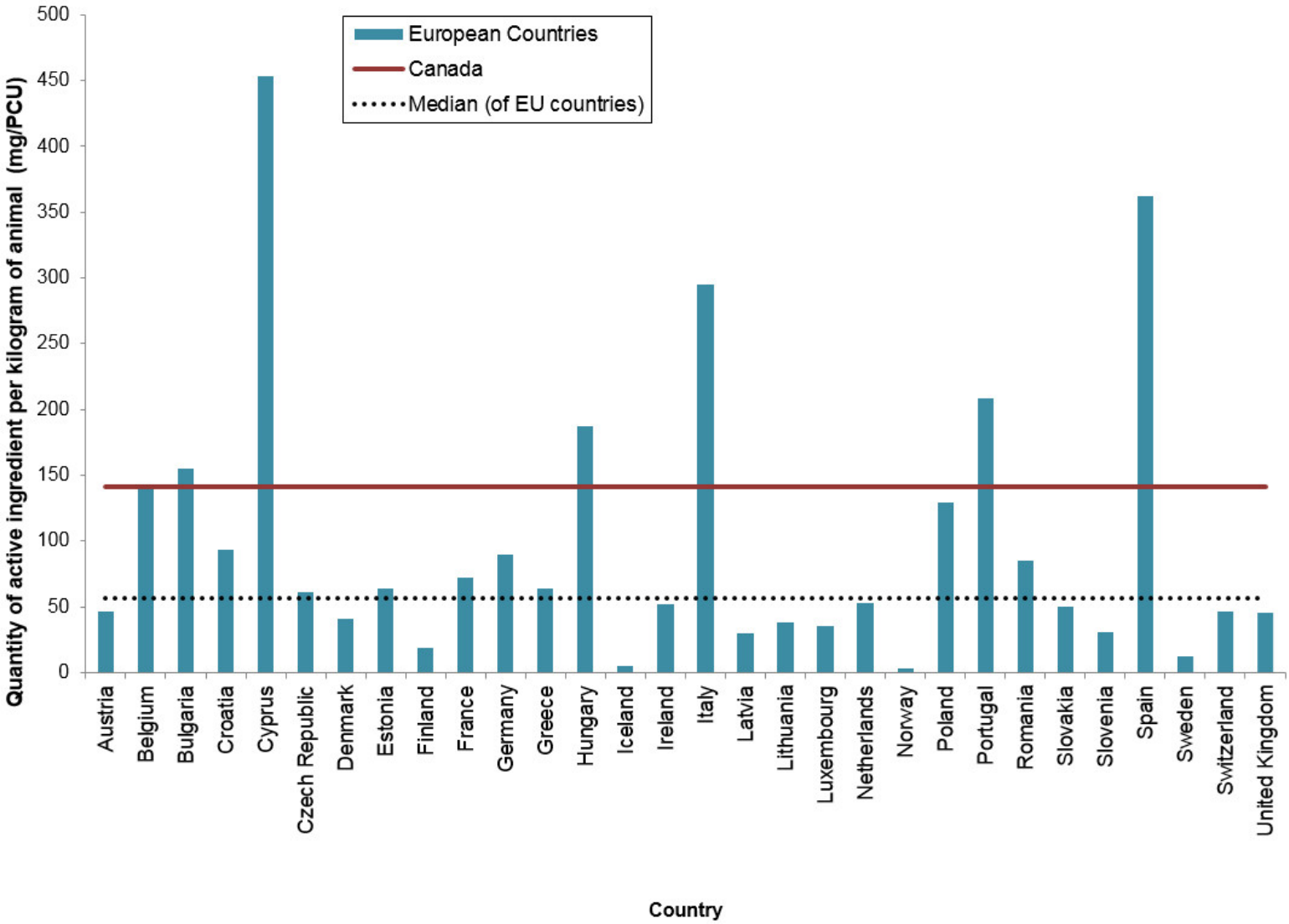
The total quantities of antimicrobials distributed for sale for use in production animals declined, both when measured in total kg and kg adjusted by biomass. These are the lowest reported values since surveillance began.

Quantities of antimicrobials distributed for use in animals.



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

Quantities of antimicrobials used (mg/PCU) by Canada (2017) and countries participating in the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) network (2016).

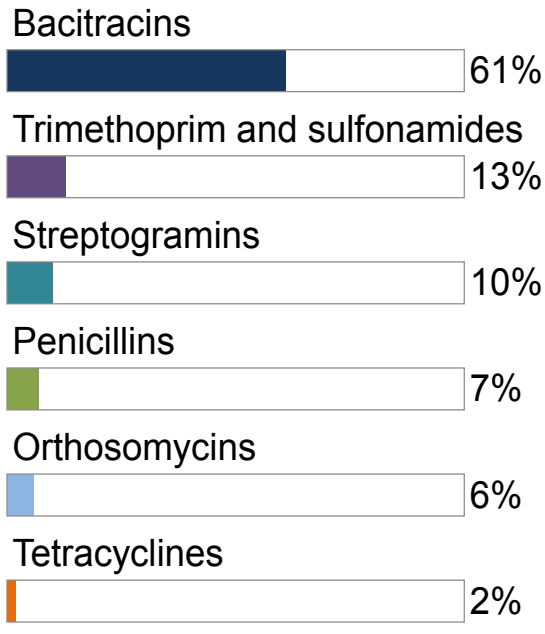


Data Sources (pgs. 6-10): Canadian Animal Health Institute (CAHI), European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), Fisheries and Oceans Canada, Health Canada's Pest Management Regulatory Agency, human pharmacy and hospital data from IQVIA via the Canadian Antimicrobial Resistance Surveillance System, Statistics Canada, Agriculture and Agri-food Canada, and Equine Canada

COMPARING FARM ANTIMICROBIAL USE DATA

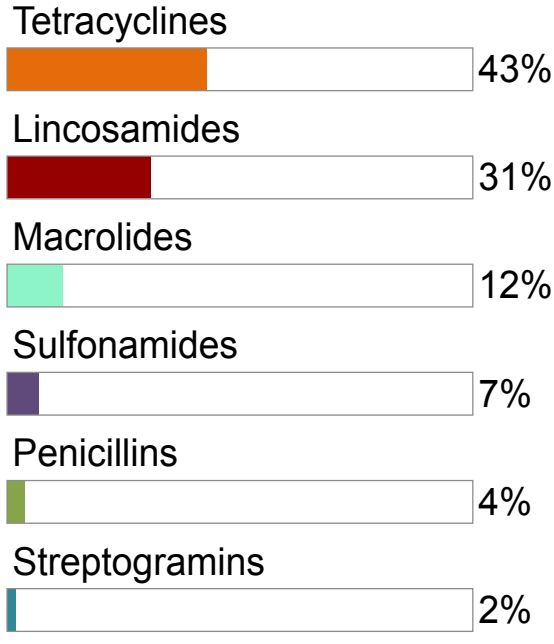
COMPARISON OF ANTIMICROBIAL CLASSES (kg of active ingredient)

BROILER CHICKENS



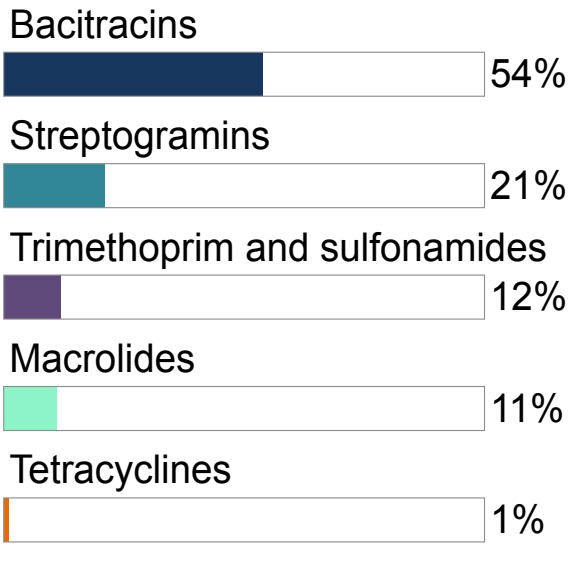
Not shown: macrolides (1%), aminoglycosides (1%), lincosamides-aminocyclitols (<1%)

GROWER-FINISHER PIGS



Not shown: pleuromutilins (1%)

TURKEYS



Not shown: penicillins (<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.

TEMPORAL TRENDS IN AMU

BROILER CHICKENS

Farm surveillance showed a reduction in antimicrobial use in 2017 compared with 2016 data in broiler chickens.

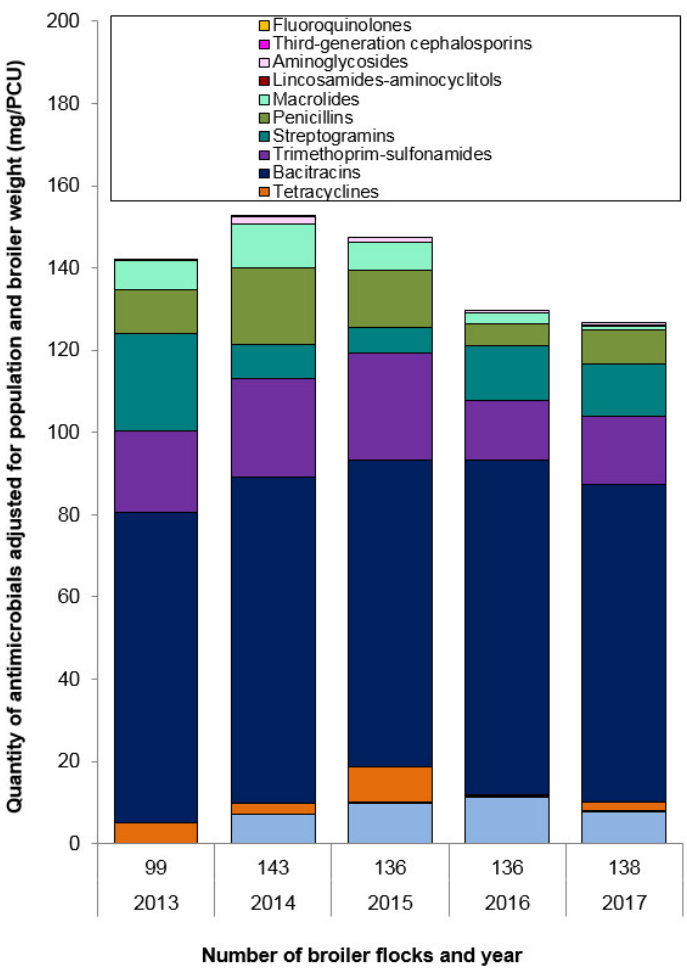
WHEN WE ACCOUNTED FOR THE NUMBER AND WEIGHT OF CHICKENS, THE TOP REPORTED ANTIMICROBIALS WERE:

1. Bacitracins
2. Trimethoprim
3. Streptogramins

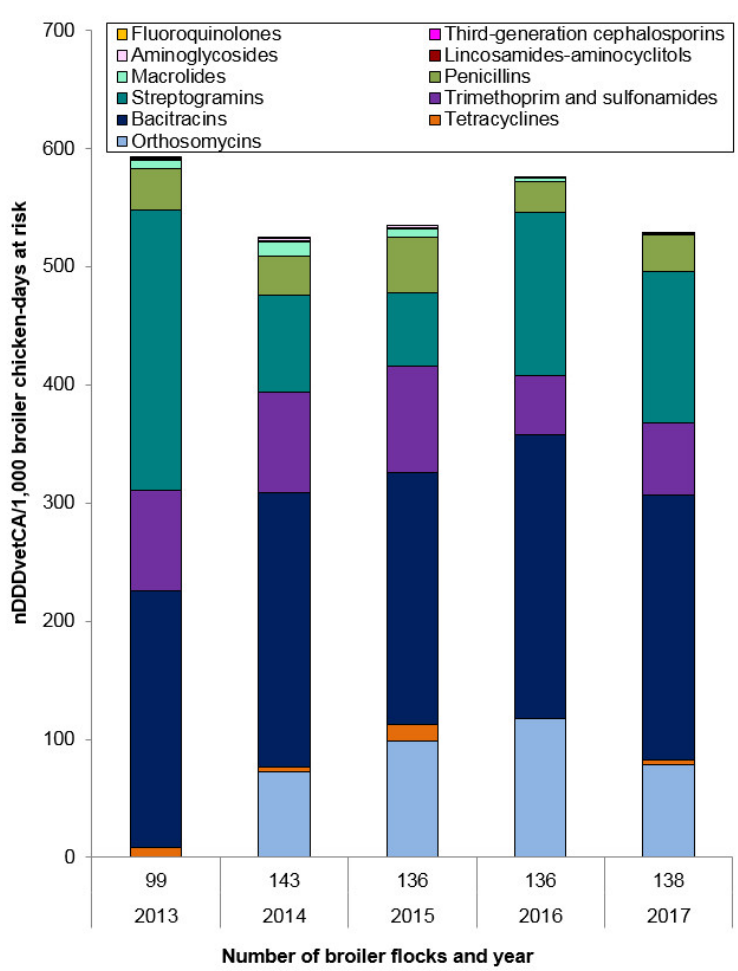
WHEN WE ACCOUNTED FOR THE NUMBER OF DOSES, THE TOP REPORTED ANTIMICROBIALS WERE:

1. Bacitracins
2. Streptogramins
3. Orthosomycins

Temporal trends in mg/PCU in broiler chickens in Canada, 2013 to 2017.



Temporal trends in nDDDvetCA/1000 chicken-days at risk in broiler chickens, 2013 to 2017.



TEMPORAL TRENDS IN AMU

GROWER-FINISHER PIGS

A grower-finisher pig is a pig that is approximately 25 kilograms to market weight. Farm surveillance showed a reduction in antimicrobials used in feed in 2017 compared with 2016 data in grower-finisher pigs.

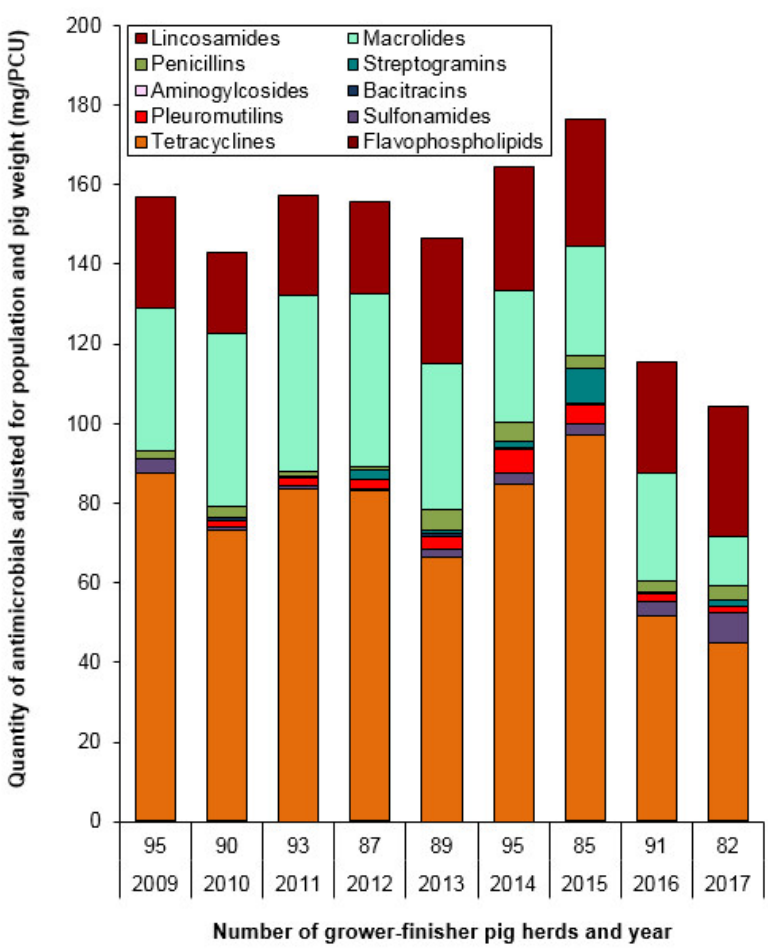
WHEN WE ACCOUNTED FOR THE NUMBER AND WEIGHT OF PIGS, THE TOP REPORTED ANTIMICROBIALS WERE:

1. Tetracycline
2. Lincosamides
3. Macrolides

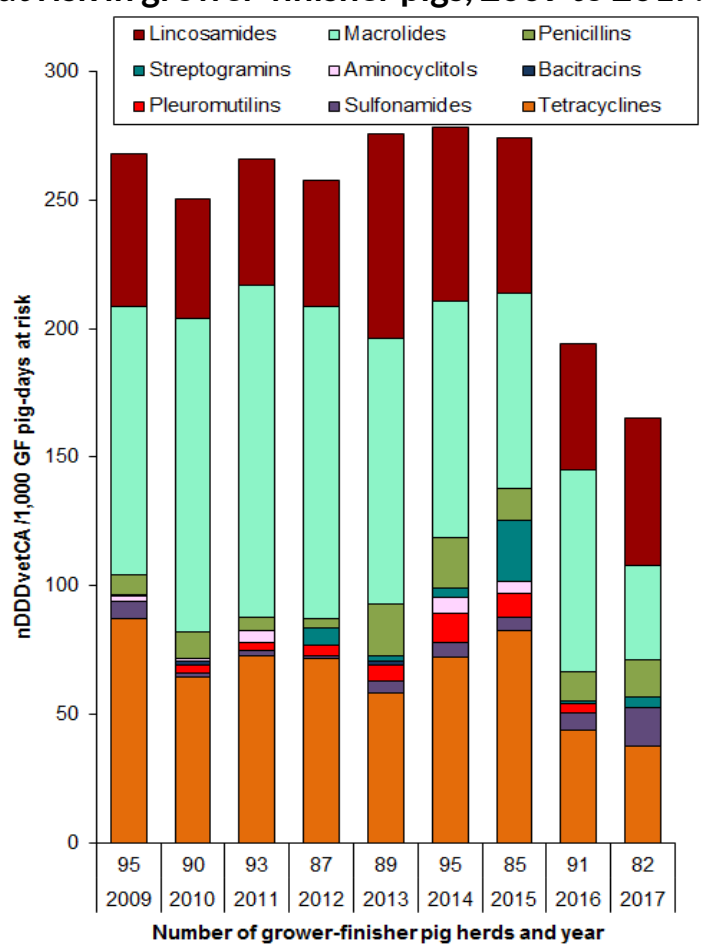
WHEN WE ACCOUNTED FOR THE NUMBER OF DOSES, THE TOP REPORTED ANTIMICROBIALS WERE:

1. Lincosamides
2. Tetracyclines
3. Macrolides

Temporal trends in mg/PCU in grower-finisher pigs in Canada, 2009 to 2017.



Temporal trends in nDDDvetCA/1000 pig-days at risk in grower-finisher pigs, 2009 to 2017.



TEMPORAL TRENDS IN AMU

TURKEYS

The overall reported antimicrobial use in turkeys was much lower than for broiler chickens and grower-finisher pigs in 2017.

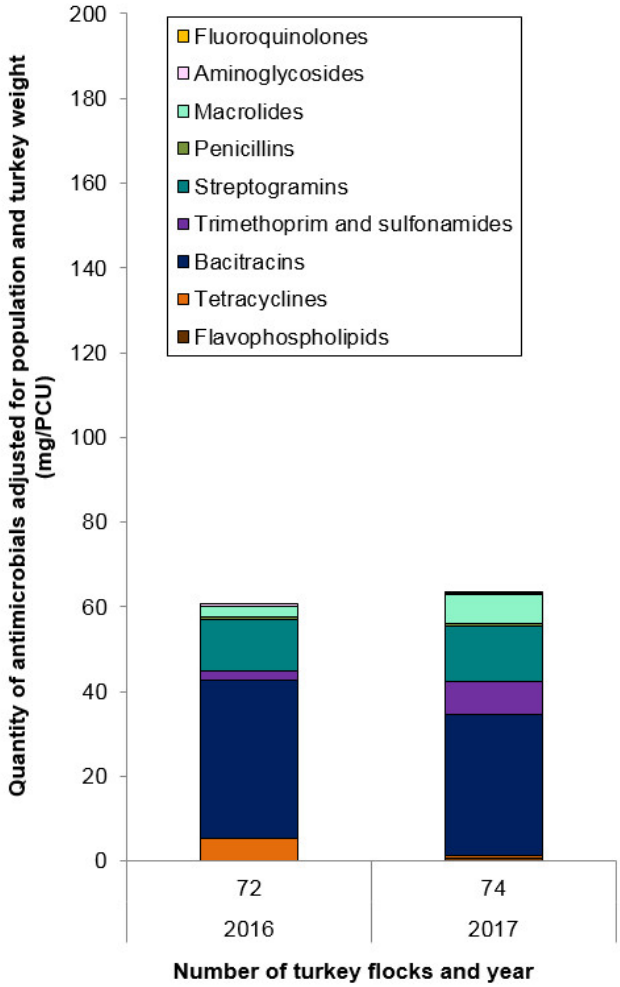
WHEN WE ACCOUNTED FOR THE NUMBER AND WEIGHT OF TURKEYS, THE TOP REPORTED ANTIMICROBIALS WERE:

1. Bacitracins
2. Streptogramins
3. Trimethoprim and sulfonamides

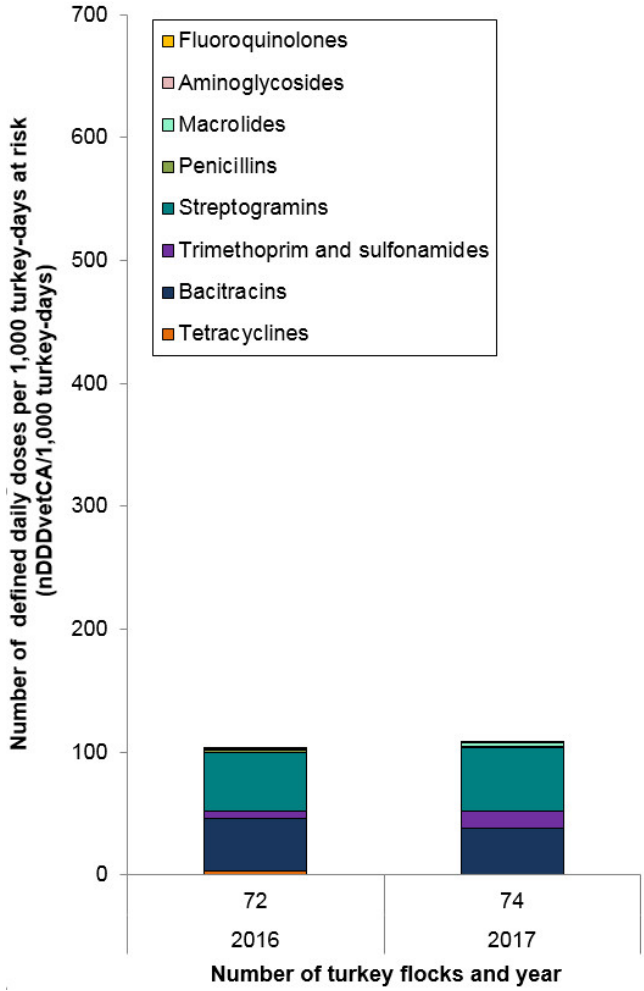
WHEN WE ACCOUNTED FOR THE NUMBER OF DOSES, THE TOP REPORTED DRUGS ANTIMICROBIALS:

1. Streptogramins
2. Bacitracins
3. Trimethoprim and sulfonamides

Temporal trends in mg/PCU in turkeys in Canada, 2016 to 2017.



Temporal trends in nDDDvet per 1000 turkey-days at risk in Canada, 2016 to 2017.

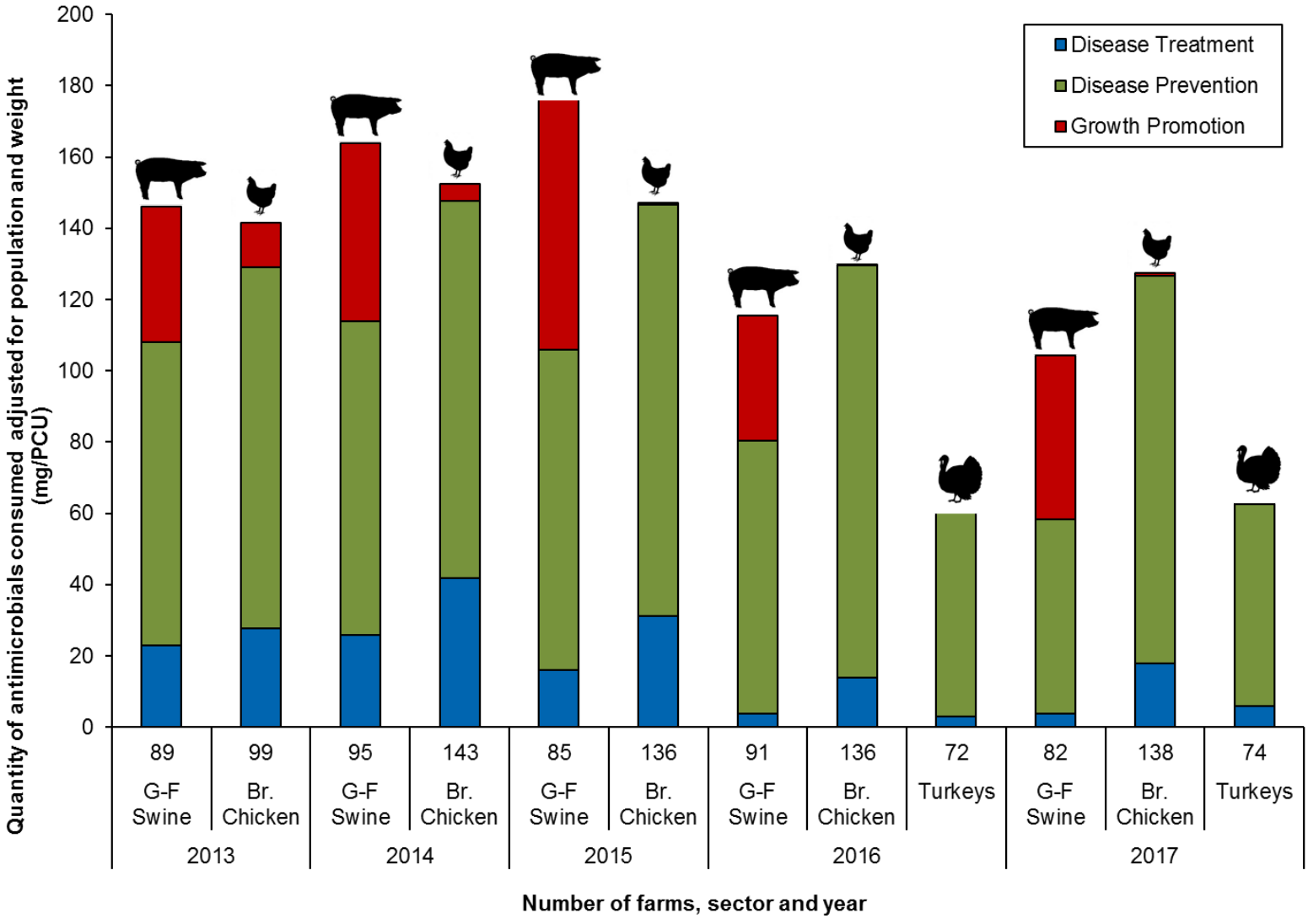


REASONS FOR ANTIMICROBIAL USE

- In broiler chickens, turkeys and grower-finisher pigs, the predominant reason for administering antimicrobials in 2017 was for disease prevention.

- In 2017, the overall reported antimicrobial use in broiler chickens and grower-finisher pigs declined.

Quantity of antimicrobials used (mg/PCU) by reason for use; CIPARS Farm 2013 to 2017.



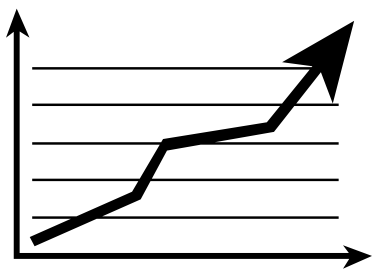
Swine data are for antimicrobial use in feed only; chicken and turkey data include all routes of administration.

Integrated Antimicrobial Resistance Data

In this section, we highlight two resistance stories: highly drug resistant *Salmonella* and fluoroquinolone-resistant *Campylobacter*.

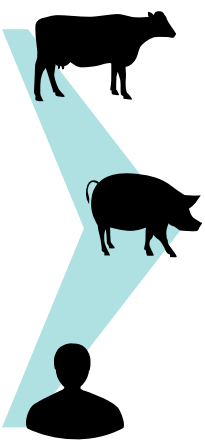
1 THE NUMBER OF HIGHLY DRUG RESISTANT ISOLATES ARE INCREASING

- In 2017, CIPARS tested for resistance to **7 antimicrobial classes.**
- While there is no international standard defining highly resistant isolates, CIPARS considers isolates which have resistance to **6 or more** classes of antimicrobials to be **highly drug resistant.**



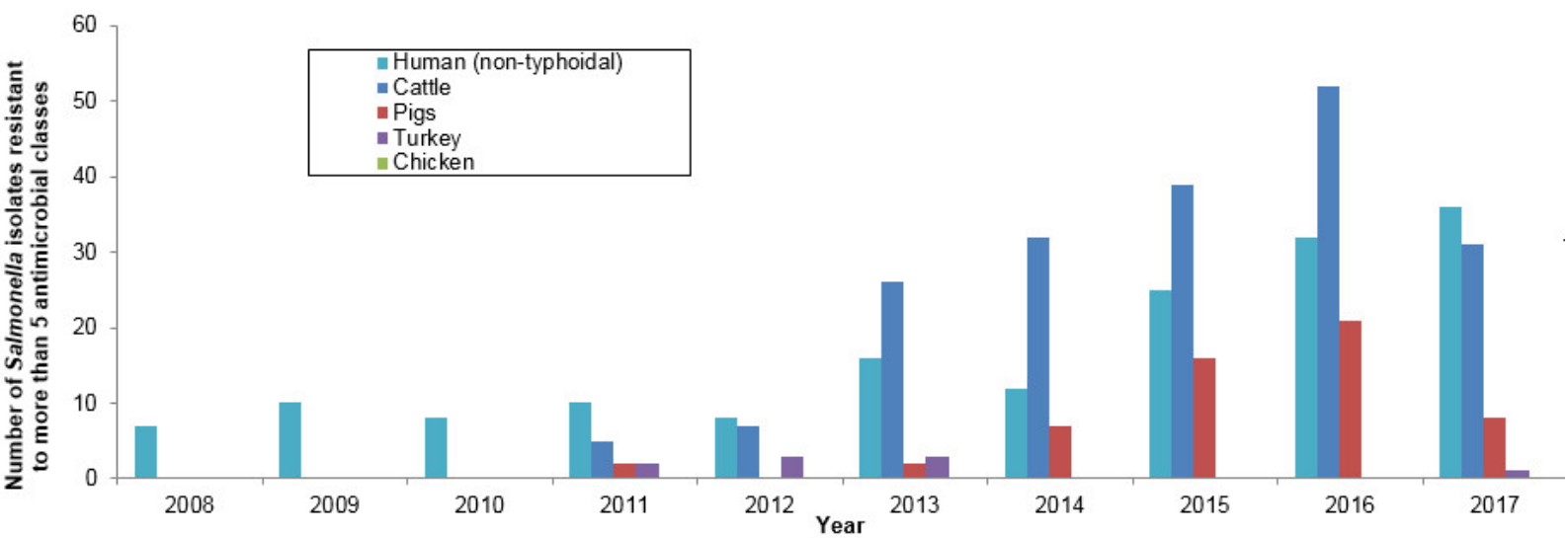
HIGHLY DRUG RESISTANT *SALMONELLA*

- Between 2008 and 2016, there was a substantial increase in the number of highly resistant *Salmonella* isolates from agri-food and human sources; however, there was a decrease in 2017.
- In 2017, 76 *Salmonella* isolates were identified as highly drug resistant from the following sources:



- **Cattle**
  - Sick cattle (clinical isolates)
  - Most of these have been *S.* Dublin and *S.* Typhimurium
- **Swine**
  - Healthy pigs (farm and abattoir isolates)
  - Sick pigs (clinical isolates)
- **Human**
  - All clinical isolates
  - Some isolates demonstrate resistance to all 7 classes of antimicrobials

Number of *Salmonella* isolates resistant to 6 or more antimicrobial classes from 2008 to 2017.

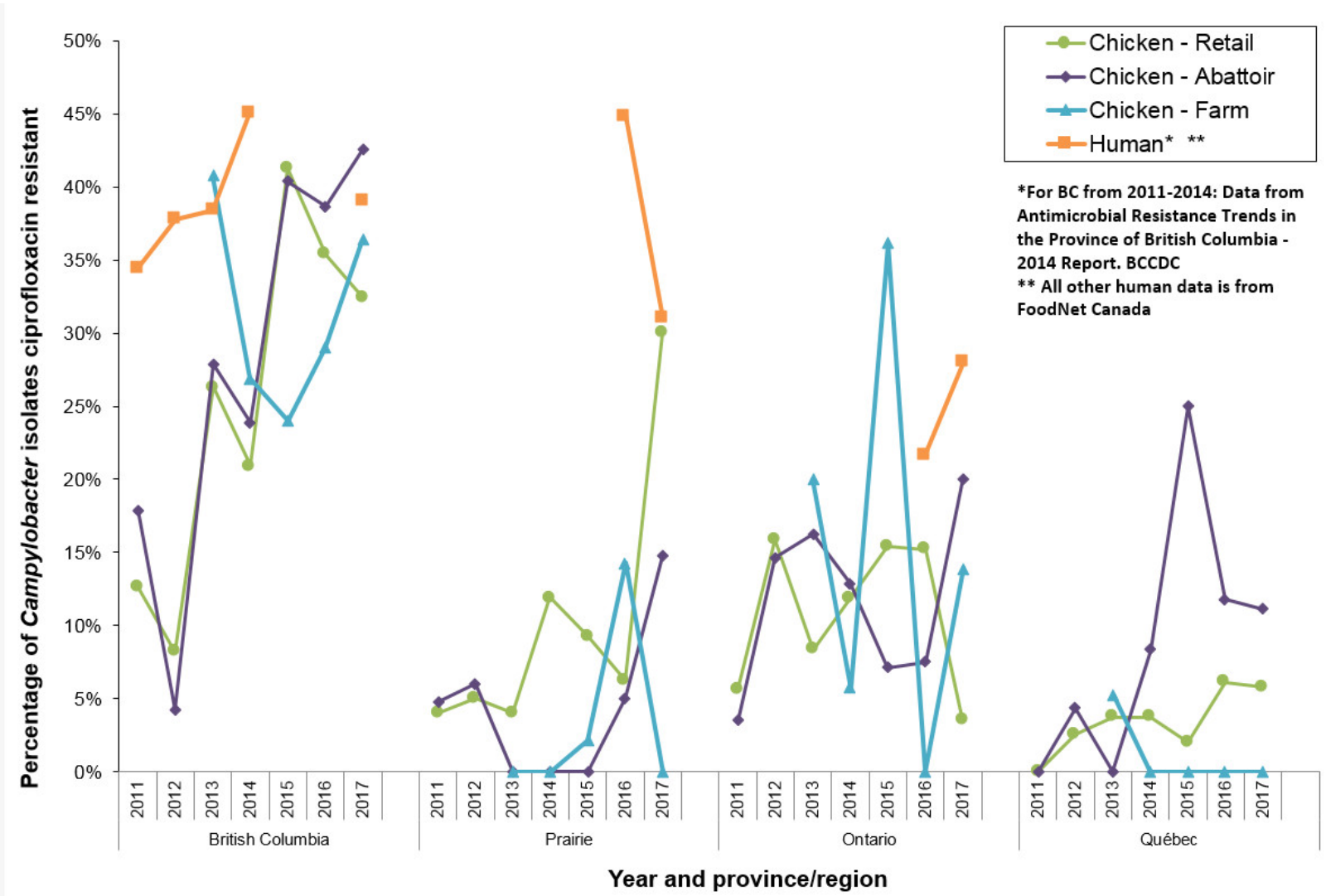


- In *E. coli*, one important difference is that highly resistant *E. coli* isolates were detected from chickens, in addition to other host species.

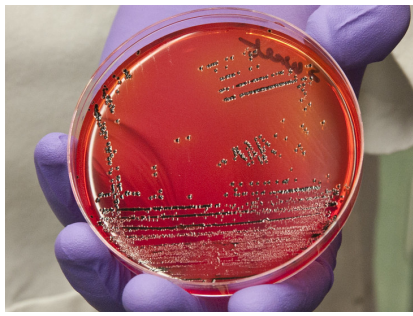
2 FLUOROQUINOLONE RESISTANCE IN *CAMPYLOBACTER*

- Resistance to ciprofloxacin in *Campylobacter* from chicken(s) continued to vary over time and across regions, although the highest proportion of resistant isolates across all surveillance components continued to be from British Columbia.
- Resistance to ciprofloxacin was more commonly identified in human isolates from British Columbia compared to Alberta and Ontario.
- Despite the different trends in resistance to ciprofloxacin among *Campylobacter* isolates from different surveillance components and regions, there has been no reported fluoroquinolone use on sentinel broiler chicken farms since 2013.

Ciprofloxacin resistance in *Campylobacter* isolates from chicken over time and between regions; CIPARS 2011 to 2017.

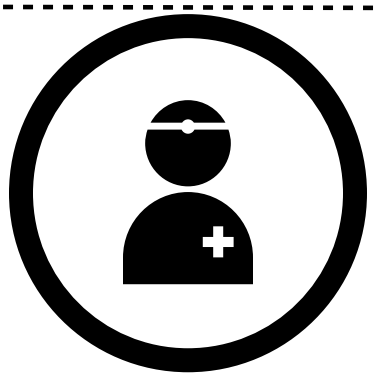


INTEGRATED ANTIMICROBIAL USE AND RESISTANCE DATA



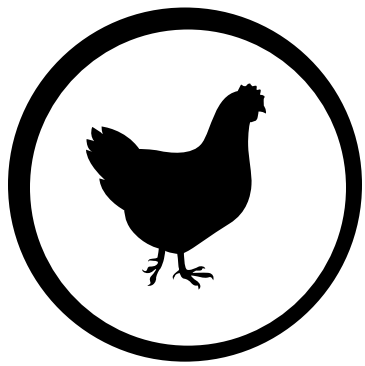
1 CEFTRIAXONE RESISTANCE IN NON-TYPHOIDAL *SALMONELLA* AND GENERIC *E. COLI*

Ceftriaxone is a **Category I antimicrobial (very high importance to human medicine)** that is used to treat a variety of human infections. They are the preferred option for the treatment of serious, potentially life-threatening human infections.



Although ceftriaxone is not used in animals, a similar drug (ceftiofur) is used to **treat a range of animal infections.** In most situations, if an organism is resistant to one of these drugs, it will also be resistant to the other.

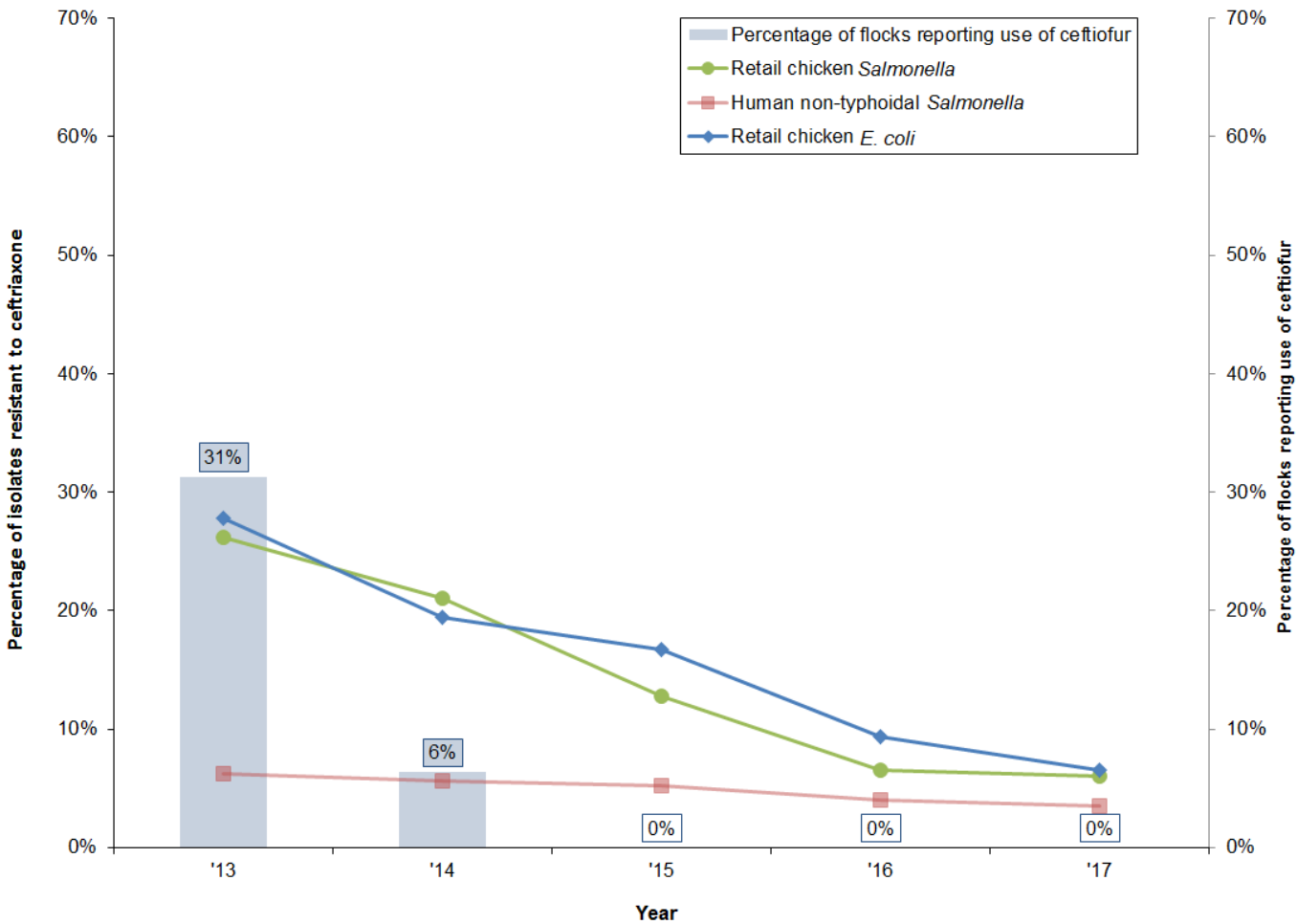
Because Category I antibiotics are those considered most important to human health, the poultry industry took steps to reduce their use. In mid-2014, the poultry industry implemented a **national ban on the use of Category I antimicrobials** for disease prevention purposes.

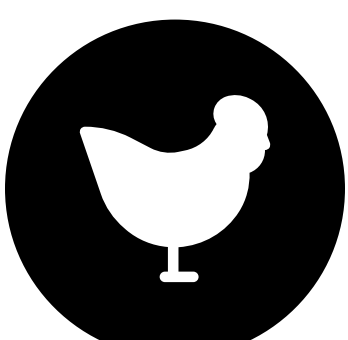


Subsequent data have **shown no reported use of ceftiofur in sentinel broiler chicken flocks since 2014** as well as **reduced resistance in both *E. coli* and *Salmonella*** from chickens and chicken meat.

- Most ceftriaxone resistance in humans has been observed in isolates of *Salmonella* Heidelberg. Resistance to ceftriaxone in *Salmonella* Heidelberg isolates from humans decreased from 15% in 2016 to 12% in 2017.
- We are seeing similar declines in ceftriaxone resistance in isolates from chicken at abattoir and on farm, and similar trends in ceftriaxone resistance in *E. coli* isolates.

Reduction in reported use of ceftiofur on farm and changing resistance to ceftriaxone in non-typhoidal *Salmonella* and *E. coli* from humans and chicken sources between 2013 and 2017.





The reduction in use of ceftiofur and associated reduction in ceftriaxone resistance in chickens and humans is a good example of a successful intervention to limit antimicrobial resistance that CIPARS continues to follow.

Glossary

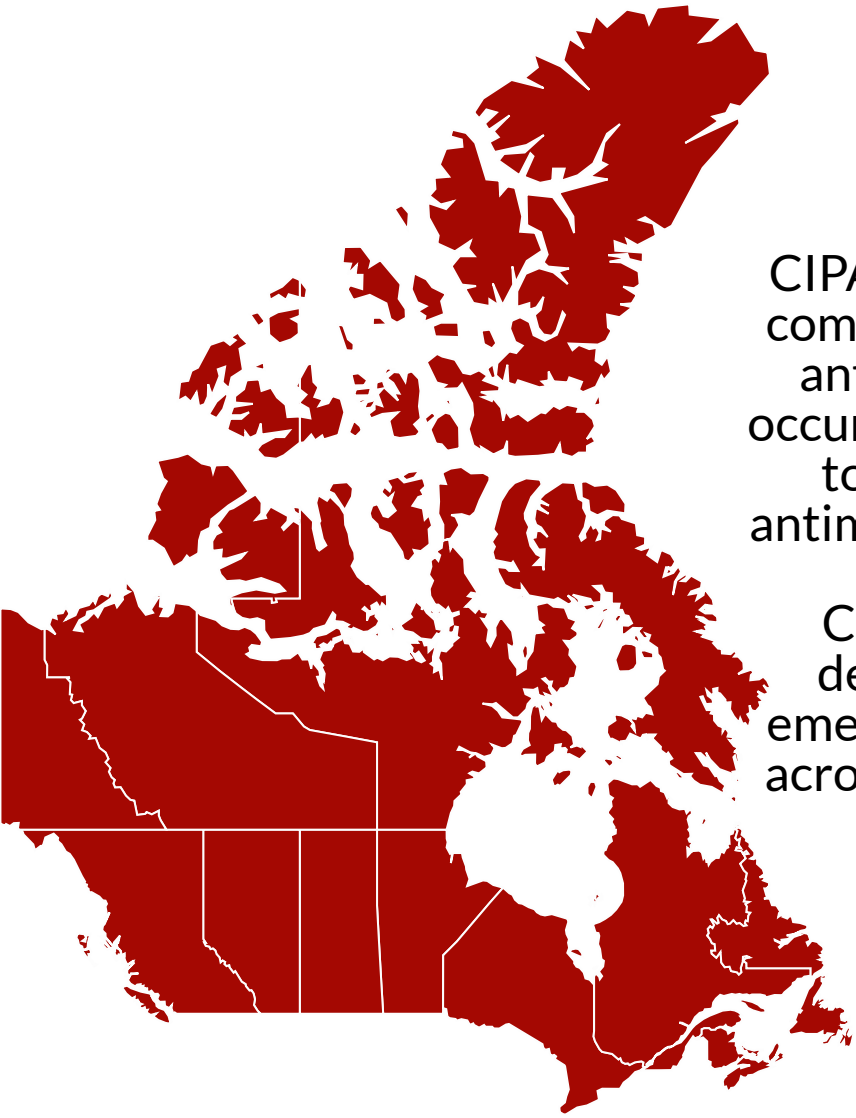
Antimicrobial class: Antimicrobials are grouped into the same class if they have a common chemical structure and method to kill or stop the growth of bacteria. CIPARS uses the Clinical and Laboratory Standards Institute to define antimicrobial class.

Biomass and Population Correction Unit (PCU): The PCU accounts for the size of the population, including the number and weight (biomass) of animals or people in the population. CIPARS adjusts (or corrects) for the "size" of populations to interpret antimicrobial use, consumption or sales data using methods reported by the European Surveillance of Veterinary Antimicrobial Consumption.

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.

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 tp help interpret antimicrobial use data.



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

CIPARS Canadian Integrated Program for Antimicrobial Resistance Surveillance

Programme intégré canadien de surveillance de la résistance aux antimicrobiens PICRA

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