The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

CIPARS 2024 Key and Integrated Findings

World Antimicrobial Resistance Awareness Week
November 18th, 2025
Presented by Carolee Carson, BSc, DVM, PhD

Canada

While we meet on a virtual platform, we acknowledge the Indigenous Peoples, who traditionally resided on all the lands that we are on today.

From coast to coast, to coast, we acknowledge the ancestral territories of all the First Nations, Inuit, and Métis peoples across the country.

We do this as a reminder as public servants of our commitments and responsibility in addressing the lasting impacts of colonization in Indigenous communities, especially the public health inequities experienced by Indigenous Populations.

I ask that you take a moment to reflect on the traditional territory where you reside.

Presentation link

- https://cahss.ca/cahss-tools/document-library
- Canadian Animal Health Surveillance System (CAHSS) has developed several documents on antimicrobial use reporting that can be found at: https://cahss.ca/cahss-networks/amuamr

Survey/Poll

- Link is in the chat
- Responses are anonymous
- Your feedback guides our products

Other housekeeping

- Please remain muted until the Q&As segment
- AI-based transcription or recording is not permitted

Agenda

Key and integrated findings

- Sales data
- AMU/AMR
- Emerging stories
- Interactive data
- Summary
- Questions and answers

Host-specific sessions

- Humans
- Poultry
- Feedlot cattle
- Dairy cattle
- Grower-finisher pigs

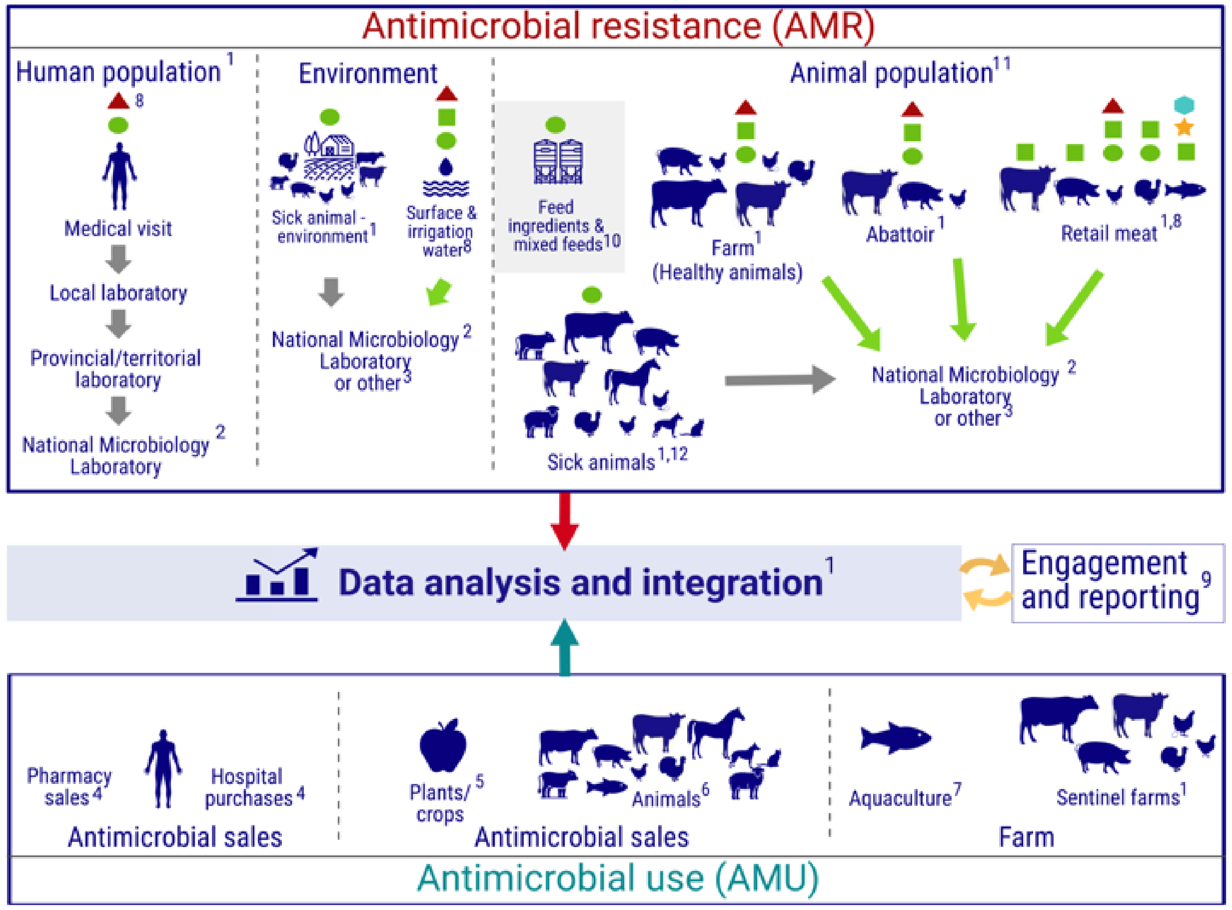
CIPARS is led by the Public Health Agency of Canada in conjunction with multiple federal departments and relevant parties.

5-year trends are now 2020-2024 (noting COVID years).

Data sources are noted on each slide. If no source is shown, the data come from CIPARS.

CIPARS timeline: https://www.canada.ca/en/public-health/services/publications/drugs-health-products/canadian-integrated-program-antimicrobial-resistance-surveillance-over-years-2002-2021.html

Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)



1 Centre for Foodborne and Environmental and Zoonotic Infectious Diseases (CFEZID), Infectious Diseases and Vaccination Programs Branch (IDVPB), Public Health Agency of Canada (PHAC)
2 Bacterial Pathogens, AMR and Wastewater Division and Division of Enteric Diseases, National Microbiology Laboratory Branch, PHAC
3 Provincial animal health laboratory, university laboratory or private laboratory
4 Canadian Antimicrobial Resistance Surveillance System (CARSS), PHAC. Data source: IQVIA
5 Pest Management Regulatory Agency, Health Canada
6 Veterinary Antimicrobial Sales Reporting (VASR), Veterinary Drugs Directorate, Health Canada and CFEZID, PHAC
7 Fisheries and Oceans Canada
8 FoodNet Canada, CFEZID, IDVPB, PHAC
9 CIPARS engagement and reporting including: Annual Stakeholder Webinars, Integrated Findings Reports, Data Visualizations, Farm Surveillance Technical Reports (including health and biosecurity data), Fact sheets, Infographics, Journal publications, VASR Highlights Reports, and CARSS Reports
10 Canadian Food Inspection Agency (CFIA)
11 Laboratory analysis reporting of *Clostridium perfringens*, *Enterococcus* spp., and bovine respiratory pathogens occurs for select years and species
12 AMRNet-Vet shares data for bovine respiratory disease bacterial pathogens

Active surveillance
Passive surveillance
AMR data
AMU data
Communication
Campylobacter
Escherichia coli
Salmonella
Aeromonas
Vibrio

Integrated antimicrobial sales

Veterinary Antimicrobial Sales Reporting (VASR)

Primary outcome indicators:

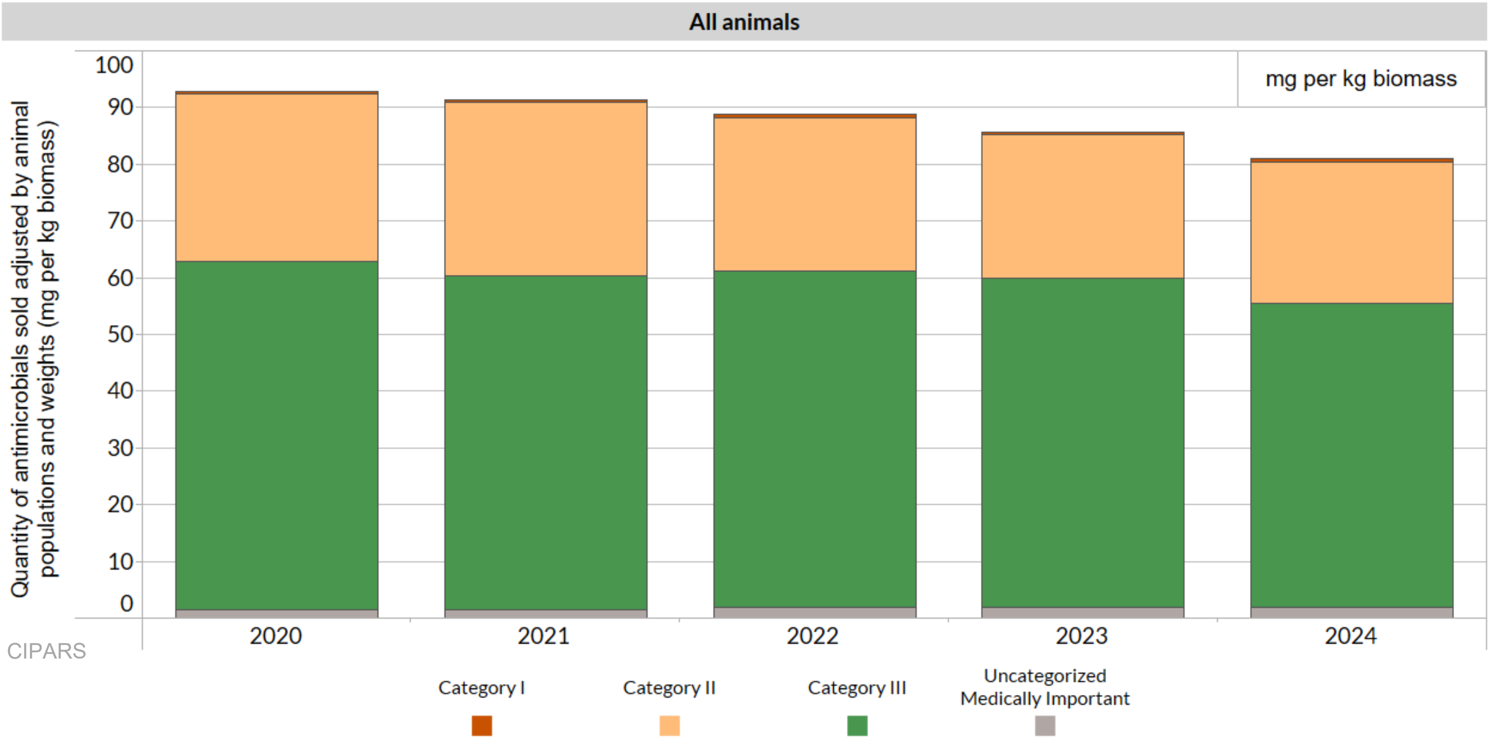
- Total quantities of Medically Important Antimicrobials[a] (MIAs) sold (kg and kg adjusted by biomass denominators)
- Quantities of Category I[b] antimicrobials sold (kg and kg adjusted by biomass denominators)
- VASR data includes medically important antimicrobials only; antifungals not included.

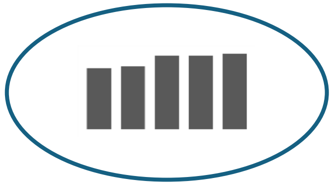
[a]https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance/animals/veterinary- antimicrobial-sales-reporting/list-a.html

[b]https://www.canada.ca/en/health-canada/services/drugs-health-products/veterinary-drugs/antimicrobial-resistance/categorization-antimicrobial-drugs-based-importance-human-medicine.html

Since 2020, the overall relative quantity of MIA sales for all animals decreased by 13% (measured in mg/kg biomass). However, Category I sales increased substantially by 23% (mg/kg biomass).

- 5% relative decrease in the total quantity of MIA sold between 2023 and 2024 (mg/kg biomass); **13%** overall between 2020 and 2024
- **Substantial relative decrease of ~26%** in the total quantity of MIA sold between 2015 and 2024[a] (mg/PCU-CA)[b]
- Category I sales are < 1% of total sales (consistent with previous years) however, Category I sales adjusted by biomass had **a substantial overall relative increase of 23%** between 2020 and 2024





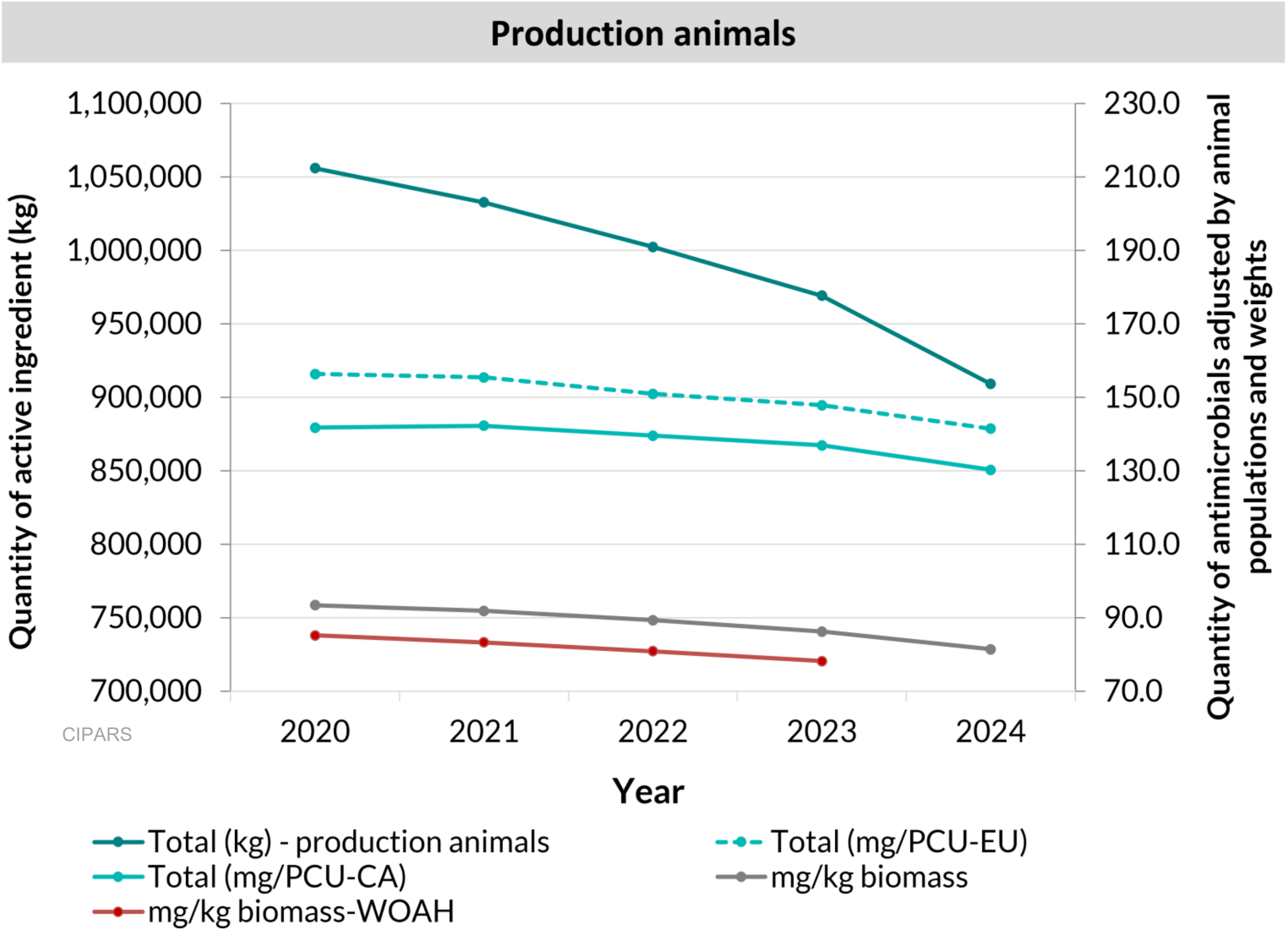
Category I trend magnified, 2020-2024

[a]In 2018, data from both the Canadian Animal Health Institute (CAHI) and VASR were available and used to estimate the percentage coverage increase with the VASR data. This percentage was retrospectively applied to the reported CAHI to generate a more comparable sales estimate (assuming the coverage difference was the same each year).
[b]The kg-biomass denominator is not available prior to 2018.

Total sales of MIAs for production animals decreased by 10-14% in 2024, relative to 2020 (across metrics).

Relative to 2020, the quantity of MIAs sold for use in production animals decreased in 2024 by:

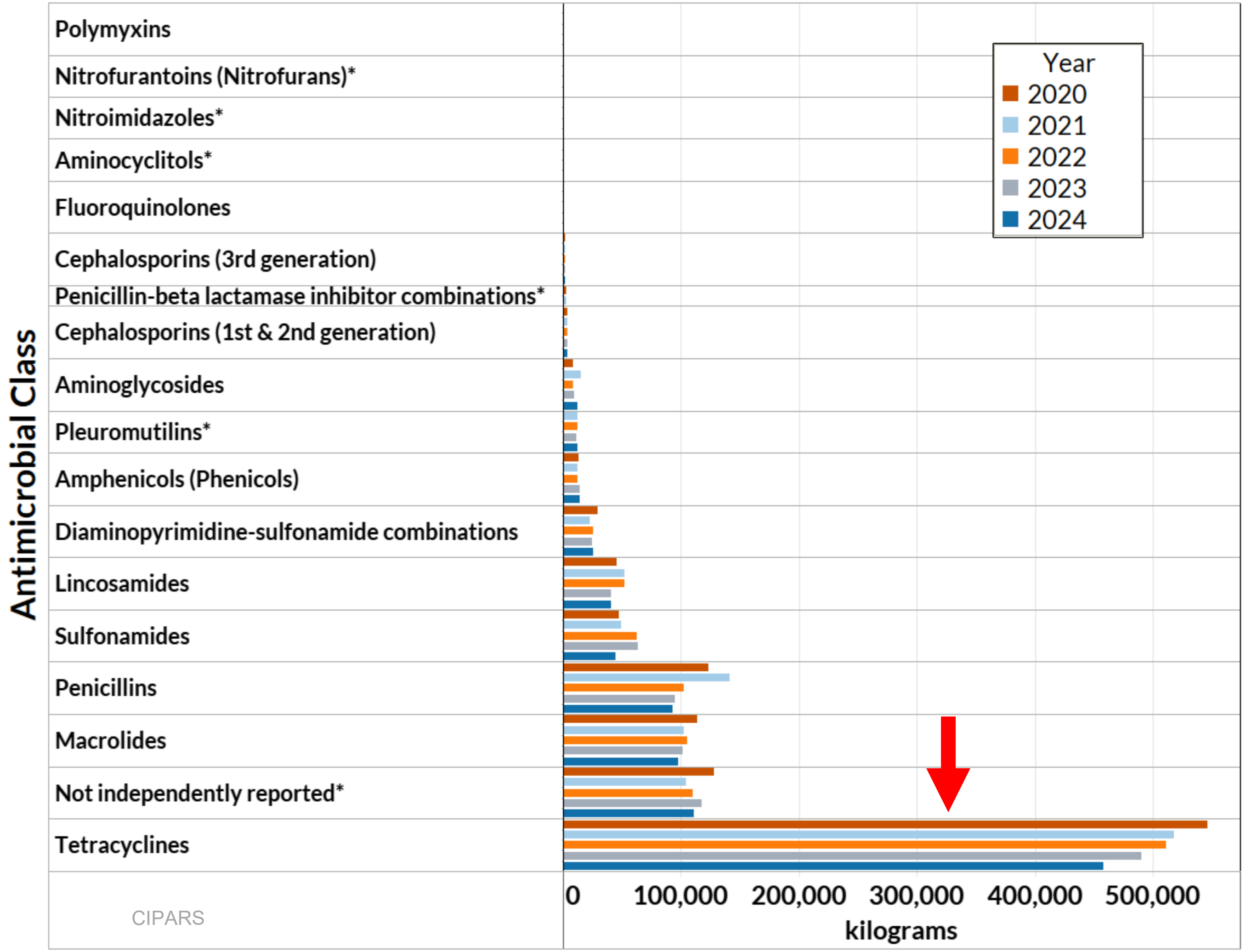
- 14% in kg
- 13% in mg/kg biomass
- 10% in mg/PCU-CA
- 10% in mg/PCU-EU



While tetracyclines highly predominate the sales each year, they have decreased by 16% relative to 2020.

All animals
Indicator: kilograms

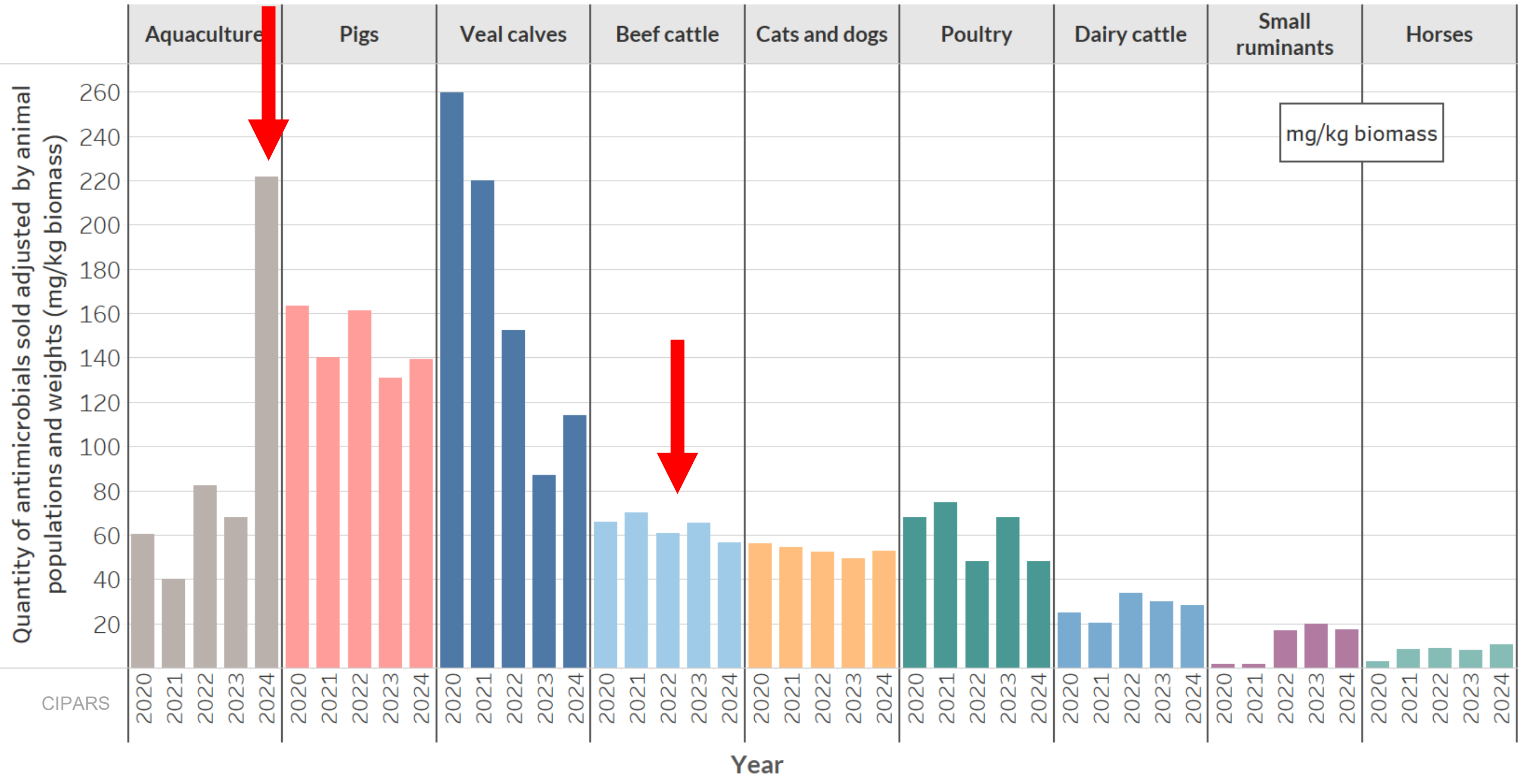
In 2024, around 97% of tetracyclines sold were for use in pigs, beef cattle, and aquaculture
- Pigs: ~ 55%
- Beef cattle: ~ 38%
- Aquaculture: ~ 4%



*Antimicrobial classes with fewer than three companies reporting are grouped together as Not Independently Reported (NIR) to prevent identification of individual company's sales volumes. Classes included in NIR vary by year.
Classes included in all years - aminocoumarins, bacitracins, carbapenems, diaminopyrimidines, fusidic acid, glycopeptides, orthosomycins, pseudomonic acids, streptogramins, and therapeutic agents for tuberculosis.
Between 2018-2020 – pleuromutilins and nitroimidazoles included
Between 2022-2024 – penicillin-beta lactamase inhibitor combinations included
In 2024 – aminocyclitols and nitrofurantoins included

For aquaculture, the total MIAs sold substantially increased in 2024, which is unusual, relative to previous years. For beef cattle, the total MIAs sold relatively decreased, though there was a 72% relative increase in Category I antimicrobials sold compared to 2020.

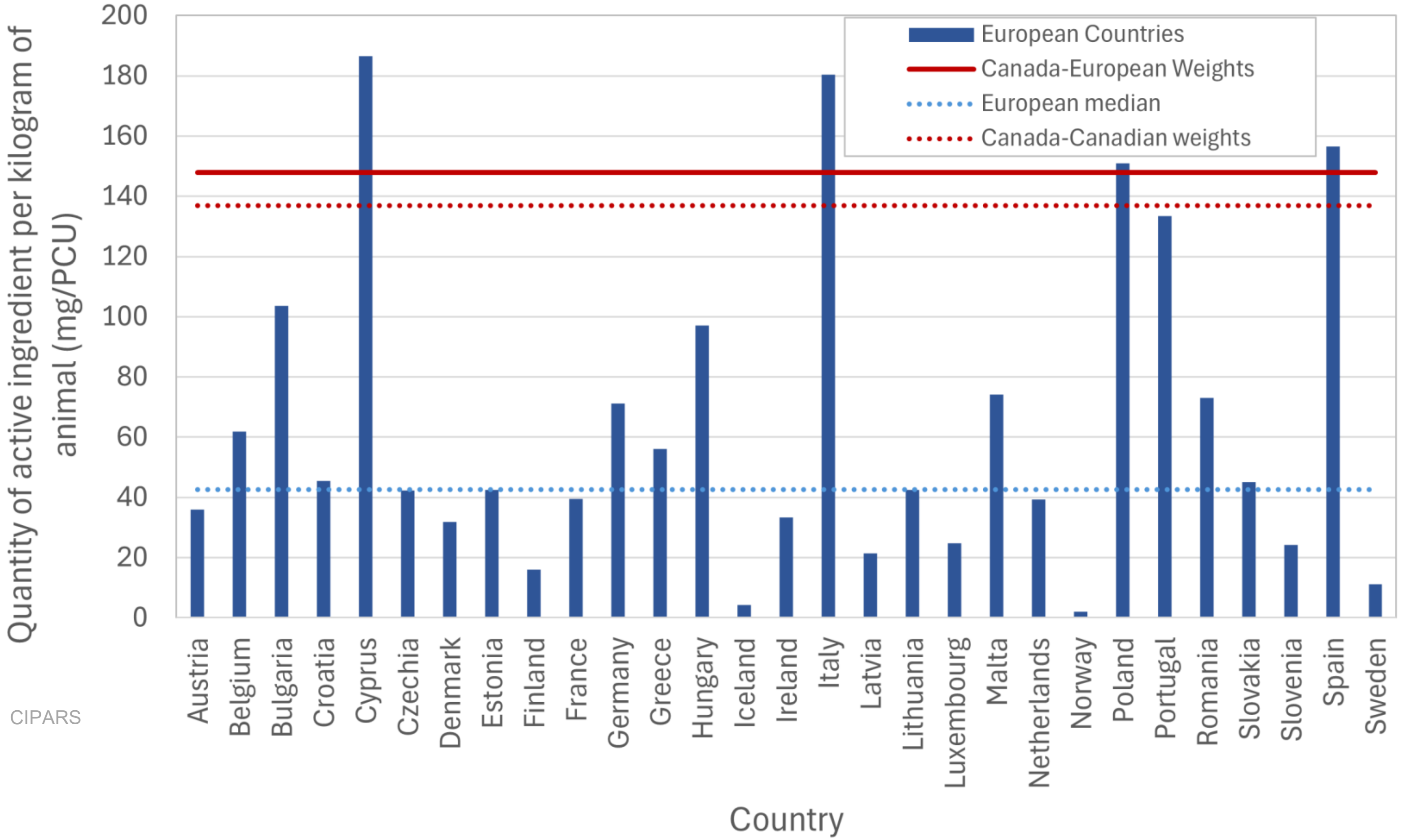
- Aquaculture now has the highest quantity of MIAs sold adjusted for biomass compared to other animal species – the increase in 2024 relative to 2020 was 226%
- Beef cattle – substantial relative increase (72%) in Category I antimicrobials sold between 2020 and 2024 (*data not shown*)
  - Represents less than 1% of their total sales (absolute difference of ~760 kg)
- Other animal species – no notable trend in Category I quantities sold



Canada is 5th highest when comparing antimicrobials sold for use in production animals to data from 29 European countries (2023 data).

	Canada	European median	
mg/PCU-CA	136.9	NA	
mg/PCU-EU	147.8	42.5	(2022: 45.8)

3.5x



European data: https://www.ema.europa.eu/en/documents/report/european-sales-use-antimicrobials-veterinary-medicine-annual-surveillance-report-2023_en.pdf (Annex 6)
US data are not included due to absence of comparable indicator

New!

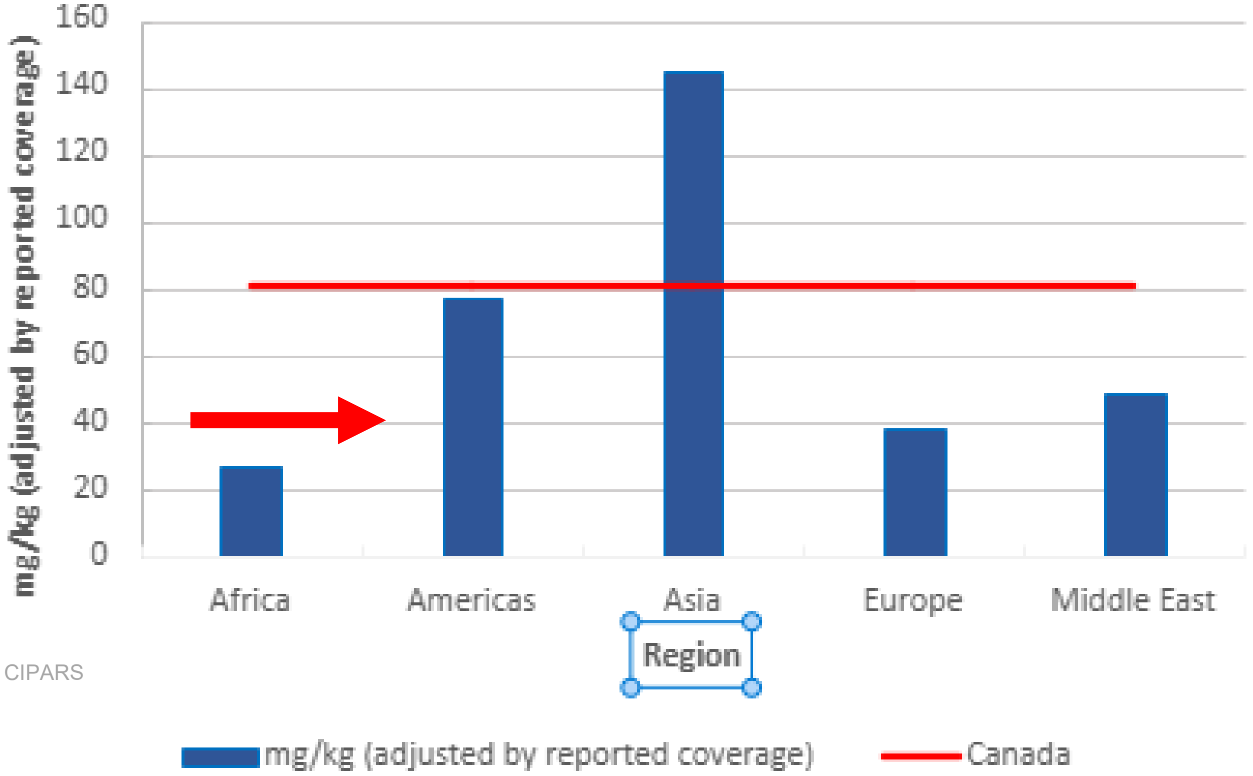
Antimicrobial sales - animal

In 2022, Canada's sales (mg/kg-WOAH) were higher than the average for the Americas (ANIMUSE).

Canada: 80.9 mg/kg-WOAH

Americas[a]: 77.8 mg/kg-WOAH

Proportionally, Canada sells **more** tetracyclines, macrolides, sulfonamides and lincosamides, and **less** fluoroquinolones than the Americas overall.



112
No. Participants

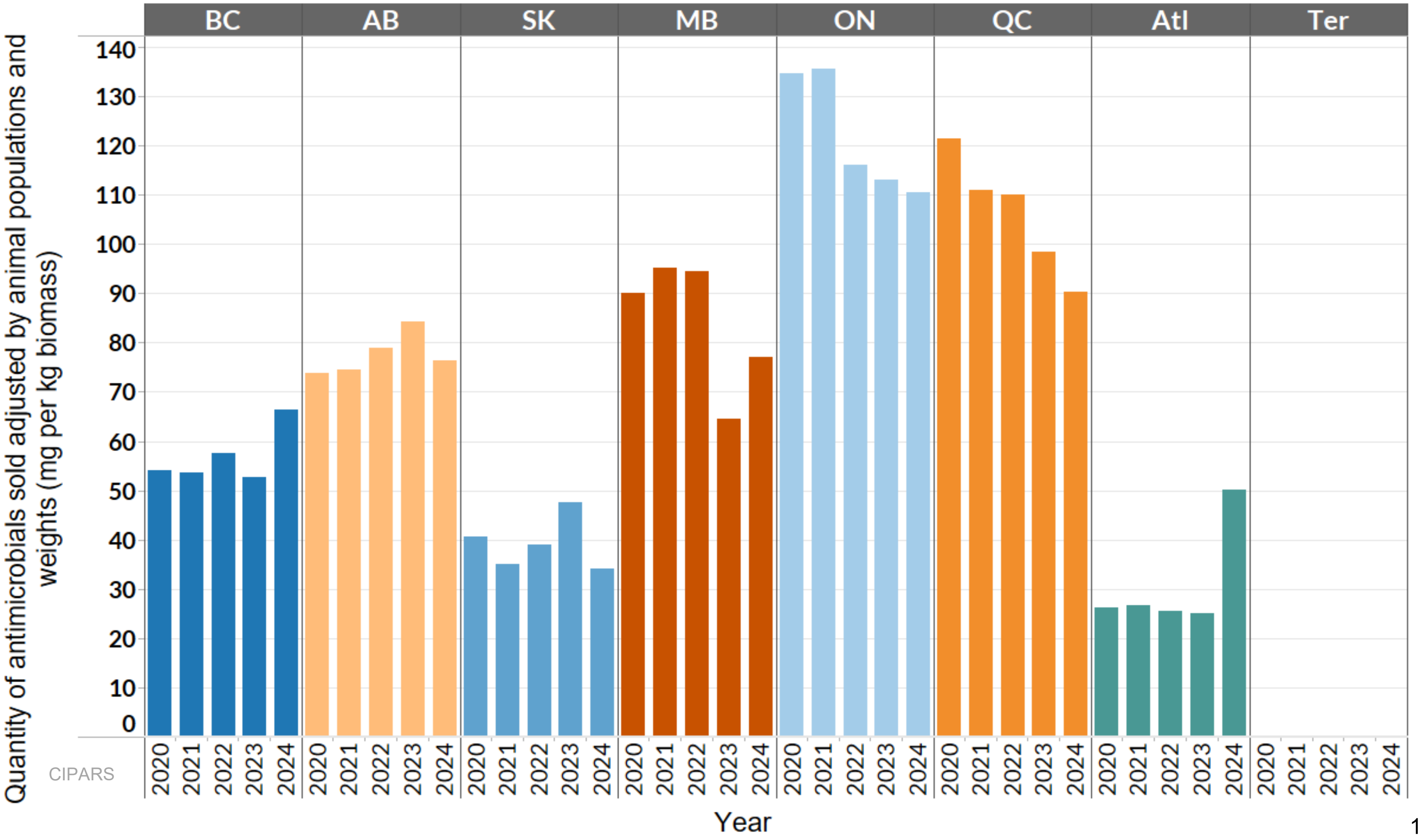
[a]Canada and 16 other countries including the US

Source: WOAH-ANIMUSE Interactive Report - https://amu.woah.org/amu-system-portal/home

There are differences in trends in quantities of MIAs sold across the provinces.

All animals
Indicator: mg/kg biomass

- Continued relative decreases in sales of MIAs for ON (24%) and QC (31%) between 2020 and 2024
- Relative increases between 2023 and 2024 in:
  - BC - 14%
  - MB – 12%
  - Atlantic provinces – 25% (Coastal changes related to sales in aquaculture)
- In 2024, sales of MIAs by compounders (data not shown) remain highest in Quebec (50% of total compounder sales) and Ontario (31% of total compounder sales)



The ratio of MIAs sold for animals compared to humans dropped in 2024 to ~1.3x; there were decreases in sales for animals and increases in sales for humans.

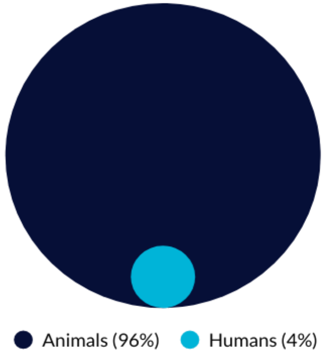
Indicator: kg (unadjusted)

76% Production animals
<1% Cats and dogs
23% Humans
<1% Plants/crops

~3.4x

~21x

more animals than people in Canada



Indicator: mg/pop-adj biomass (humans); mg/PCU-CA (animals)

~1.3x

more medically important antimicrobials were sold for use in animals (**all**) than for use in all people **after adjusting for underlying biomass**

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For humans and animals, only systemic routes are included (oral and parenteral). Antifungal information not included on this slide.
Indicators used: Humans – kilograms (unadjusted) & mg/population adjusted biomass; Animals – kilograms (unadjusted) & mg/PCU-CA; Crops – kilograms (unadjusted)
Data sources: Human hospital purchases and community pharmacy dispensations: SHAMU (IQVIA); Crops: Health Canada's Pest Management Regulatory Agency (HC-PMRA); Human population: Statistics Canada

There are very different relative uses of antimicrobial classes between animals and humans. Substantially more Category I antimicrobials were sold for use in humans than in animals, adjusted for biomass.

Indicators: mg/PCU-CA (animal); mg/population adjusted biomass (human)

In 2024:

- 11x more 3rd generation cephalosporins sold for use in humans than animals
- 25x more fluoroquinolones sold for use in humans than animals
- 22x more tetracyclines sold for use in animals than humans

Human 2020	Human 2021	Human 2022	Human 2023	Human 2024	Antimicrobial Class	All Animals 2020	All Animals 2021	All Animals 2022	All Animals 2023	All Animals 2024
2.29	2.13	2.30	2.25	2.36	3rd & 4th generations cephalosporins	0.18	0.18	0.19	0.20	0.21
0.46	0.46	0.46	0.46	0.48	carbapenems[a]				0.00	
4.63	4.22	4.35	4.13	3.97	fluoroquinolones	0.05	0.08	0.13	0.14	0.16
17.26	15.14	17.85	20.11	22.19	penicillin beta-lactamase inhibitor combin..	0.38	0.42	0.43	0.42	0.43

mg adjusted for biomass

0.00 – 25.00

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[a]Note the quantity of carbapenems sold for use in animals in 2023 were <0.01 mg/kg biomass. Prior to 2023 there were no reported sales of carbapenems for use in animals.

Data sources: SHAMU (IQVIA) and CIPARS; data include antimicrobials for systemic use only; see appendix for more details

★ New! **Antifungal sales – plants/crops**

The quantity of antifungals sold as pesticides on plants/crops in 2023 was greater than the total quantity of medically important antibiotics sold for humans, animals, and plants/crops combined.

Plants/crops

- Total quantity sold in 2024: **2,209,507 kgs**
- These are all triazoles (biologically active compounds with antifungal properties)
- Have many uses, including as antifungals and retardants on plants and crops
- None of the antifungal active ingredients sold for use on plants/crops are approved for veterinary or human use (although there are other triazoles approved for use in animals and people)
- Like antimicrobials, resistance can develop and is a concern

Antifungal active ingredient
difenoconazole
flutriafol
ipconazole
mefentrifluconazole
metconazole
myclobutanil
paclobutrazol
propiconazole
prothioconazole
tebuconazole
tetraconazole
triticonazole
uniconazole-p

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Data on antifungals intended for use in humans and animals are not currently available.
Data on antifungal sales for plants/crops provided by Health Canada's Pest Management Regulatory Agency.

Integration of sales and farm AMU data

Veterinary Antimicrobial Sales Reporting (VASR), sentinel terrestrial farms, all aquaculture operations

Primary outcome indicators:

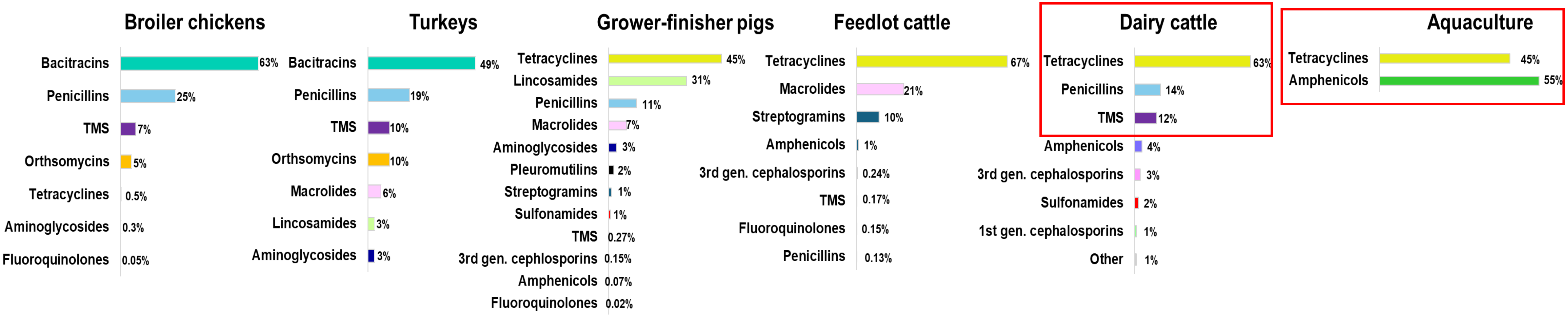
- Relative percentages of antimicrobial classes used or sold per animal group
- Total quantities of MIAs used or sold (kg and kg adjusted by biomass denominators) for aquaculture

Canada

There are differences in the relative uses of various antimicrobial classes across animal species. VASR data and farm data are similar for species where comparisons are appropriate.

Farm AMU

Indicator: % of use (in kg)



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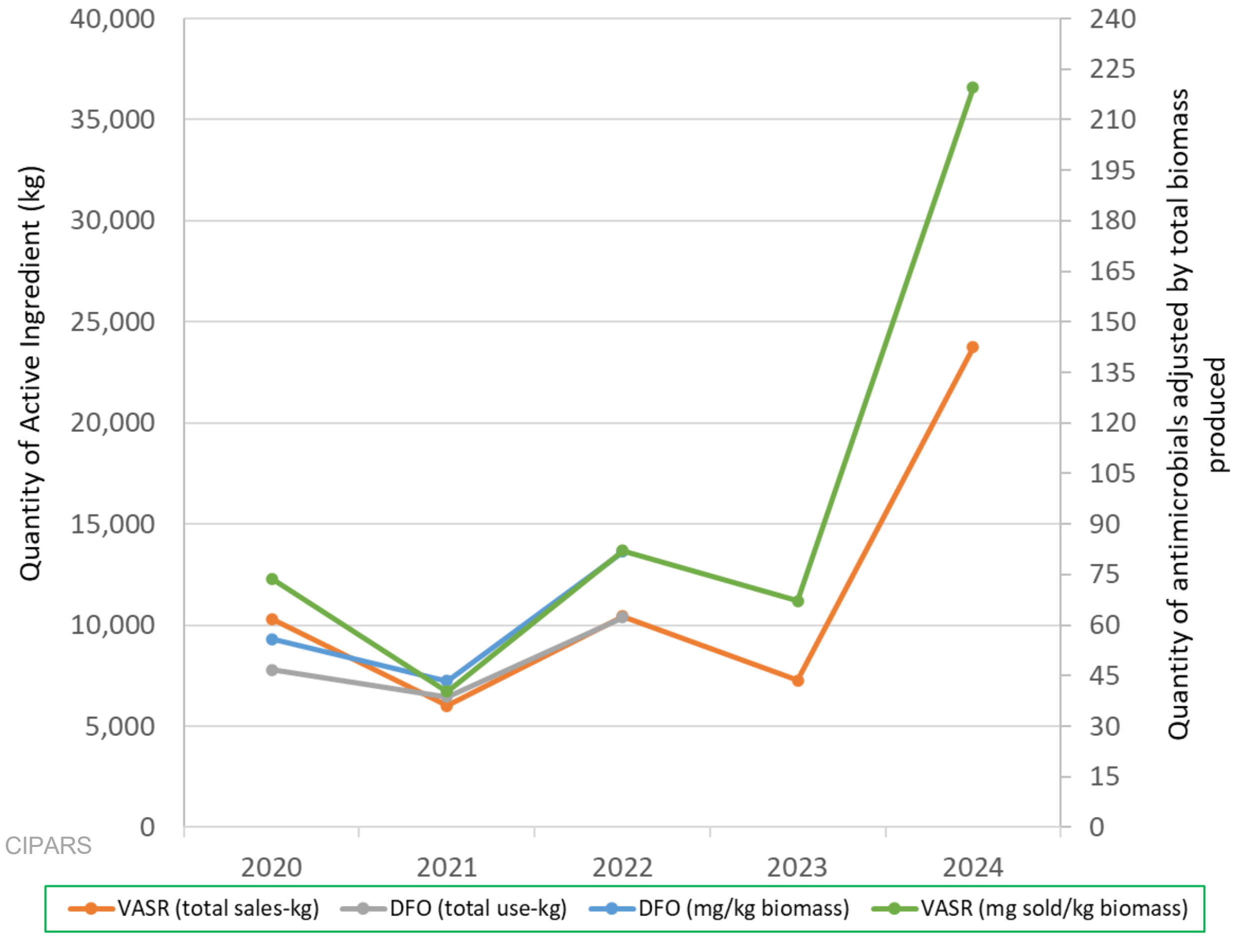
Red squares indicate the top classes reported sold for use in that host species/group by VASR (where host species/group are comparable)
Terrestrial farm data are from CIPARS sentinel farms.
Aquaculture data is from Fisheries and Oceans data and represents all aquaculture operations in Canada. Latest data available for aquaculture are from 2022.

The quantity of antimicrobials sold and used nationally in aquaculture are highly similar. There is a recent substantial increase in AMU/sales for aquaculture

Aquaculture
Indicators kg, mg/kg biomass

- Only datasets where we have complete data for both farm (Fisheries and Oceans Canada) and sales (VASR)
- The two data sets follow highly similar trends
- A downward trend was noted between 2018 and 2021, followed by a sharp increase, particularly between 2023 and 2024



Note: Antimicrobial totals do not include antiparasitic drugs for either dataset

AMR and integrated AMU/AMR

CIPARS – data from sentinel farms, abattoir, and retail meat

Primary outcome indicators:

- AMU: total AMU, Category I, II and III AMU – measured in nDDDvetCA/1000 animal-days at risk
- AMR: % of isolates fully susceptible (in appendix), % not susceptible to ciprofloxacin for *E. coli* and *Salmonella*, % resistant to ciprofloxacin for *Campylobacter,* % resistant to ceftriaxone, % multidrug-resistant (resistant to 3 or more classes)
    - 14 antimicrobials in 11 antimicrobial classes for *E. coli* and *Salmonella*
    - 9 antimicrobials in 7 classes for *Campylobacter*

NOTE: both "not susceptible to ciprofloxacin" and "resistant to ciprofloxacin" are referred to as "resistant to ciprofloxacin" for the remainder of the presentation

Orientation to new tables

Species/group XXX

Fully Susceptible					
Bacteria	Component	2020 (%)	2024 (%)	Percent difference*	Five-year trend
Escherichia coli	Farm	38	32	6%	
	Abattoir	39	42	3%	
	Retail	45	48	3%	
Salmonella	Farm	40	59	19%	
	Abattoir	43	49	6%	
	Retail	70	20	50%	
Campylobacter	Farm	54	65	11%	
	Abattoir	38	51	13%	
	Retail	48	48	0%	

*Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

Species/group YYY

Ciprofloxacin resistance					
Bacteria	Component	2020 (%)	2024* (%)	Percent difference*	Five-year trend
Escherichia coli	Farm	9	6	3%	
	Abattoir	10	19	9%	
	Retail	12	7	5%	
Salmonella	Farm	4	5	1%	
	Abattoir	5	17	12%	
	Retail	2	33	31%	
Campylobacter	Farm	30	15	15%	
	Abattoir	21	29	8%	
	Retail	28	29	1	

*Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

Note: colour schemes and legends
“significant”: *p*-value ≤ 0.05; “substantial”: ≥ 20% absolute difference

All bacterial species from chicken abattoir samples had an increasing trend in ciprofloxacin resistance. At retail, one third of *Salmonella* and *Campylobacter* were ciprofloxacin-resistant.

Broiler chickens/chicken

E. coli

- Abattoir: significant increase to moderate

Salmonella

- Abattoir: significant increased to moderate
- Retail: significant and substantial increase to high

Campylobacter

- Farm: percent of resistant isolates decreased from high to moderate in 2024
- Abattoir and retail: remained high

Ciprofloxacin resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 33%)
Escherichia coli	Farm	9	6	3%	
	Abattoir	10	19	9%	
	Retail	12	7	5%	
Salmonella	Farm	4	5	1%	
	Abattoir	5	17	12%	
	Retail	2	33	31%	
Campylobacter	Farm	30	15	15%	
	Abattoir	21	29	8%	
	Retail	28	29	1%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

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Note: Partial farm sampling in one province impacted the national-level estimates

There was a significant increase in ceftriaxone resistance in retail chicken *Salmonella* isolates. Ceftriaxone resistance in other broiler chicken components remained low.

Broiler chickens/chicken

E. coli

- All components: resistance was low

Salmonella

- Farm and abattoir: resistance remained low
- Retail: increase in resistance from low to moderate

Ceftriaxone resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 16%)
Escherichia coli	Farm	4	6	2%	
	Abattoir	3	2	1%	
	Retail	3	3	0%	
Salmonella	Farm	4	5	1%	
	Abattoir	4	9	5%	
	Retail	3	16	13%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

Note: Partial farm sampling in one province impacted the national-level estimates

AMR indicator: multidrug resistance (MDR)

For MDR in *Salmonella*, there was a significant increase to moderate and high at abattoir and retail, respectively.

Broiler chickens/chicken

E. coli

- Farm and abattoir: MDR remained high

Salmonella

- Farm: MDR remained low
- Abattoir: MDR increased significantly to moderate
- Retail: MDR significantly and substantially increased from low to high

Campylobacter

- All components: MDR ranged from rare to low

Multidrug resistance (MDR)

Bacteria	Component	2020 (%)	2024(%)	Percent difference[a]	Five-year trend (vertical 0% to 29%)
Escherichia coli	Farm	24	29	5%	
	Abattoir	21	24	3%	
	Retail	22	16	6%	
Salmonella	Farm	7	9	2%	
	Abattoir	7	17	10%	
	Retail	3	25	22%	
Campylobacter	Farm	0	0	No change	
	Abattoir	0	1	1%	
	Retail	0.8	0	1%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

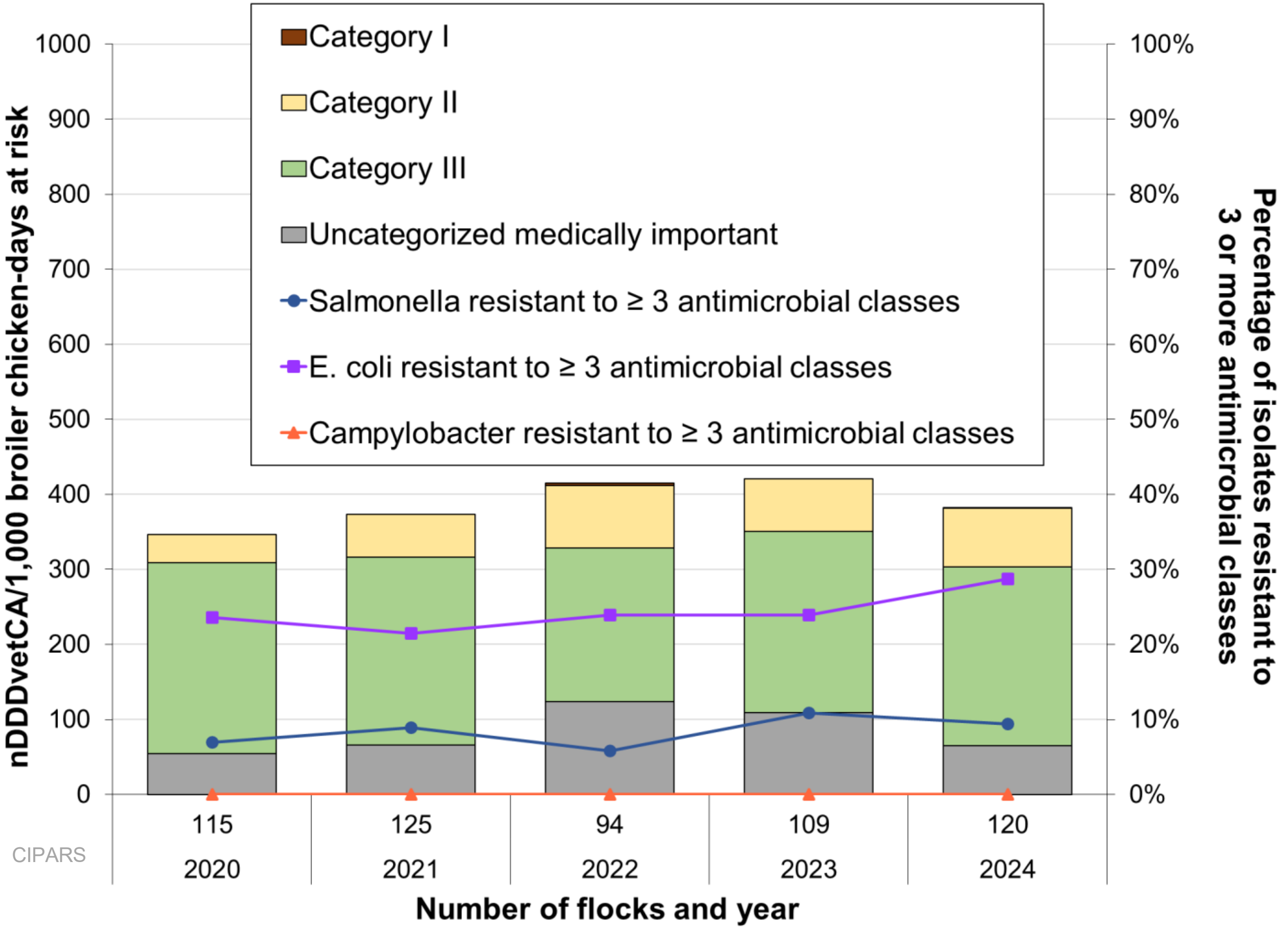
Note: Partial farm sampling in one province impacted the national-level estimates

On broiler chicken farms, AMU decreased (since 2022) with shifts in the categories of MIA. The frequency of MDR in *E. coli* significantly increased (since 2021).

Broiler chickens on farm

Reported AMU: nDDDvetCA/1000 broiler chicken-days at risk

	2020	2024	Percent change[a]
Total	346	382	10% increase
Category I	0	0.36	100% increase
Category II	37	79	110% increase
Category III	255	238	6% decrease
Uncategorized	54	65	19% increase



[a]Percent change=((Value 2024-Value 2020)/Value 2020)X100

AMR indicator: ciprofloxacin resistance

For healthy turkeys on farm and retail turkey, one third of *Campylobacter* isolates were resistant to ciprofloxacin. Ciprofloxacin resistance ranged from rare to low for *E. coli* and *Salmonella.*

Turkeys/turkey

E. coli and *Salmonella*

- Farm and retail: resistance ranged between rare to low

Campylobacter

- Farm and retail: resistance was high (>30%)

Ciprofloxacin resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 38%)
Escherichia coli	Farm	5	6	1%	
	Retail	3	1	2%	
Salmonella	Farm	2	0.6	>1%	
	Retail	0	0	0%	
Campylobacter	Farm	18	31	13%	
	Retail	38	31	7%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

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Ceftriaxone resistance in bacteria from turkey(s) ranged from rare to low across components and years.

Turkeys/turkey

E. coli

- Farm: resistance was observed in 2019 (1%)
- Retail: resistance remained low

Salmonella

- Farm and retail: resistance ranged from rare to low

Ceftriaxone resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 10%)
Escherichia coli	Farm	0	0	0%	
	Retail	6	2	4%	
Salmonella	Farm	0	2	2%	
	Retail	2	0	2%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

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For *E. coli* from turkey farms, MDR significantly decreased from high to moderate between 2020 and 2024, though it ranged from rare to low for *Salmonella* and *Campylobacter* isolates.

Turkeys/turkey

<u>*E. coli*</u>

- Farm: MDR significantly decreased from high to moderate

<u>*Salmonella* and *Campylobacter*</u>

- Farm and retail: MDR ranged from rare to low

Multidrug resistance (MDR)

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 25%)
Escherichia coli	Farm	22	13	9%	
	Retail	13	7	6%	
Salmonella	Farm	5	2	3%	
	Retail	4	0	4%	
Campylobacter	Farm	0	2	2%	
	Retail	0	6	6%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

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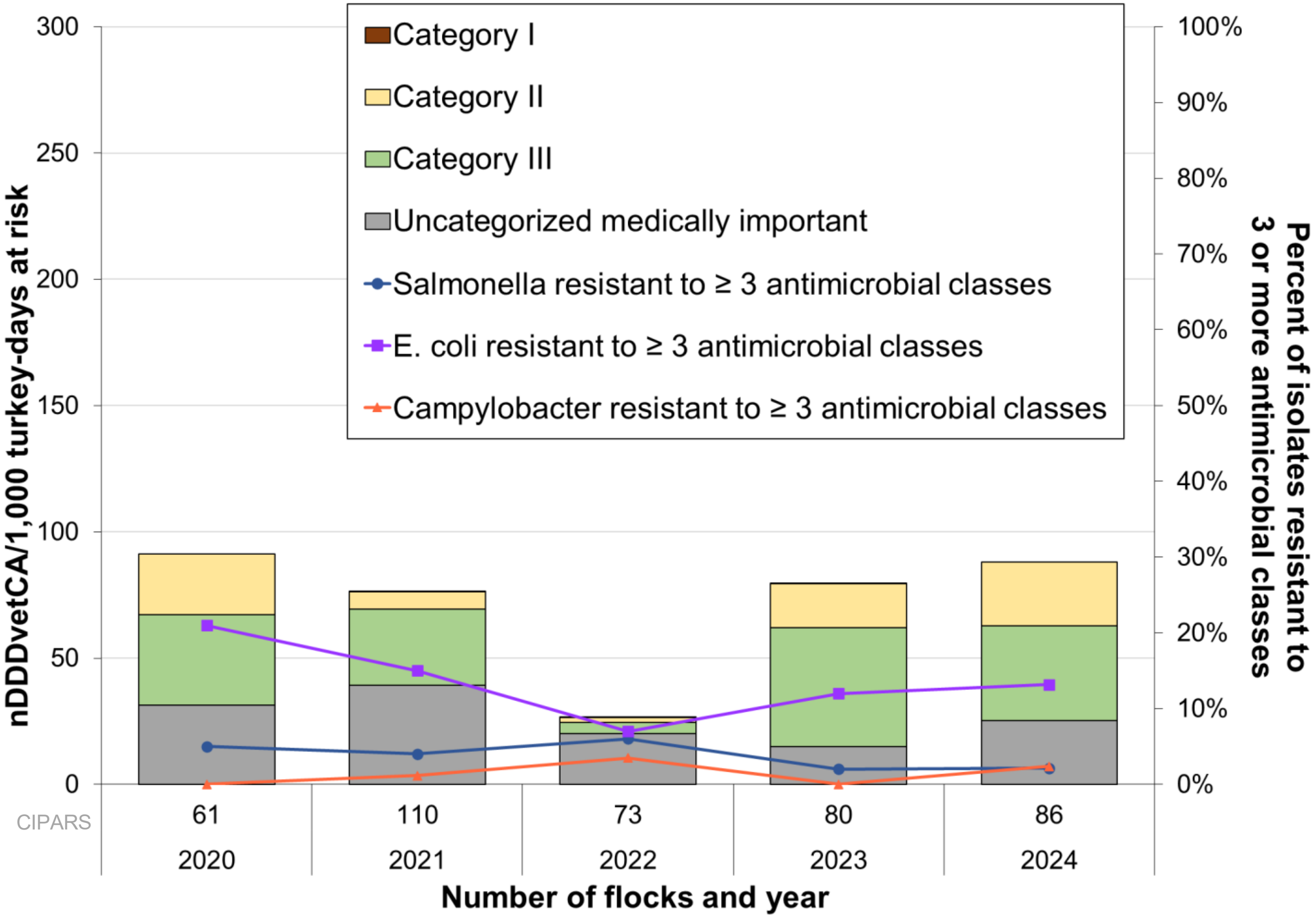
For turkeys, reported AMU has been increasing since 2022. In 2024, there was no reported Category I use, whereas Category II and III use increased. MDR in *E. coli* significantly decreased between 2020 and 2024.

Turkeys on farm

Reported AMU: nDDDvetCA/1000 turkey-days at risk

	2020	2024	Percent change[a]
Total	91	88	4% decrease
Category I	0	0	No change
Category II	24	25	4% increase
Category III	36	37	5% increase
Uncategorized	31	25	19% decrease



[a]Percent change=((Value 2024-Value 2020)/Value 2020)X100

For layer chickens in 2024, while the frequency of resistance to ciprofloxacin in *Salmonella* and *E. coli* was ≤2%, it was 21% for *Campylobacter*.

Layer chickens on farm

E. coli

- Resistance remained low

Salmonella

- Resistance not observed

Campylobacter

- Resistance was high (at 21%)

Ciprofloxacin resistance

Bacteria	Component	2020/21 (%)	2024 (%)	Percent difference[a]	Trend (vertical 0% to 30%)
Escherichia coli	Farm	2	2	0%	
Salmonella	Farm	0	0	0%	
Campylobacter	Farm	16	21	5%	

[a]Percent difference=Percent 2024-Percent 2020/21

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

For layer chickens, 2020 and 2021 were pilot years; hence are combined.

AMR indicator: ceftriaxone resistance

For layer chickens, ceftriaxone resistance was not observed in *E. coli* or *Salmonella*.

Layer chickens on farm

- Not observed – for *E. coli* or *Salmonella*

Ceftriaxone resistance					
Bacteria	Component	2020/21 (%)	2024 (%)	Percent difference[a]	Trend (vertical 0% to 10%)
Escherichia coli	Farm	0	0	0%	
Salmonella	Farm	0	0	0%	

[a]Percent difference=Percent 2024-Percent 2020/21

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

For layer chickens, 2020 and 2021 were pilot years; hence are combined.

For layer chickens, MDR was low in *E. coli* and not observed in *Salmonella or Campylobacter.*

Layer chickens on farm

E. coli

- MDR was very low (1%)

Salmonella and *Campylobacter*

- Not observed

Multidrug resistance (MDR)

Bacteria	Component	2020/21 (%)	2024 (%)	Percent difference[a]	Trend (vertical 0% to 10%)
Escherichia coli	Farm	3	1	2%	
Salmonella	Farm	0	0	0%	
Campylobacter	Farm	0	0	0%	

[a]Percent difference=Percent 2024-Percent 2020/21

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

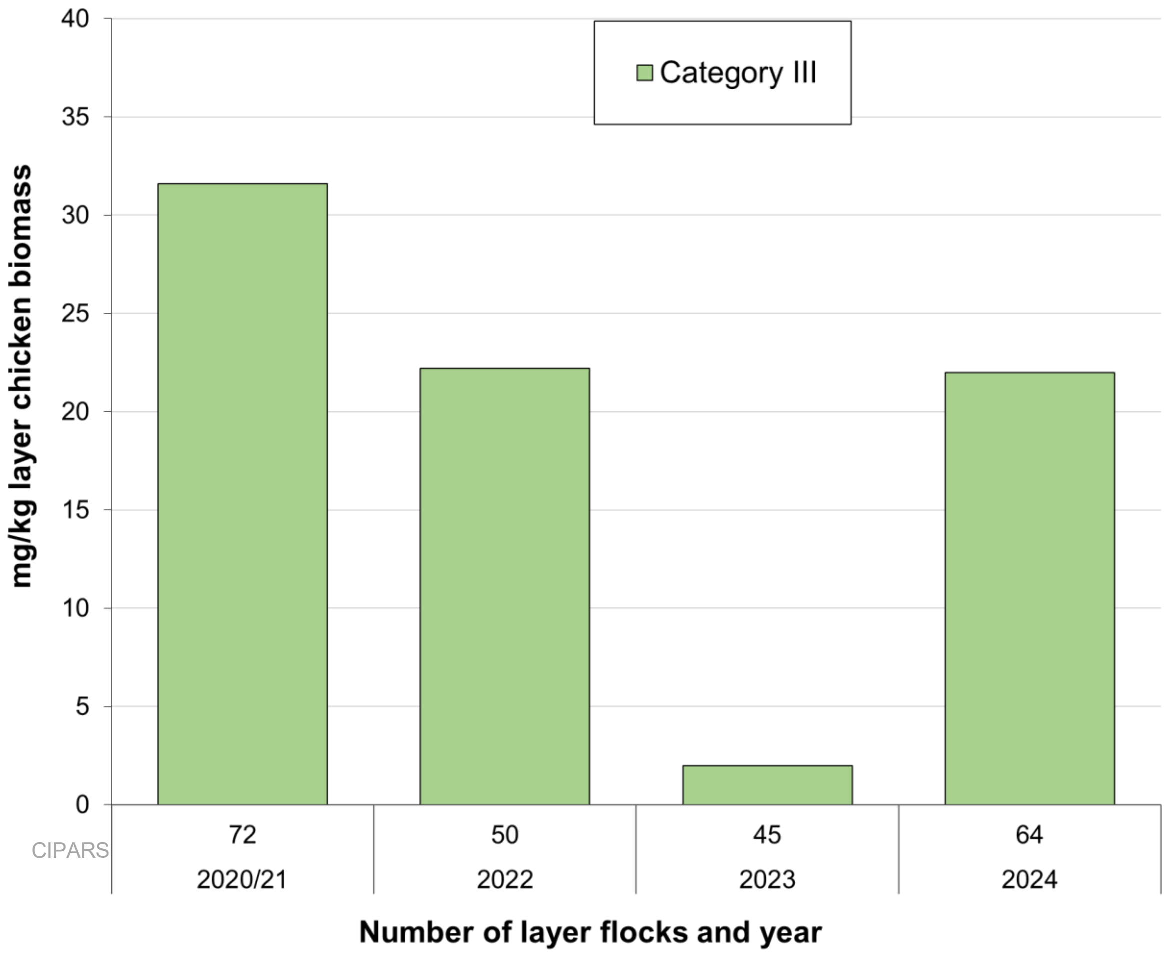
For layer chickens, 2020 and 2021 were pilot years; hence are combined.

For MIAs, only Category III antimicrobials were reported for layer chicken flocks. Multidrug resistance was only detected in *E. coli* (≤3% over time).

Layer chickens on farm

Reported AMU: mg/kg layer chicken biomass

	2020/21	2024	Percent change[a]
Total	32	22	30% decrease
Category I, II and uncategorized	Not reported	Not reported	
Category III	32	22	30% decrease



For layer chickens, 2020 and 2021 were pilot years; hence are combined.

[a]Percent change=((Value 2024-Value 2020/21)/Value 2020/21)X100

For pigs, ciprofloxacin resistance significantly increased in all bacterial species from abattoir between 2020 and 2024. On farm, ciprofloxacin resistance significantly increased in *Campylobacter*.

Grower-finisher pigs/pork

<u>*E. coli*</u>

- Abattoir: significant increase

<u>*Salmonella*</u>

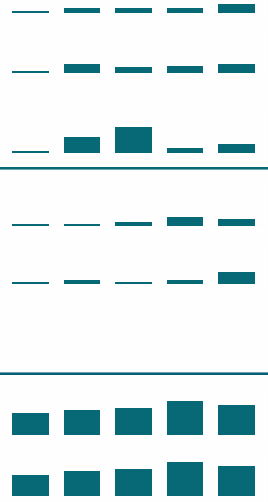
- Abattoir: significant increase

<u>*Campylobacter*</u>

- Farm: significant increase
- Abattoir: significant increase from low to moderate

Ciprofloxacin resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 20%)
Escherichia coli	Farm	1	5	4%	
	Abattoir	0	4	4%	
	Retail	0	4	4%	
Salmonella	Farm	1	3	2%	
	Abattoir	0	5	5%	
	Retail	0	0	0%	
Campylobacter	Farm	12	17	5%	
	Abattoir	10	19	9%	



[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

For pigs at abattoir, ceftriaxone resistance in *Salmonella* isolates significantly increased.

Grower-finisher pigs/pork

E. coli

- All components: resistance was rare to low

Salmonella

- Abattoir: significant increase
- Retail: 4/8 isolates were resistant

Ceftriaxone resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 10%)
Escherichia coli	Farm	1	1	0%	
	Abattoir	3	1	2%	
	Retail	0	2	2%	
Salmonella	Farm	1	8	7%	
	Abattoir	1	10	9%	
	Retail	0	50	50%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

For pigs/pork, MDR frequencies were moderate to high. The frequency of MDR in *Campylobacter* on farm significantly decreased.

Grower-finisher pigs/pork

Salmonella

- Farm and abattoir: MDR was high
- Retail: MDR was observed in 4/8 isolates

Campylobacter

- Farm: MDR significantly decreased from high to moderate

Multidrug resistance (MDR)

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 39%)
Escherichia coli	Farm	18	20	2%	
	Abattoir	24	19	5%	
	Retail	12	21	9%	
Salmonella	Farm	34	35	1%	
	Abattoir	22	21	1%	
	Retail	0	50	50%	
Campylobacter	Farm	26	19	7%	
	Abattoir	22	28	6%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

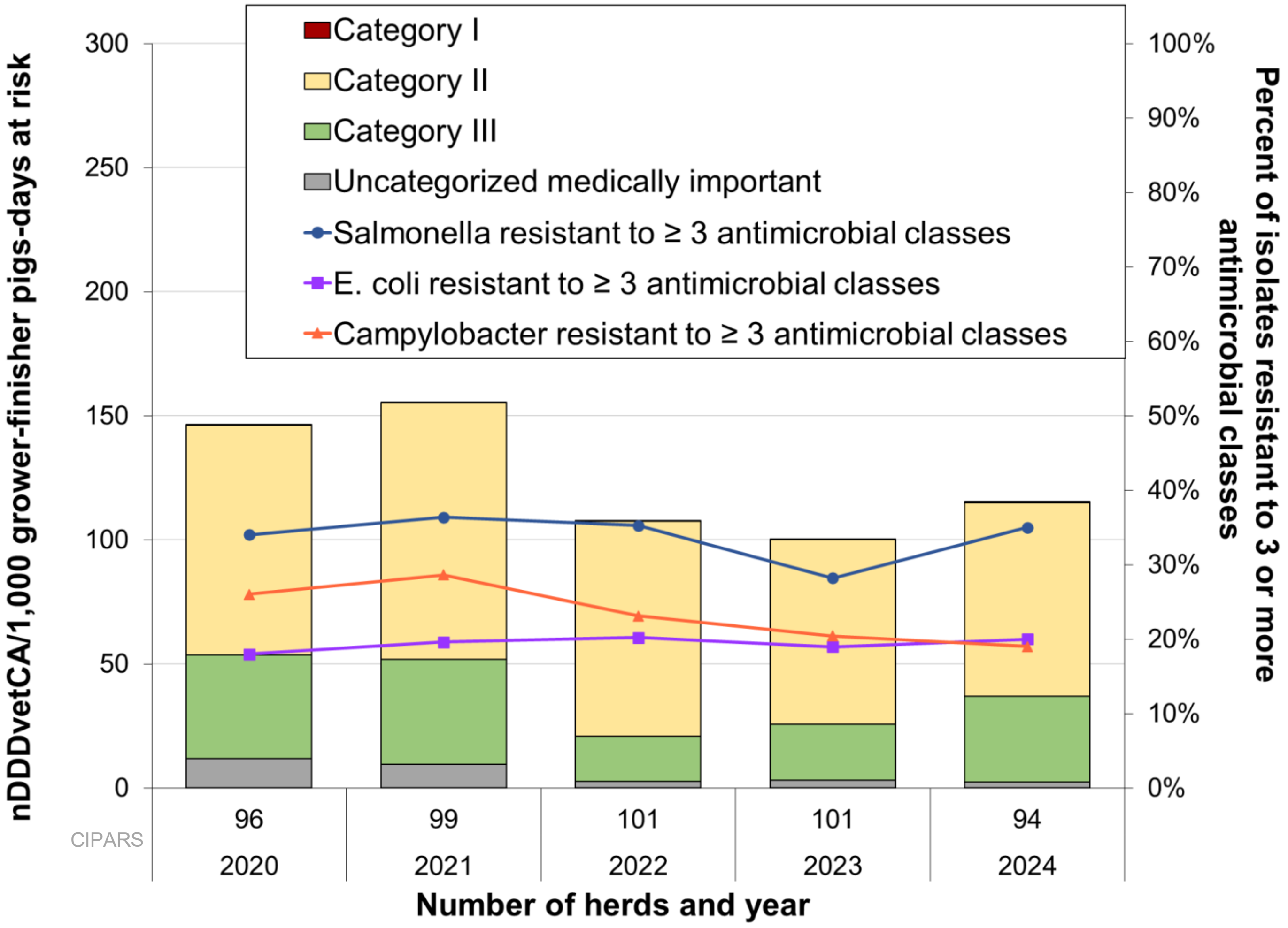
CIPARS

For grower-finisher pigs, there was a substantial relative increase in Category I use between 2020 and 2024 (though Cat I represent < 1% total reported AMU). MDR frequencies were moderate to high.

Grower-finisher pigs on farm

Reported AMU: nDDDvetCA/1000 grower-finisher pig-days at risk

	2020	2024	Percent change[a]
Total	146	115	21% decrease
Category I	0.09	0.41	380% increase
Category II	93	78	16% decrease
Category III	42	35	17% decrease
Uncategorized	12	2	81% decrease



[a]Percent change=((Value 2024-Value 2020)/Value 2020)X100

For feedlot cattle and cattle at abattoir, the frequency of *Campylobacter* resistant to ciprofloxacin was high or very high with significant and substantial increases.

Feedlot cattle/abattoir cattle/beef

E. coli

- All components: resistance was rare to low

Salmonella

- Farm: 10 isolates

Campylobacter

- For farm and abattoir: frequency of ciprofloxacin resistance was high or very high with significant and substantial increases

Ciprofloxacin resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 59%)
Escherichia coli	Farm	1	1	0%	
	Abattoir	3	0	3%	
	Retail	3	3	<1%	
Salmonella	Farm	0	0	0%	
	Retail		100	Not tested	Not tested
Campylobacter	Farm	29	59	30%	
	Abattoir	18	41	23%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

AMR indicator: ceftriaxone resistance

For feedlot cattle, cattle at abattoir, and ground beef, ceftriaxone resistance in *E. coli* isolates ranged from rare to low.

Feedlot cattle/abattoir cattle/beef

E. coli

- Resistance was rare to low

Salmonella

- Farm: 10 isolates

Ceftriaxone resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 38%)
Escherichia coli	Farm	0	0	0%	
	Abattoir	0	0	0%	
	Retail	0	2	1%	
Salmonella	Farm	0	0	0%	
	Retail		100	Not tested	Not tested

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

AMR indicator: multidrug resistance (MDR)

Multidrug resistance in *E. coli* significantly increased in retail ground beef.

Feedlot cattle/abattoir cattle/beef

E. coli

- Abattoir: ranged from moderate to low
- Retail: significant increase in MDR from low to moderate, between 2023 and 2024

Salmonella

- Farm: 10 isolates

Campylobacter

- Abattoir: decrease in MDR from moderate to low (p-value 0.0588)

Multidrug resistance (MDR)

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 38%)
Escherichia coli	Farm	7	8	1%	
	Abattoir	11	6	5%	
	Retail	3	12	9%	
Salmonella	Farm	0	0	0%	
	Retail	Not tested	100	Not applicable	
Campylobacter	Farm	8	7	1%	
	Abattoir	14	3	11%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

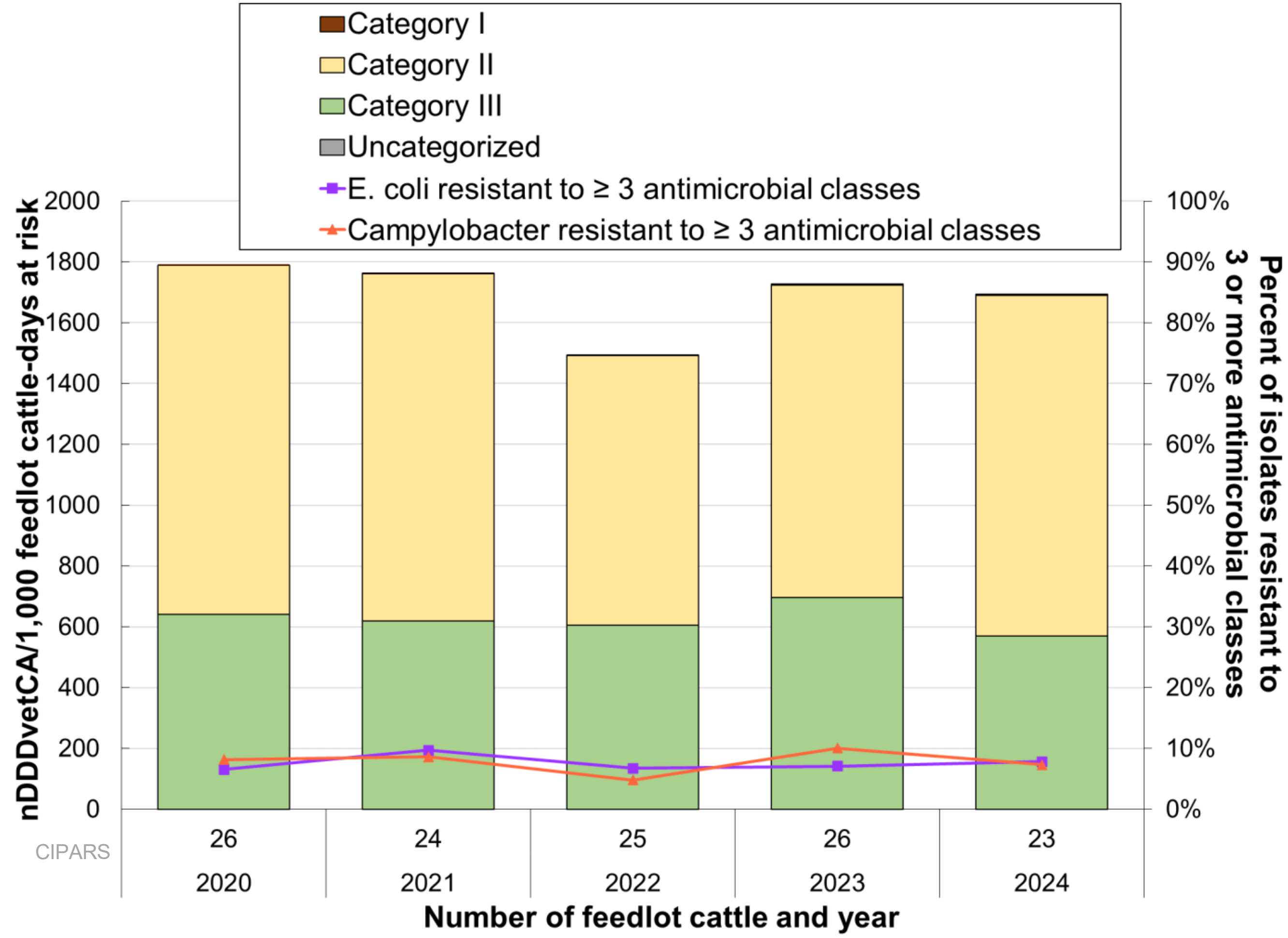
CIPARS

Overall, reported AMU on feedlots decreased by 6% relative to 2020. Reported Category I use (less than 1% of total use) also decreased. The frequency of MDR was low for *E. coli* and *Campylobacter*.

Feedlot cattle on farm

Reported AMU:
nDDDvetCA/1000 feedlot cattle-days at risk

	2020	2024	Percent change[a]
Total	1792	1693	6% decrease
Category I	3.1	2.9	8% decrease
Category II	1148	1120	2% decrease
Category III	641	570	11% decrease
Uncategorized	0	0	Not reported



[a]Percent change=((Value 2024-Value 2020)/Value 2020)X100

For dairy cattle, the frequency of ciprofloxacin resistance in *Campylobacter* significantly increased between 2020 and 2024.

Dairy cattle on farm[a]

E. coli

- Ciprofloxacin resistance was low

Salmonella

- 14 isolates

Campylobacter

- Significant increase in resistance to ciprofloxacin from moderate in 2020 to high in 2024

Ciprofloxacin resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[b]	Five-year trend (vertical 0% to 26%)
Escherichia coli	Farm	1	1	0%	
Salmonella	Farm	0	14	13%	
Campylobacter	Farm	12	23	11%	

[b]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

[a]Inclusive of calf, heifer, lactating cows, and manure pit samples

For dairy cattle, the frequency of ceftriaxone resistance in *E. coli* isolates was low.

Dairy cattle on farm[a]

E. coli

- Resistance was low

Salmonella

- 14 isolates

Ceftriaxone resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[b]	Five-year trend (vertical 0% to 10%)
Escherichia coli	Farm	2	2	0%	
Salmonella	Farm	0	0	0%	

[b]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

[a]Inclusive of calf, heifer, lactating cows, and manure pit samples

For dairy cattle, MDR in *E. coli* isolates was low, whereas in *Campylobacter*, it was only observed in 2022 (<1% of isolates).

Dairy cattle on farm[a]

E. coli

- MDR was low in 2024

Salmonella

- Isolate counts were low (<20) in 2024

Campylobacter

- MDR was only observed in 2022 (1% of isolates in 2022)

Multidrug resistance (MDR)

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[b]	Five-year trend (vertical 0% to 25%)
Escherichia coli	Farm	13	10	3%	
Salmonella	Farm	0	7	7%	
Campylobacter	Farm	0	0	0%	

[b]Percent difference=Percent 2024-Percent 2020

Legend							
20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

[a]Inclusive of calf, heifer, lactating cow, and manure pit samples

AMU and AMR – human *Salmonella* and *Campylobacter*

CIPARS and FNC data

- *Campylobacter* isolates are from FNC sentinel sites

Primary outcome indicators:

- Antimicrobial purchases/dispensations: DDDs/1000 inhabitants per year
- AMR: % of isolates fully susceptible, % not susceptible to ciprofloxacin for *Salmonella,* % resistant to ciprofloxacin for *Campylobacter, %* resistant to ceftriaxone, % multidrug-resistant (resistant to 3 or more antimicrobial classes)
  - 14 antimicrobials in 11 antimicrobial classes for *Salmonella*
  - 9 antimicrobials in 7 classes for *Campylobacter*

Canada

AMR indicator: ciprofloxacin resistance

Ciprofloxacin resistance in human non-typhoidal *Salmonella* isolates continues to increase.
Ciprofloxacin resistance in human *Campylobacter* isolates was consistently high.

Human

Non-typhoidal *Salmonella*

- Resistance increased from moderate in 2020 to high in 2024 (33%)

Campylobacter

- Resistance was consistently high with a variable temporal trend

Ciprofloxacin resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 40%)
Salmonella[b]	Diagnostic	18	33	15%	
Campylobacter	Diagnostic	30	35	5%	

[a]Percent difference=Percent 2024-Percent 2020
[b]Non-typhoidal *Salmonella* only

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

Ceftriaxone resistance in human non-typhoidal *Salmonella* isolates remained low (≤3%).

Human

Non-typhoidal *Salmonella*

- Frequency of ceftriaxone resistance was consistently low

Ceftriaxone resistance

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 10%)
Salmonella[b]	Diagnostic	2	3	1%	

[a]Percent difference=Percent 2024-Percent 2020

[b]Non-typhoidal *Salmonella* only

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

Multidrug resistance in human non-typhoidal *Salmonella* and *Campylobacter* isolates remained low.

Human

Non-typhoidal *Salmonella* and *Campylobacter*

- Frequency of MDR remained low

Multidrug resistance (MDR)

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 11%)
***Salmonella*[b]**	Diagnostic	9	10	1%	
Campylobacter	Diagnostic	2	2	0%	

[a]Percent difference=Percent 2024-Percent 2020
[b]Non-typhoidal *Salmonella* only

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

CIPARS

The quantity of antimicrobials purchased by human hospitals and dispensed by community pharmacies increased overall by 23% to pre-pandemic levels. At the same time, MDR remained low.

Human

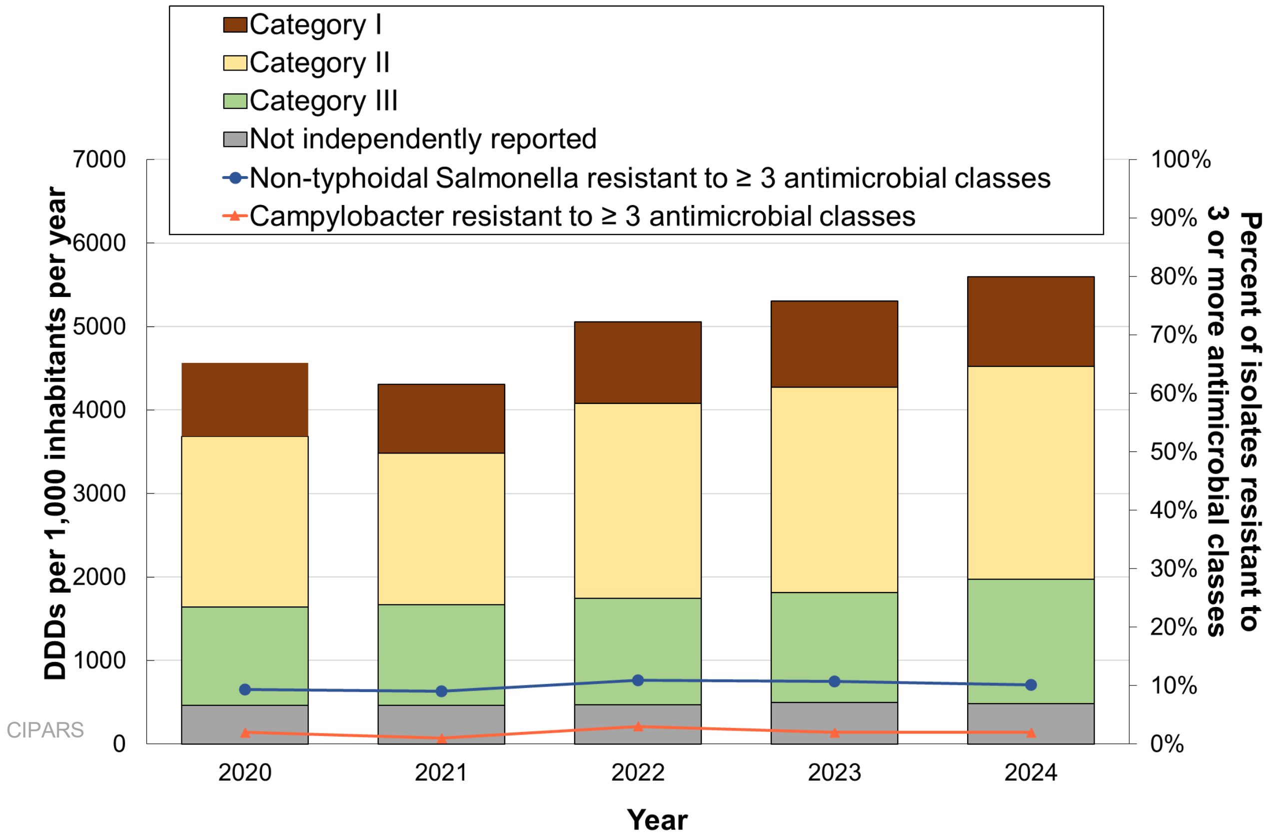
Reported AMU: DDDs/1000 inhabitant per year

	2020	2024	Percent change[a,c]
Total	4564	5593	23% increase
Category I	883	1074	22% increase
Category II	2043	2546	25% increase
Category III	1173	1488	27% increase
Not independently reported (NIR)[b]	465	485	4% increase

Number of isolates

	2020	2021	2022	2023	2024
Non-typhoidal *Salmonella*	4839	3277	4483	5845	6164
Campylobacter	379	435	322	272	331

[a]Percent change=((Value 2024-Value 2020)/Value 2020)X100



AMU data source: SHAMU (IQVIA)

[b]NIR includes: aztreonam, bacitracin, ceftobiprole-medocaril, ceftolozane-tazobactam, chloramphenicol, daptomycin, fosfomycin, fusidic acid, linezolid, metronidazole, nitrofurantoin and vancomycin

[c]Quantity of antimicrobials are returning to pre-pandemic levels

Additional surveillance components - AMR

- Retail seafood (*E. coli*)
- *Salmonella* from the farm environment (from diagnostic animal samples)
- *Salmonella* from feed ingredients and mixed feeds (Canadian Food Inspection Agency)
- Water (*E. coli*, *Salmonella*, *Campylobacter*)

AMR indicator: frequency of fully susceptible, ciprofloxacin resistance, ceftriaxone resistance and MDR

In retail seafood, the recovery of *E. coli* was rare and only one shrimp isolate in 2024 was resistant to Category I antimicrobials.

Retail seafood

E. coli

- Frequency of recovery was 1.7% across sample types (inclusive of trout, haddock, others)
- In 2023, one isolate from a scallop was resistant to ciprofloxacin
- In 2024, the MDR isolate from shrimp was resistant to 6 classes of antimicrobials, including ciprofloxacin

Sample type	Year	Recovery	Indicator			
			% Susceptible	%CIP	%CRO	% MDR
Shrimp	2023	1% (1/71)	100% (1/1)	0% (0/1)	0% (0/1)	0% (0/1)
	2024	3% (4/149)	75% (3/4)	25% (1/4)	0% (0/4)	25% (1/4)
Salmon	2023	1% (1/72)	100% (1/1)	0% (0/1)	0% (0/1)	0% (0/1)
	2024	1% (1/141)	100% (1/1)	0% (0/1)	0% (0/1)	0% (0/1)
Scallop	2023	7% (1/14)	0% (0/1)	100% (1/1)	0% (0/1)	0% (0/1)
	2024	4% (1/27)	100% (1/1)	0% (0/1)	0% (0/1)	0% (0/1)

CIPARS

Resistance to ceftriaxone and resistance to 6 or more classes were infrequent yet present in *Salmonella* isolated from the farm environment.

No meropenem or colistin resistance was found

2020-2024	Chicken Farm Environment	Pig Farm Environment	Turkey Farm Environment
Number of isolates (n)	39	9	45
Top 2 Serovars	*S.* Infantis & *S.* Enteritidis	*Salmonella* I 4,[5],12:i:- (all others n=1)	*S.* Uganda & *S.* Hadar
Fully susceptible (%)	64%	11%	29%
Ciprofloxacin resistance (%)	0	0	0
Ceftriaxone resistance (%)	0	22% (n = 2; *S.* Infantis & *S.* Typhimurium)	2% (n = 1; *S.* Javiana)
Multidrug resistance (MDR)	8% (n=3, *S.* Enteritidis, *S.* Infantis & *S.* Lexington)	33% (n= 3; *S.* Derby, *S.* Infantis, *S.* Typhimurium)	16% (n = 7; S. Hadar (n = 2))
Maximum resistance (number of classes)	4 classes: 5% (n=2, *S.* Infantis & *S.* Lexington	7 classes: 11% (n=1: *S.* Typhimurium)	6 classes: 2% (n= 1; *S.* Javiana)

CIPARS

Only three isolates from cattle farm environments were recovered during this time frame

Antimicrobial-resistant isolates were infrequent yet detected in *Salmonella* isolated from feed ingredients and mixed feeds.

In 2024, all *Salmonella* isolates (n=11) in the CFIA's sampling programs were fully susceptible

- Top two serovars *S.* Cubana (n=3) and *S.* Agona (n=2)
- Regions – Quebec (n=5), Prairies (n=4), and Ontario (n=2)
- Most were isolated from mixed feeds (n=9)
  - Poultry complete feed for laying hens (n=5)
  - Swine complete feed (n=2)
  - Beef complete feed for adults (n=1)
  - Dairy complete feed with monensin for lactating cows (n=1)

- Between 2018 and 2023, a small number of *Salmonella* isolates were resistant to at least one antimicrobial (n=6)
  - All resistant isolates from mixed feeds were in feed intended for chickens (n=4)

Line listings with completely duplicated data were removed

For *E. coli* isolated from untreated/raw water, 9% were resistant to ciprofloxacin.

- Most to all isolates were fully susceptible (*E. coli, Salmonella,* and *Campylobacter)*
- 9% of the *E. coli* isolates were resistant to ciprofloxacin in 2024
- No resistance to ceftriaxone was observed in *Salmonella* or *E. coli* isolates from 2022-2024
- MDR was found in 5% and 2% of *E. coli* isolates in 2023 and 2024, respectively
- No MDR in *Salmonella* or *Campylobacter* isolates from 2022 to 2024

Fully susceptible

Bacteria	Component	2022	2023	2024
Escherichia coli	Raw water	-	75% (n=60)	85% (n=96)
Salmonella	Raw water	100% (n=46)	97% (n=38)	95% (n=60)
Campylobacter	Raw water	79% (n=19)	96% (n=25)	89% (n=35)

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

CIPARS

Resistant to ciprofloxacin

Bacteria	Component	2022	2023	2024
Escherichia coli	Raw water	-	3% (n=60)	9% (n=96)
Salmonella	Raw water	0% (n=46)	0% (n=38)	0% (n=60)
Campylobacter	Raw water	16% (n=19)	4% (n=25)	0% (n=35)

Legend	20 or fewer isolates recovered	Rare 0-0.1%	Very low 0.1% to 1%	Low >1% to 10%	Moderate >10% to 20%	High >20% to 50%	Very high >50% to 70%	Extremely high >70%

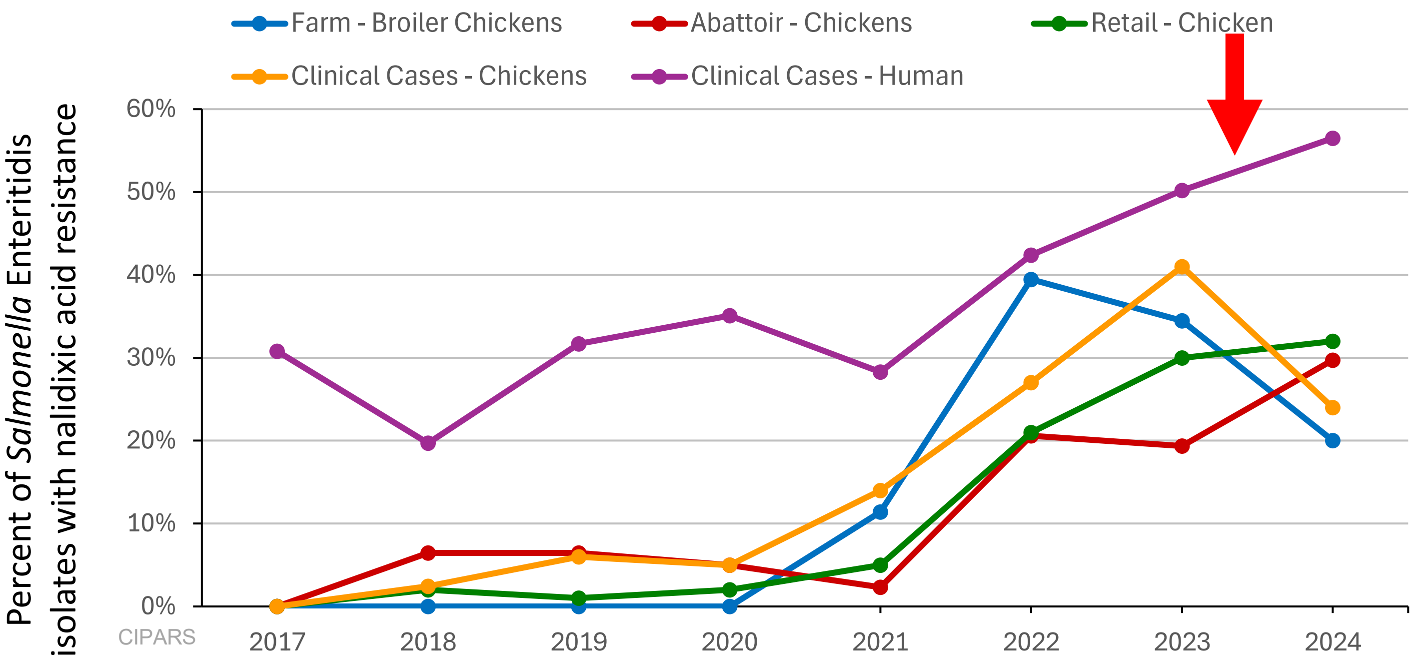
CIPARS

Follow-ups to emerging stories

Nalidixic acid resistance in *Salmonella* Enteritidis (SE) in chickens at abattoir, retail chicken and humans continued to increase.

Broiler chickens, chickens, chicken and humans

- Nalidixic acid-resistance in SE from chickens at abattoir and retail chicken continued to increase
- Nalidixic acid-resistance in SE from broiler chickens on farm and clinical cases in chickens decreased since 2023
- Nalidixic acid resistance in SE from humans substantially increased



n	Farm – Broiler Chickens	69	70	46	37	35	38	29	20
	Abattoir - Chickens	28	31	31	20	43	34	31	37
	Retail - Chicken	83	67	72	51	55	57	70	37
	Clinical Cases - Chickens	112	111	133	92	88	44	80	50
	Clinical Cases - Human	1060	2818	2359	1486	1188	1857	2352	2682

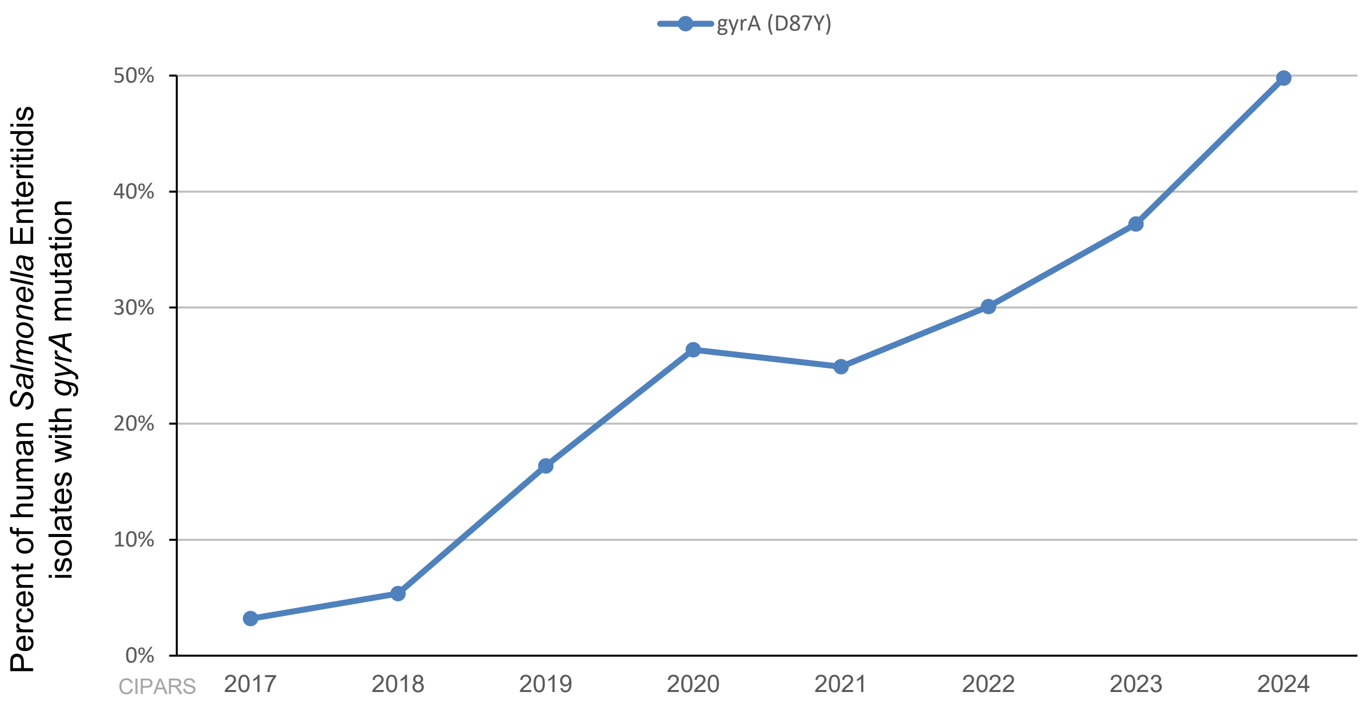
Year, Surveillance Component, and Isolate Number (n)

Nalidixic acid resistance in *Salmonella* Enteritidis and *gyr*(A) D87Y mutation

There was a rapid emergence of a mutation in *gyrA* (D87Y) in *Salmonella* Enteritidis (SE) from chickens, retail chicken and humans.

Broiler chickens, chickens, chicken and human

- Since 2018, all nalidixic acid-resistant SE isolates from broiler chickens (farm, abattoir and clinical cases) and retail, were sequence type 11 and had a mutation in *gyrA* (D87Y)
- In humans, SE isolates with a mutation in *gyrA* (D87Y) substantially increased (figure) and 99.4% of SE isolates with *gyrA* (D87Y) mutation were sequence type 11
- In humans, *Salmonella* Infantis isolates with a mutation in *gyrA* (D87Y) substantially increased – 11% in 2017 to 42% in 2024 (of all *S*. Infantis)



n	Clinical Cases - Human	1060	2818	2359	1486	1188	1857	2352	2682

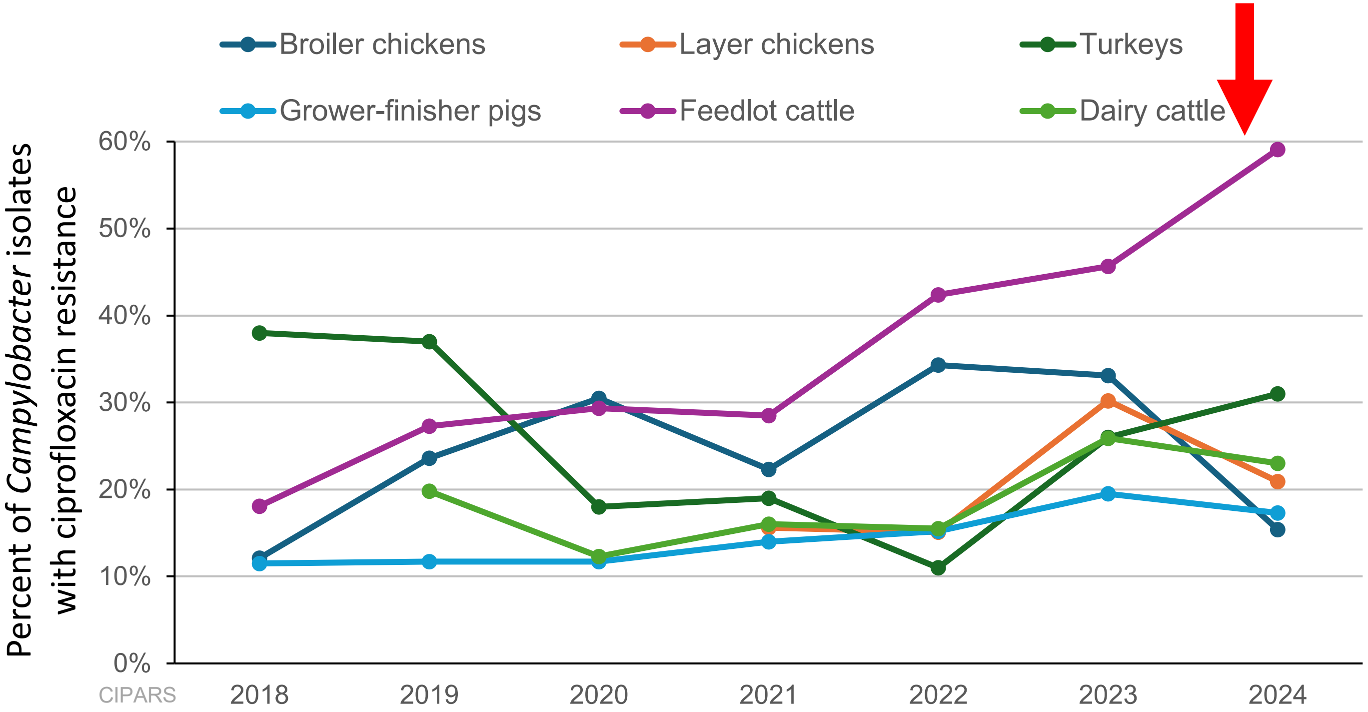
Year, Surveillance Component, and Isolate Number (n)

Ciprofloxacin resistance in *Campylobacter* substantially increased in feedlot cattle, cattle at abattoir and retail beef.

All surveillance components

Ciprofloxacin resistance in *Campylobacter* isolates from:

- Feedlot cattle, cattle at abattoir and retail beef continued to **substantially increase**
- Farm (layer chickens, grower-finisher pigs, turkeys and dairy cattle), abattoir (chickens and pigs) and retail chicken - resistance increased since 2020, but variable trends
- Broiler chickens on farm and retail turkey **decreased** since 2020 and 2023 with variability between
- Humans was variable and high, ranging from 25% to 44% between 2018 and 2024 (*data not shown*)



		2018	2019	2020	2021	2022	2023	2024
n	Farm – Broiler Chickens	122	142	78	123	123	140	81
	Farm – Layer Chickens				183	115	107	170
	Farm - Turkeys	191	214	90	240	115	109	147
	Farm – Grower-finisher Pigs	483	447	349	367	365	425	376
	Farm – Feedlot Cattle	94	162	92	247	184	149	93
	Farm – Dairy Cattle		360	285	284	298	283	231

Year, Surveillance Component, and Number of Isolates (n)

ESBL-producing non-typhoidal *Salmonella* isolates recovered from humans and animals/food continued to increase, with a sharp increase in animals/food in 2024.

Overall frequency prior to 2017 was < 0.5% for humans and animals/food

- 2024 – humans - 1.9%; animals/food - 2.9%

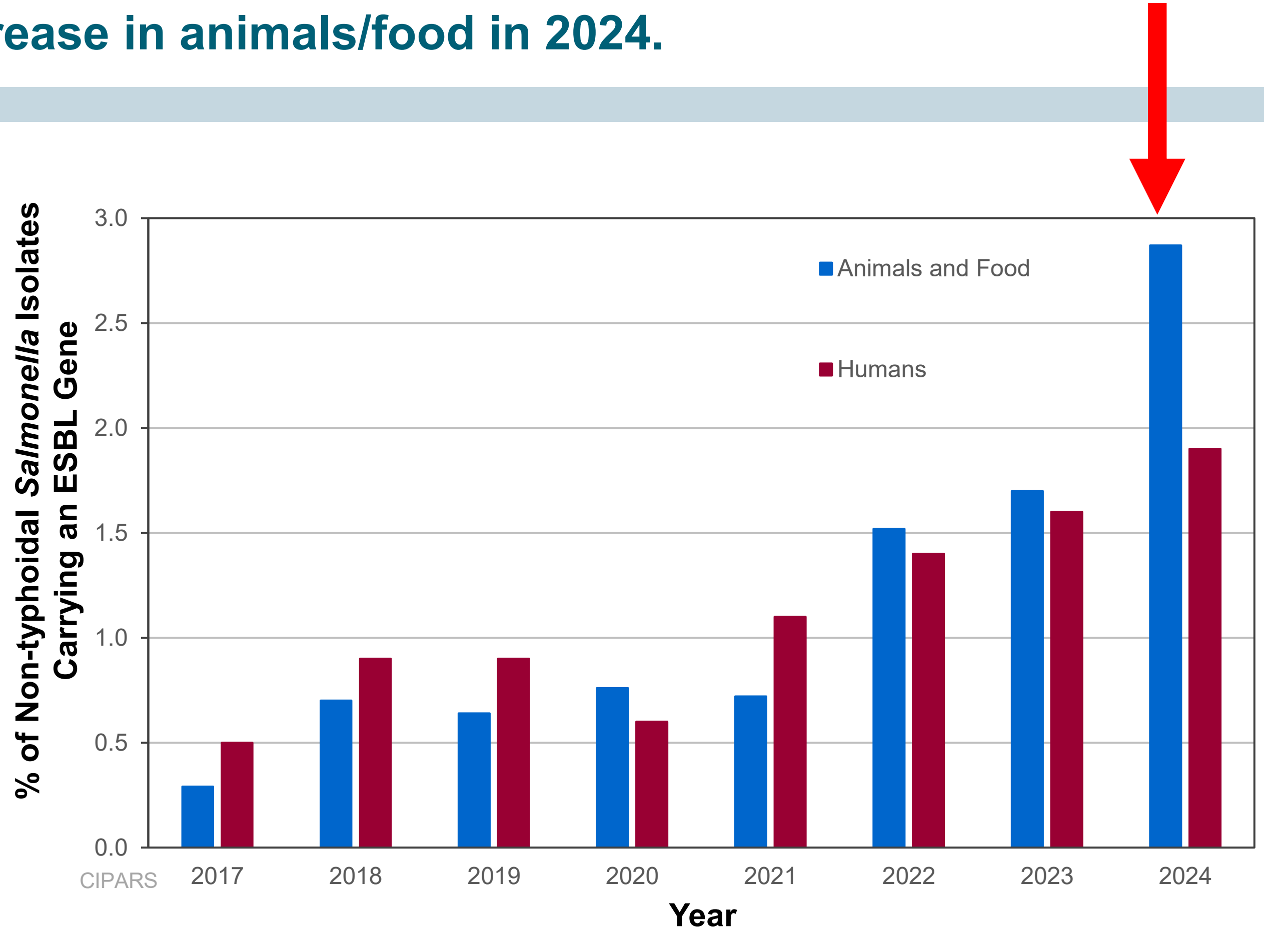
Humans

Since 2017,

- Frequency of ***bla***$_{\text{CTX-M-65}}$ increased (0.3% → 1.1% of all isolates; vast majority are *S*. Infantis)
- Frequency of ***bla***$_{\text{CTX-M-55}}$ increased (0.1% → 0.5% of all isolates; predominantly *Salmonella* I 4,[5],12:i:-)

Animal/food sources

- Frequency of ***bla***$_{\text{CTX-M-65}}$ substantially increased since 2021 (0.1% → 2.45% of all isolates; vast majority *S*. Infantis)
- Frequency of ***bla***$_{\text{CTX-M-55}}$ was variable since 2017 (range 0.1% to 0.5% of all isolates; predominantly *Salmonella* I 4,[5],12:i:-)



Note: from retail seafood, recovery of ESBL-producing isolates from other Enterobacterales was 6% in 2024

Mobile colistin resistance continued to be detected, though rarely among human and seafood samples.

Humans

- Mobile colistin resistance was detected in 2 *Salmonella* isolates in **2024**
    1. *mcr 1.1* detected in 1 *S.* Enteritidis isolate – resistant to 2 antimicrobials (ampicillin and colistin) in 2 antimicrobial classes
    2. *mcr 1.1* detected in 1 *Salmonella* I 4,[5],12:i:- isolate – resistant to 9 antimicrobials (ampicillin, chloramphenicol, ciprofloxacin, colistin, ceftriaxone, gentamicin, sulfisoxazole, trimethoprim sulfamethoxazole and tetracycline) in 8 classes
- 15 isolates with mobile colistin resistance detected between 2017 and 2023

Animal, Food and Water Sources

- Mobile colistin resistance was detected in 4 isolates between **2017 and 2024**
    1. *mcr 3.15* detected in 1 *Aeromonas* isolate from retail **salmon** from **Canada** in **2024** – no additional resistance
    2. *mcr 3.3* detected in 1 *Aeromonas* isolate from retail **shrimp** from **Vietnam** in 2023 – no additional resistance
    3. *mcr 4.2* detected in 1 *S.* Mbandaka isolate from a **chicken** at **abattoir** in 2019 – no additional resistance
    4. *mcr 1* detected in 1 *Salmonella* I 4,[5],12:i:- isolate from a **horse diagnostic** sample in 2017 – resistant to 8 antimicrobials (chloramphenicol, ciprofloxacin, colistin, gentamicin, nalidixic acid, sulfisoxazole, trimethoprim-sulfamethoxazole and tetracycline) in 6 classes

No carbapenemase-producing *Salmonella* detected since 2018.

Carbapenemase-producing organisms

Humans

- *blaOXA-48* detected in 1 *Salmonella* London isolate in **2018**
    - Resistant to 2 antimicrobials (ampicillin and meropenem) in 2 antimicrobial classes

Animal and Food Sources

- *blaIMP-27* detected in 1 *S.* Schwarzengrund from a sick pig in **2017**
    - Resistant to 9 antimicrobials (amoxicillin-clavulanic acid, ampicillin, chloramphenicol, ceftriaxone, cefoxitin, meropenem, sulfisoxazole, streptomycin and tetracycline) in 8 antimicrobial classes

Interactive Data Displays

CIPARS Interactive data visualizations: *One Stop Shop*

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

https://health-infobase.canada.ca/cipars/

Canada

Summary and take away messages

Take-away messages

- Relative to 2020, sales of MIAs for animals **decreased by ~13%**, whereas **Category I sales increased by 23%** (mg/kg biomass)
- Sales for use in aquaculture **increased by 226% relative to 2020, however the increase in 2024 was unusual, anecdotal information indicates there was likely a disease outbreak driving this increase.**
- Canadian sales of MIAs for animals were slightly higher than the average for the Americas, according to global data in WOAH's ANIMUSE (*based on 2022 data*)
- New data on **antifungals sold as pesticides**: total quantity was greater than the total quantity of medically important antibiotics sold for humans, animals, and plants/crops combined
- Broiler chickens/chicken: increase in ciprofloxacin resistance in *E. coli* and *Salmonella*
- Grower-finisher pigs, increase in reported AMU between 2023 and 2024, with a substantial increase in Category I antimicrobials used
- Humans, the frequency of ciprofloxacin resistance increased in *Salmonella*
- Retail seafood, resistance **to colistin (salmon *Aeromonas*) and ciprofloxacin (scallop *E. coli*)** was found

Take-away messages

- While infrequent, *Salmonella* isolates with **Category I resistance and MDR were found in the environment** of sick animals

- *E. coli* **resistant to ciprofloxacin were found in untreated/raw water samples**

- **CIPARS continued to detect increasing proportions of nalidixic acid-resistant *S.* Enteritidis** from broiler chickens, chicken meat and humans. This increase appeared to be attributed to the emergence of a mutation in *gyrA* (D87Y).

- **Ciprofloxacin resistance** in *Campylobacter* from feedlot cattle, healthy cattle at abattoir and retail ground beef continued to rise. **This trend was variable in other species/stages of the food chain.** Overall, ciprofloxacin resistance in *Campylobacter* from humans remained high with a variable trend (35%, 2024).

- **ESBL-producing non-typhoidal *Salmonella*** from humans, and animals/food continued to increase. The frequency of ESBL-producing *Salmonella* prior to 2017 was less than 0.5% for each of humans and animals/food, in 2024 this stands at 1.9% and 2.9%, respectively.

- **Mobile colistin resistance and carbapenemase-producing *Salmonella* were rarely detected**. Mobile colistin resistance was detected in two human *Salmonella* isolates and one retail salmon *Aeromonas* isolate from Canada in **2024.** Carbapenemase-producing *Salmonella* have not been found from either human or animal sources since 2018.

Acknowledgements

Human (AMR):
- NML Division of Enteric Diseases and PulseNet Canada
- Provincial Public Health Laboratories
- FoodNet Canada Sentinel Sites (*Campylobacter*)
- National Enteric Surveillance Program (NESP)

Farm (AMR and AMU):
- Veterinarians, producers and component groups, and academic and federal partners who participate in the farm program
- Saskatchewan Agriculture
- Feedlot Cattle Surveillance - partial funding current & past: Canadian Agricultural Partnership in Alberta and Ontario, Alberta Cattle Feeders Association, Bayer Animal Health, Beef Farmers of Ontario, Beef Cattle Research Council, Alberta Beef Producers, McDonald’s, Saskatchewan Cattle Feeders and Vetoquinol
- Dairy Cattle Surveillance – partial funding: Dairy Farmers of Canada Dairy Research Cluster as part of the Canadian Agricultural Partnership
- Fisheries and Oceans Canada (DFO)

Abattoir:
- Canadian Food Inspection Agency, abattoir operators, samplers and personnel

Retail and Water:
- Health Units and institutions that participate in FoodNet Canada
- Alberta Irrigation Districts Association
- Alberta Agriculture and Irrigation
- Participating water treatment plants

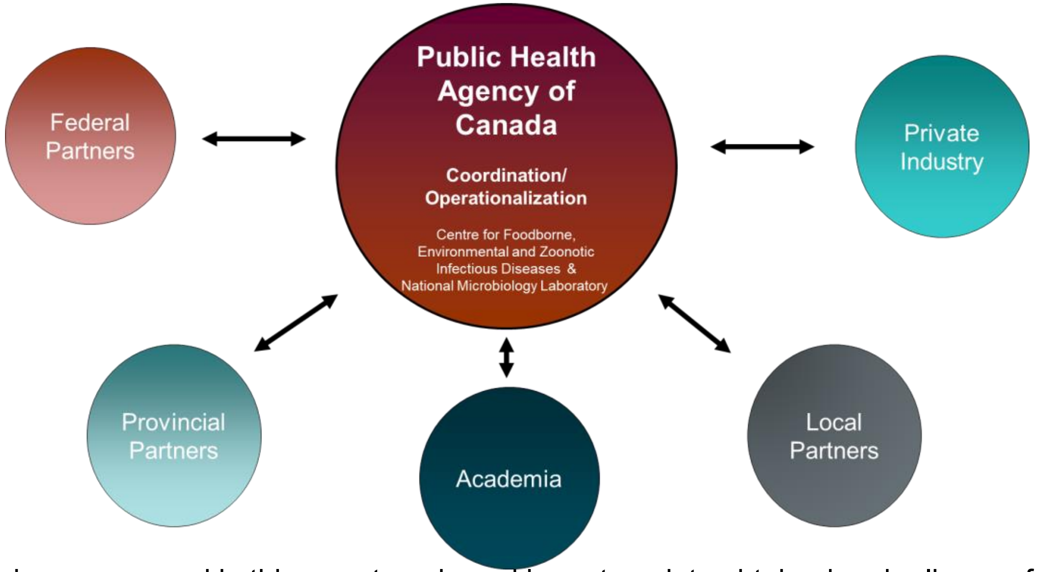
Clinical Animal Isolates:
- Provincial Animal Health Laboratories

Antimicrobial sales for animals:
- VASR: Health Canada’s Veterinary Drugs Directorate and PHAC

Antimicrobial Use - humans:
- SHAMU (PHAC AMR Task Force) and IQVIA. The statements, findings, conclusions, views, and opinions expressed in this report are based in part on data obtained under license from IQVIA Solutions Canada Inc. concerning the following information service(s): Compuscript, from January, 2020 to December, 2024. All Rights Reserved. The statements, findings, conclusions, views, and opinions expressed herein are not necessarily those of IQVIA Inc. or any of its affiliated or subsidiary entities.

Antimicrobials Sold as Pesticides for use in Crops:
- Health Canada’s Pest Management and Regulatory Agency

Feed Ingredients and Mixed Feeds:
- Canadian Food Inspection Agency



Appendix

Antimicrobials are grouped into categories based on their importance to human medicine

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

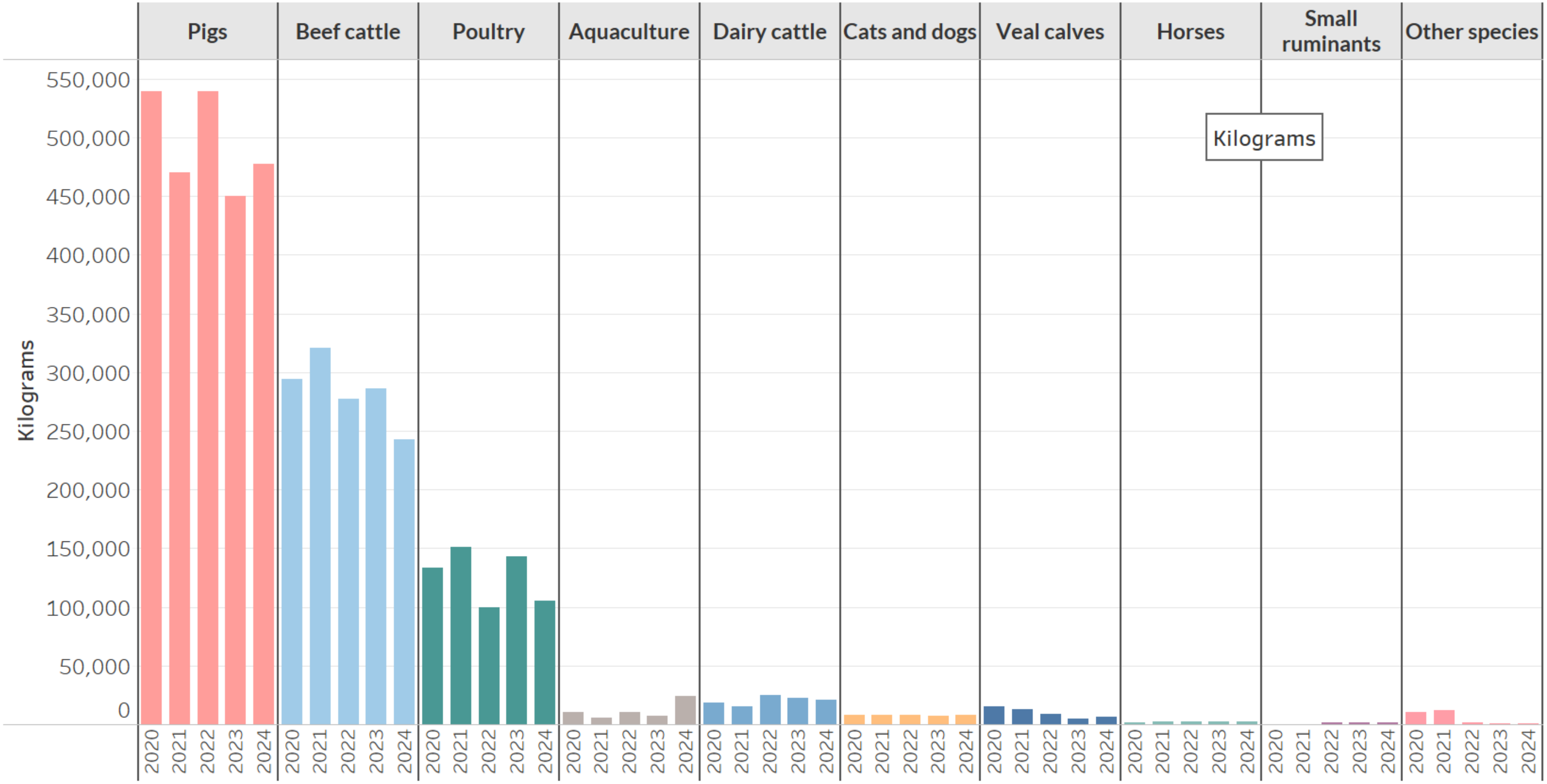
Category IV: Low importance

Example: ionophores

*Categorization system developed by Health Canada's Veterinary Drugs Directorate
Chemical coccidiostats are considered out of scope of medically important antimicrobials. Uncategorized medically important antimicrobials include pleuromutilins, orthosomycins, coumarins and pseudomonic acids

Categorization of antimicrobials: https://www.canada.ca/en/health-canada/services/drugs-health-products/veterinary-drugs/antimicrobial-resistance/categorization-antimicrobial-drugs-based-importance-human-medicine.html
List of certain antimicrobial active pharmaceutical ingredients: https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance/animals/veterinary-antimicrobial-sales-reporting/list-a.html

For In kg, reported sales were primarily for pigs, beef cattle and poultry



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Antimicrobial sales – animal, human

There was a different spectrum of antimicrobials sold for use in animals compared to people.

Groups: human and all animals
Indicators: mg/kg biomass (animal) mg/population adjusted biomass (human)

The only medically important antimicrobial class sold for use on crops are aminoglycosides (Source: HC-PMRA)

Data for humans and animals (food animals, horses, cats and dogs) are for systemic use only (oral and parenteral)

Antimicrobial Class	Human 2020	Human 2021	Human 2022	Human 2023	Human 2024	All Animals 2020	All Animals 2021	All Animals 2022	All Animals 2023	All Animals 2024
carbapenems	0.46	0.46	0.46	0.46	0.48				0.00	
3rd & 4th generations cephalosporins	2.29	2.13	2.30	2.25	2.36	0.18	0.18	0.19	0.20	0.21
fluoroquinolones	4.63	4.22	4.35	4.13	3.97	0.05	0.08	0.13	0.14	0.16
penicillin beta-lactamase inhibitor combinations	17.26	15.14	17.85	20.11	22.19	0.38	0.42	0.43	0.42	0.43
1st & 2nd generation cephalosporins	14.78	14.19	13.95	14.29	14.63	0.43	0.47	0.47	0.46	0.48
aminoglycosides	0.07	0.07	0.06	0.06	0.06	1.06	1.99	1.15	1.11	1.65
lincosamides	2.17	1.95	1.78	1.66	1.49	5.98	7.07	7.06	5.59	5.63
macrolides	2.87	2.18	3.08	3.18	3.67	14.93	13.86	14.26	13.91	13.40
penicillins	21.12	19.27	26.51	28.12	28.18	13.76	17.12	13.30	11.61	11.74
sulfonamides	6.08	5.77	5.84	5.92	6.30	6.92	5.97	6.40	5.88	6.58
tetracyclines	2.57	2.63	2.60	2.62	2.87	71.87	69.91	69.57	67.46	63.07
other	6.37	6.45	6.61	7.27	7.74	18.59	17.46	17.90	19.34	18.15

mg adjusted for biomass
0.00 – 75.00

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Others for **humans** includes: bacitracins, 5th generation cephalosporins, fosfomycins, fusidic acid, glycopeptides, lipopeptides, monobactams, nitrofurans, nitroimidazoles, oxazolidinones, phenicols, and polymyxins.
Others for **animals** includes: aminocoumarins, aminocyclitols, amphenicols, β-lactamase inhibitors, cyclic polypeptides, fusidic acid, glycopeptides, nitrofurantoins, nitroimidazoles, orthosomycins, phosphonic acid derivatives, pleuromutilins, polymyxins, pseudomonic acids, streptogramins, and therapeutic agents for tuberculosis
Data sources: SHAMU (IQVIA) and CIPARS

AMR indicator: fully susceptible

There was a significant and substantial decrease in fully susceptible *Salmonella* isolates from retail chicken. However, there was a significant increase in fully susceptible *Campylobacter* isolates from chickens at abattoir and on farm and *Salmonella* in chickens on farm.

Broiler chickens/chicken

E. coli

- Frequency ranged from 32-48%

Salmonella

- Farm: a significant increase with many isolates fully susceptible
- Retail: significant and substantial decrease. Most isolates were fully susceptible in 2020 and only some were in 2025.

Campylobacter

- Farm and abattoir: significant increases between 2020 and 2024

Fully susceptible

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 70%)
Escherichia coli	Farm	38	32	6%	
	Abattoir	39	42	3%	
	Retail	45	48	3%	
Salmonella	Farm	40	59	19%	
	Abattoir	43	49	6%	
	Retail	70	20	50%	
Campylobacter	Farm	54	65	11%	
	Abattoir	38	51	13%	
	Retail	48	48	0%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

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Note: Partial farm sampling in one province impacted the national-level estimates

For turkeys, there was a significant increase in fully susceptible *Campylobacter* farm isolates between 2020 and 2024.

Turkeys/turkey

Campylobacter

- Farm: fully susceptible isolates significantly increased from some to many

Fully susceptible

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 68%)
Escherichia coli	Farm	33	39	6%	
	Retail	50	55	5%	
Salmonella	Farm	44	52	8%	
	Retail	63	68	5%	
Campylobacter	Farm	35	53	18%	
	Retail	63	50	13%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

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For layer chickens, there was a wide range of frequencies of fully susceptible across bacterial species (37% to 83%).

Layer chickens on farm

- None of the changes between 2020/2021 and 2024 were statistically significant for any of the bacterial species

Fully susceptible

Bacteria	Component	2020/21 (%)	2024 (%)	Percent difference[a]	Trend (vertical 0% to 83%)
Escherichia coli	Farm	72	83	11%	
Salmonella	Farm	59	37	22%	
Campylobacter	Farm	65	55	10%	

[a]Percent difference=Percent 2024-Percent 2020/21

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

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For layer chickens, 2020 and 2021 were pilot years; hence are combined.

For grower-finisher pigs, there was a significant increase in the frequency of fully susceptible isolates on farm.

Grower-finisher pigs/pork

E. coli

- Abattoir: an increasing trend (not sig – *p*-value = 0.06)

Salmonella

- Retail: 4/8 isolates were fully susceptible

Campylobacter

- Farm: significant increase in frequency of fully susceptible

Fully susceptible

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 83%)
Escherichia coli	Farm	29	30	1%	
	Abattoir	26	35	9%	
	Retail	55	51	4%	
Salmonella	Farm	41	41	0%	
	Abattoir	51	52	1%	
	Retail	0	50	50%	
Campylobacter	Farm	21	27	6%	
	Abattoir	26	23	3%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

CIPARS

AMR indicator: fully susceptible

There was a significant decrease in fully susceptible *E. coli* isolates from retail beef. The frequency of fully susceptible *Campylobacter* isolates was 2%.

Feedlot cattle/abattoir cattle/beef

E. coli

- Retail: most isolates were fully susceptible, yet there was a significant decrease

Salmonella

- Farm: 10 isolates

Campylobacter

- Farm: the frequency of fully susceptible on farm decreased (not significant; p-value = 0.06)

Fully susceptible

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 85%)
Escherichia coli	Farm	43	41	2%	
	Abattoir	51	54	3%	
	Retail	83	64	19%	
Salmonella	Farm	13	20	7%	
	Retail		0	Not tested	Not tested
Campylobacter	Farm	9	2	7%	
	Abattoir	14	22	8%	

[a]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

CIPARS

AMR indicator: fully susceptible

For dairy cattle, the frequency of fully susceptible *E. coli* isolates was >80%.

Dairy cattle on farm[a]

<u>*E. coli*</u>

- Most isolates were fully susceptible

<u>*Salmonella*</u>

- 14 isolates

<u>*Campylobacter*</u>

- Although many isolates were fully susceptible, there was a decrease between 2020 and 2024 (not significant, *p*-value = 0.07)

Fully susceptible

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[b]	Five-year trend (vertical 0% to 84%)
Escherichia coli	Farm	81	81	0%	
Salmonella	Farm	84	57	27%	
Campylobacter	Farm	51	43	8%	

[b]Percent difference=Percent 2024-Percent 2020

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

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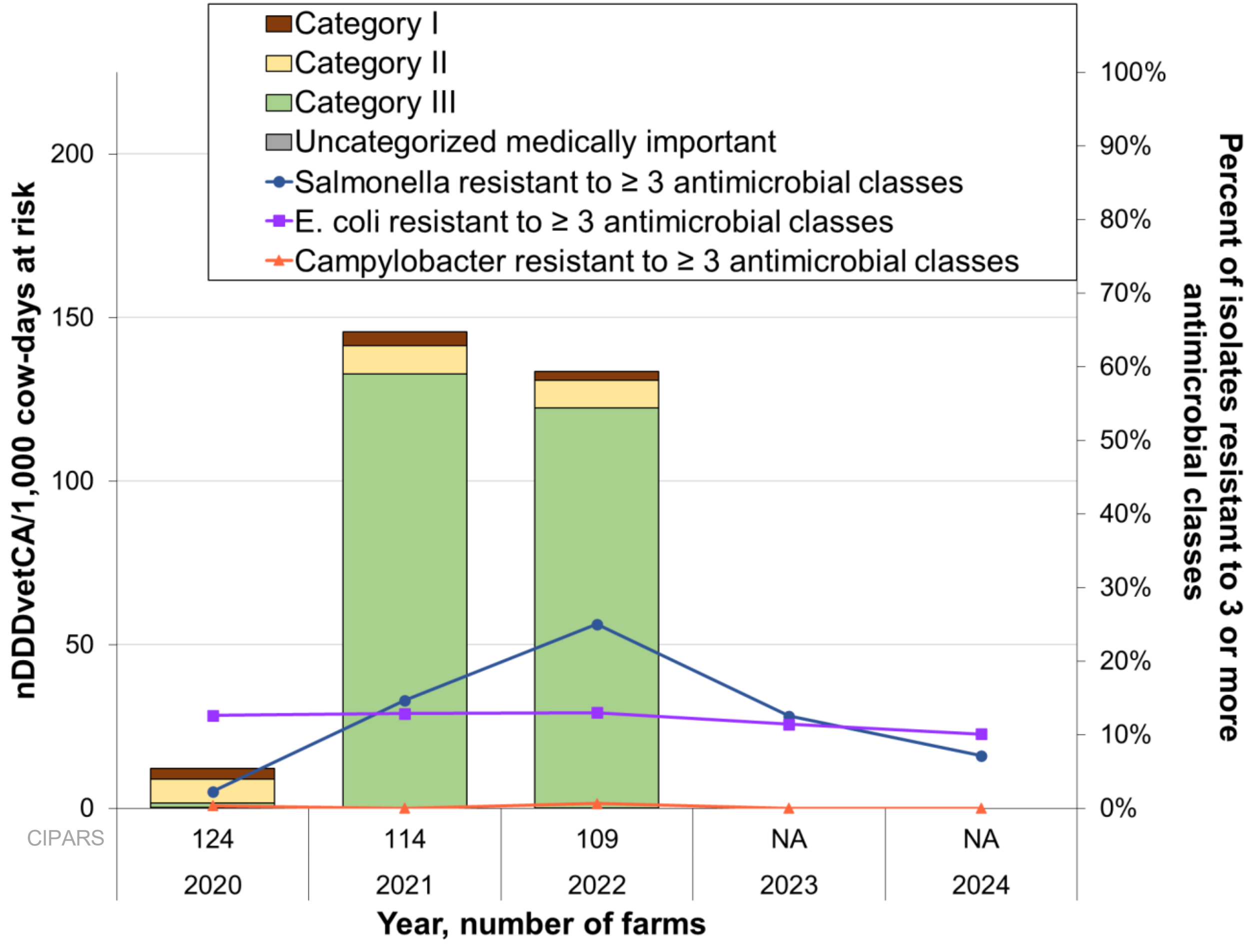
[a]Inclusive of calf, heifer, lactating cows, and manure pit samples

There were no significant changes in MDR.

Dairy cattle on farm[a]

Please join the dairy specific presentation for further explanation of the AMU trends



For *Salmonella*, caution with interpreting the trend line; 2023 – n=16; 2024 – n=14 isolates

[a]Inclusive of calf, heifer, lactating cow, and manure pit samples

[b]Percent change=((Value 2022-Value 2020)/Value 2020)X100

Fully susceptible non-typhoidal *Salmonella* in humans continues to decrease and was less than 50%. Fully susceptible *Campylobacter* in humans was consistently less than 50%.

Human

Non-typhoidal *Salmonella*

- Frequency of fully susceptible decreased from most isolates in 2020 to many isolates in 2024
- In 2024, the frequency was less than 50%

Campylobacter

- Many isolates were fully susceptible; however, the frequency was consistently less than 50%

Fully susceptible

Bacteria	Component	2020 (%)	2024 (%)	Percent difference[a]	Five-year trend (vertical 0% to 72%)
Salmonella[b]	Diagnostic	67	49	18%	
Campylobacter	Diagnostic	41	46	5%	

[a]Percent difference=Percent 2024-Percent 2020
[b]Non-typhoidal *Salmonella* only

Legend	20 or fewer isolates recovered	Few 0%-20%	Some >20% to 40%	Many >40% to 60%	Most >60% to 80%	Nearly all >80% to 100%

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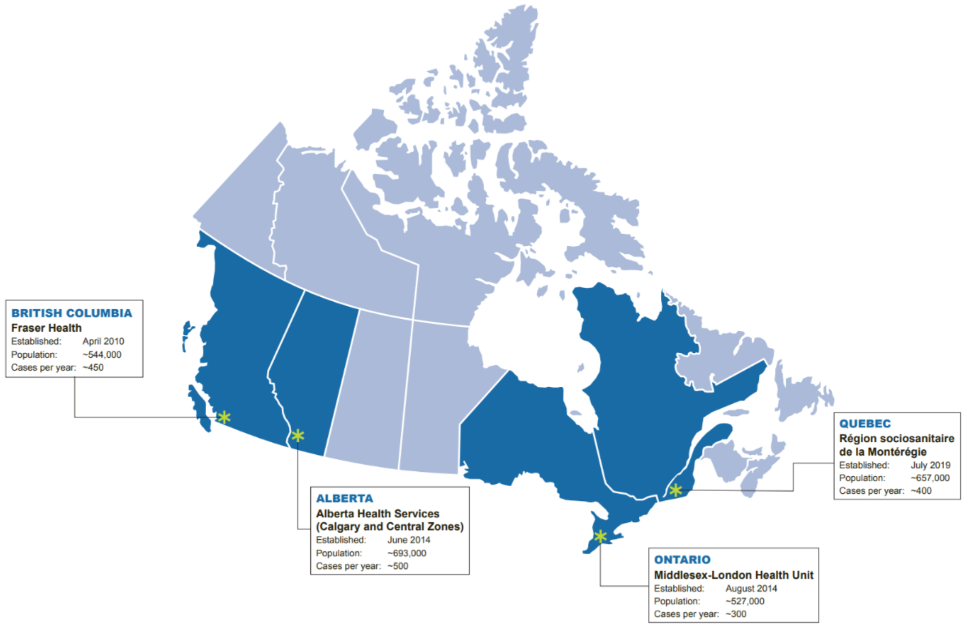
FNC Water sampling objective: to understand pathogen levels and the transmission of enteric pathogens from water sources.

FoodNet Canada Sentinel Sites



Overall methods:

- Active water sampling in four sentinel sites
- Types of water sampled depends on the local water system within the site, and have included recreational, surface and irrigation
- The core pathogens tested include: STEC, *Salmonella* and *Campylobacter*
- Supports CIPARS attribution activities
- AMR testing for CIPARS

2012 British Columbia samples recreational water

2013 British Columbia starts sampling irrigation water

2014 Alberta starts sampling irrigation water

2019 Ontario starts sampling surface water along the Thames River

2021 Quebec starts sampling surface water and British Columbia samples recreational water*

2022 British Columbia water sampling paused; wastewater pilot initiated

2024 British Columbia water short-term sampling of irrigation & recreational water

*outside of sentinel site boundaries due to the COVID-19 pandemic